Subcommittee on Innovation, Data, & Commerce

Hearing entitled "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China"

[July 26, 2023]

Documents for the record

At the conclusion of the meeting, the chair asked and was given unanimous consent to include the following documents into the record:

1. A group letter on autonomous vehicle legislation, July 19, 2023, submitted by the Majority.
2. An op-ed from the Pittsburgh Post-Gazette titled, "Rich Fitzgerald and Farnam Jahanian: Autonomous vehicle testing bill essential to regional economy," January 26, 2022, submitted by the Majority.
3. A letter from undersigned groups and advocacy organizations dedicated to promoting free markets and pro-consumer policies, July 20, 2023, submitted by the Majority.
4. A letter from Advocates for Highway and Auto Safety (Advocates), July 25, 2023, submitted by the Majority.
5. A letter from the Center for Auto Safety and other undersigned organizations, July 24, 2023, submitted by Representative Soto.
6. A letter from the Competitive Carriers Association ("CCA"), July 26, 2023, submitted by the Majority.
7. A letter from representatives of a coalition on artificial intelligence and automated vehicle regulation, July 25, 2023, submitted by the Majority.
8. A report from the U.S. Chamber of Commerce Technology Engagement Center, July 2023, submitted by the Majority.
9. A letter from the National Safety Council, July 25, 2023, submitted by the Majority.
10. A letter from the Consortium for Constituents with Disabilities, July 26, 2023, submitted by the Representative Bilirakis and Representative Pallone.
11. Comments of the National Association of Mutual Insurance Companies, July 26, 2023, submitted by the Majority.
12. A letter from the Partnership for Transportation Innovation and Opportunity (PTIO), July 26, 2023, submitted by the Majority.
13. A letter from the International Association of Fire Chiefs (IAFC), the International Association of Fire Fighters (IAFF) and the National Volunteer Fire Council (NVFC), July 26, 2023, submitted by Representative Veasey.
14. A letter to Secretary Buttigieg and Secretary Raimondo, July 17, 2023, submitted by the Representative Walberg.
15. A press release titled, "TEAMSTERS TO CONGRESS: AUTONOMOUS VEHICLE SAFETY CAN'T WAIT," July 26, 2023, submitted by the Minority.

16. A letter from the Active Transportation Alliance, July 26, 2023, submitted by Representative Schakowsky.
17. A letter from the Amalgamated Transit Union, July 28, 2023, submitted by the Minority
18. A report from the Amalgamated Transit Union, May 2023, submitted by the Minority.
19. A letter from the New York Bicycling Coalition and the League of American Bicyclists, July 24, 2023, submitted by the Minority.
20. A letter from Dan O'Dowd, founder the Dawn Project, July 25, 2023, submitted by the Minority.
21. A letter from the American Property Casualty Insurance Association, July 17, 2023, submitted by the Minority.
22. A letter from the International Union of Police Associations, July 17, 2023, submitted by the Representative Veasey.
23. A letter from the Transportation Trades Department, AFL-CIO to Chair Rodgers, Ranking Member Pallone, Chair Bilirakis, and Ranking Member Schakowsky, submitted by Representative Schakowsky.
24. A letter from the Transport Workers Union of America, AFL-CIO to Chair Bilirakis and Ranking Member Schakowsky, submitted by Representative Schakowsky.
25. A letter from Ride Illinois and the League of American Bicyclists to Ranking Member Schakowsky, submitted by Representative Schakowsky.
26. A letter from AFL-CIO to Members of the Subcommittee on Innovation, Data, and Commerce, submitted by Representative Schakowsky.
27. A letter from state and local government elected and appointed officials, July 17, 2023, submitted by the Representative Clarke.
28. A letter from the Transport Workers Union of America, July 25, 2023, submitted by the Representative Trahan.
29. A letter from the Transport Workers Union Local 1400, July 24, 2023, submitted by the Representative Trahan.
30. A letter from the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW), July 26, 2023, submitted by the Minority.
31. A paper titled, "Assessing Readiness of Self-Driving Vehicles," submitted by the Minority.
32. A letter from TechNet, July 25, 2023, submitted by the Minority.
33. A letter from William H. Widen, submitted by the Minority.
34. Comments from AMERICAN ALLIANCE FOR VEHICLE OWNERS' RIGHTS, July 26, 2023, submitted by the Majority.
35. A letter from the Active Transportation Alliance, July 26, 2203, submitted by the Minority.
36. Comments from the American Alliance for Vehicle Owners' Rights ("AAVOR"), July 26, 2023, submitted by the Majority.

July 19, 2023

The Honorable Gus M. Bilirakis, Chair
The Honorable Jan Schakowsky, Ranking Member
Committee on Energy and Commerce
Innovation, Data, and Commerce Subcommittee
United States House of Representatives
Washington, D.C. 20510

Dear Chairman Bilirakis and Ranking Member Schakowsky:

We are writing to state our opposition to autonomous vehicle (AV) legislation, which may be considered by your Subcommittee, that would allow for mass exemptions from federal motor vehicle safety standards (FMVSS), would not require AV manufacturers to provide detailed safety data to the public, would preempt state laws in the absence of federal regulations and would not ensure safety and accessibility for people with differing disabilities and vulnerable road users, among other possible deleterious provisions which have been included in previous AV bills. Since the Energy and Commerce Committee considered similar legislative proposals in the 115th Congress, real-world experience and reliable data have demonstrated numerous operational failures of faulty AV technology. These fiascoes have not occurred on "test tracks" but rather on neighborhood streets and roads at the expense of public safety.

On average, 118 people were killed every day on roads in the U.S. in 2021, totaling nearly 43,000 fatalities for the year. An additional 2.5 million people were injured. This represents a 27 percent increase in deaths in just a decade. Early projections for 2022 show traffic fatalities remain high. In particular, fatalities among certain road users are alarming. Pedestrian fatalities increased 18 percent, and bicyclist deaths were up 12 percent from 2019 (pre-pandemic) to 2021. Motorcycle rider fatalities increased 22 percent during that period, reaching the highest fatality total in a single year (2021, 6,101 riders killed) since data collection began in 1975. Large truck crashes killed nearly 5,800 people in 2021. These crashes also come with a tremendous price tag. Conservatively, the annual economic cost of motor vehicle crashes is approximately $340 billion (2019 dollars).[i] This means that every person living in the U.S. essentially pays an annual "crash tax" of over $1,000. Moreover, the total value of societal harm from motor vehicle crashes in 2019 was nearly $1.4 trillion.[ii]

We are hopeful that effective safety solutions adopted in the bipartisan Infrastructure Investment and Jobs Act (IIJA, Pub. L. 117-58) directing the U.S. Department of Transportation to issue overdue and essential vehicle safety standards will soon result in a significant and sustained decline in deaths and injuries. We would like to commend you as well as Chair McMorris Rodgers, Ranking Member Pallone and the rest of the Committee for your leadership in advancing these safety improvements.

Proven solutions, such as those in the IIJA, are currently available that can prevent or mitigate the unacceptable death and injury toll. Advanced driver assistance systems (ADAS) should be standard equipment on all new vehicles and meet minimum federal performance standards. Research performed by the Insurance Institute for Highway Safety (IIHS) has found that these systems can help to prevent and reduce the severity of crashes. In addition, since 2016, the National Transportation Safety Board (NTSB) has included increasing implementation of collision avoidance technologies in its Most Wanted Lists of Transportation Safety Improvements.

In the absence of safety standards, there have been numerous crashes involving cars equipped with autonomous driving technology that have been the focus of investigations by the NTSB and the National Highway Traffic Safety Administration (NHTSA). In addition, *The Washington Post* reported last month that according to NHTSA data, there have been 17 fatal incidents, five serious injuries and 736 crashes involving Tesla vehicles operating in Autopilot mode since 2019. Furthermore, according to data collected from July 2021 to April 2023 by NHTSA's Standing General Order (SGO) 2021-1 requiring manufacturers to report certain crashes involving vehicles equipped with automated driving systems (ADS) or SAE Level 2 ADAS, there have been 281 crashes involving ADS and 916 with ADAS. These include 21 crashes resulting in a fatality. Moreover, AVs operating in San Francisco have caused serious and dangerous traffic problems. The media has widely reported on incidents involving erratic driving, blocking traffic, entering an active crime scene, endangering city workers, failing to respond to law enforcement officers, interfering with transit service, and obstructing emergency vehicles.

Many claims have been made about AVs bringing meaningful and lasting reductions in motor vehicle crashes and resulting deaths and injuries, as well as traffic congestion and vehicle emissions. Additionally, assertions have been made that AVs will expand mobility and accessibility, improve efficiency, and create more equitable transportation options and opportunities. However, they are unverified, unrealistic and unfounded. Several leading academic and industry experts predict it will be decades before self-driving technology achieves these improvements.

The absence of necessary protections will result in adverse effects including safety risks for all people and all vehicles on our roadways, job displacement, degradation of current mobility options, infrastructure and environmental problems, and exacerbation of current transportation inequities. Requiring that AVs meet minimum standards and that operations are subject to adequate oversight throughout development and deployment will save lives and save money for consumers and manufacturers. This commonsense and reasonable process is set out in the comprehensive *AV Tenets*, a people-and-safety-first approach to AV development and deployment. The Tenets are supported by 65 organizations representing consumers, safety and medical professionals, labor, local governments, disability rights, vulnerable road users including motorcycle riders and emergency responders.

In conclusion, we urge you not to advance legislation that will turn our Nation's public roadways into private testing grounds and turn the public against this technology.

Thank you for your consideration and we look forward to continuing to work with you to make sure every person on every trip returns home safely.

Sincerely,

Advocates for Highway and Auto Safety
American Motorcyclist Association
American Public Health Association
America Walks
Center for Auto Safety
Citizens for Reliable and Safe Highways
Joan Claybrook, Former Administrator National Highway Traffic Safety Administration
Consumer Federation of America
Families for Safe Streets
Health by Design

Kids and Car Safety
League of American Bicyclists
Missouri Bicycle & Pedestrian Federation
National Coalition for Safer Roads
National Consumers League
Parents Against Tired Truckers
Public Citizen
Skilled Motorcyclist Association - Responsible Trained and Educated Riders, Inc.
The Mark Wandall Foundation
Transportation for America
Trauma Foundation
Truck Safety Coalition

Encls: AV Tenets Summary and Supporters List

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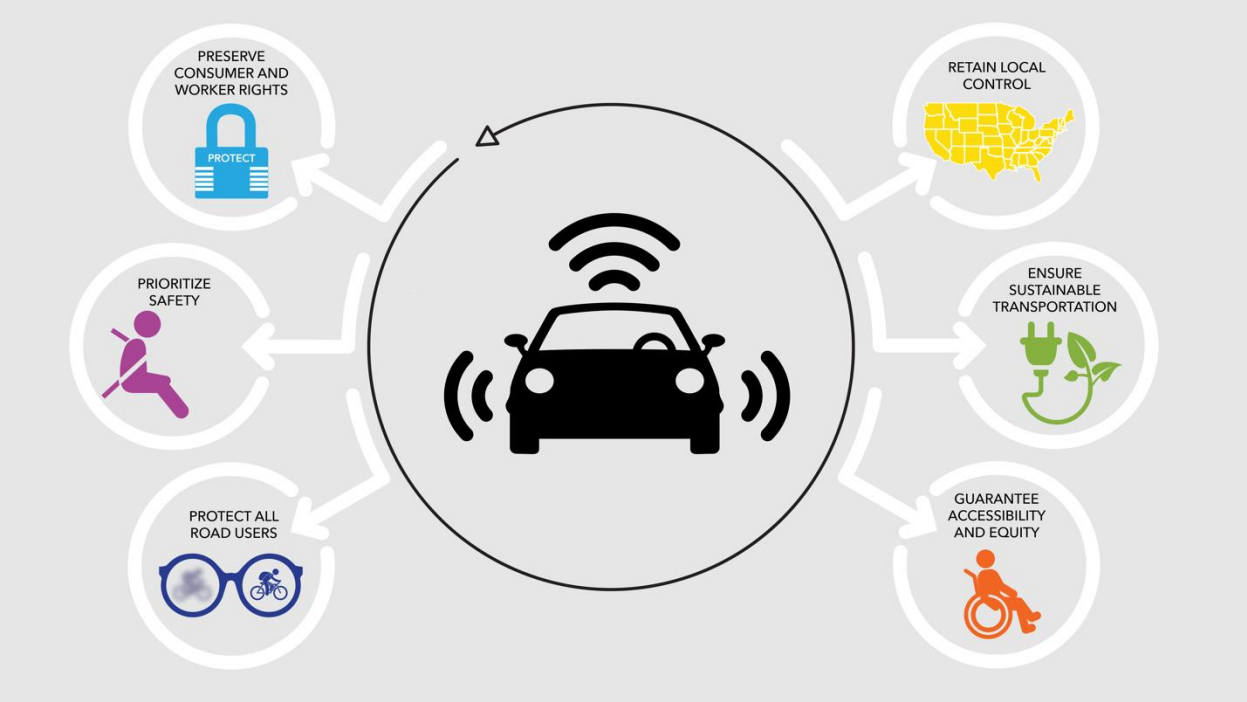
[i] The Economic and Societal Impact of Motor Vehicle Crashes, 2019, NHTSA, Dec. 2022, DOT HS 813 403. (Economic and Societal Impact 2019).
[ii] Economic and Societal Impact 2019.

Introduction to Autonomous Vehicle (AV) Tenets
By Advocates for Highway and Auto Safety
November 30, 2020



In 2019, more than 36,000 people were killed and millions more were injured in motor vehicle crashes. The National Highway Traffic Safety Administration (NHTSA) currently values each life lost in a crash at $9.6 million. Annually crashes impose a financial toll of over $800 billion in total costs to society and $242 billion in direct economic costs, equivalent to a "crash tax" of $784 on every American. Additionally, crashes cost employers $47.4 billion in direct crash-related expenses annually, based on 2013 data (Network of Employers for Traffic Safety (NETS)).

Many promises have been made about autonomous vehicles (AVs) bringing meaningful and lasting reductions in motor vehicle crashes and resulting deaths and injuries, traffic congestion and vehicle emissions. Additionally, claims have been made that AVs will expand mobility and accessibility, improve efficiency, and create more equitable transportation options and opportunities. However, these potentials remain far from a near-term certainty or reality. Without commonsense safeguards the possibilities are imperiled at best and could be doomed at worst. Additionally, the absence of protections could result in adverse effects including safety risks for all people and vehicles on and around the roads, job displacement, degradation of current mobility options, infrastructure and environmental problems, marginalization of certain users, and others. Requiring that AVs meet minimum standards and that operations are subject to adequate oversight throughout development and deployment will save lives as well as costs for both the consumer and the manufacturer.

Moreover, on the path to AVs, proven solutions are currently available that can prevent or mitigate the exorbitant death and injury toll now while laying the foundation for AVs in the future. Available vehicle technologies, also known as advanced driver assistance systems (ADAS), should be standard equipment with minimum performance standards. Research performed by the Insurance Institute for Highway Safety (IIHS) has found that these systems can help to prevent and lessen the severity of crashes. For example, IIHS has determined that automatic emergency braking (AEB) can decrease front-to-rear crashes with injuries by 56 percent. In addition, the National Transportation Safety Board (NTSB) has included increasing implementation of collision avoidance technologies in its Most Wanted Lists of Transportation Safety Improvements since 2016.

It is a transformational time in transportation history. Yet, Benjamin Franklin's infamous quote from 1736, "An ounce of prevention is worth a pound of cure," aptly applies. We urge our Nation's leaders to use this document as the "GPS," the way to "guarantee public safety," as AV development and deployment moves forward.

Summary of Tenets of Autonomous Vehicle (AV) Legislation[1]

Prioritizing Safety of All Road Users

Safety Rulemakings: All levels of automated vehicles [2] must be subject to comprehensive and strong federal standards ensuring they are safe and save lives. The rulemakings must address known and foreseeable safety issues, many of which have been identified by the National Transportation Safety Board (NTSB) and others, including:

- ***Revising Federal Motor Vehicle Safety Standards:*** Any actions by the National Highway Traffic Safety Administration (NHTSA, Agency) to revise or repeal existing Federal Motor Vehicle Safety Standards (FMVSS) must be through a public rulemaking. Any revision must meet the safety need provided by current standards.
- ***Collision Avoidance Systems:*** Certain advanced safety technologies, which may be foundational technologies for AVs, already have proven to be effective at preventing and mitigating crashes across all on-road modes of transportation and must be standard equipment with federal minimum performance requirements. These include automatic emergency braking with pedestrian and cyclist detection, lane departure warning, and blind spot warning, among others.
- ***"Vision Test" for AVs:*** AVs must be subject to a "vision test" to guarantee it will operate on all roads and weather conditions as well as properly detect and respond to all vehicles, people and objects in the operating environment.
- ***Human-Machine Interface (HMI) for Driver Engagement:*** AVs must provide adequate alerts to capture the attention of the human driver with sufficient time to respond and assume the dynamic driving task for any level of vehicle automation that may require human intervention.
- ***Cybersecurity Standard:*** Vehicles must be subject to cybersecurity requirements to prevent hacking and to ensure mitigation and remediation of cybersecurity events.
- ***Electronics and Software Safety Standard:*** Vehicles must be subject to minimum performance requirements for the vehicle electronics and software that power and operate vehicle safety and driving automation systems individually and as interdependent components.
- ***Operational Design Domain (ODD):*** The NHTSA must issue federal standards to ensure safeguards for driving automation systems to limit their operation to the ODD in which they are capable of functioning safely.
- ***Functional Safety Standard:*** Requires a manufacturer to ensure the design, development, verification and validation of safety-related electronics or software demonstrates to NHTSA that an AV will perform reliably and safely under the conditions the vehicle is designed to encounter.
- ***Safe Fallback:*** Every driving automation system must be able to detect a malfunction, degraded state, or operation outside of ODD and safely transition to a condition which reduces the risk of a crash or physical injury.
- ***Crash Procedures Standard:*** Requires manufacturers to have procedures in place for when an AV is involved in a crash to ensure the safety of all occupants of the AV, other road users and emergency responders.
- ***Standard for Over-the-Air (OTA) Updates:*** Requires consumers be given timely and appropriate information on the details of the OTA update and ensures any needed training or tutorials are provided.

Safety and Performance Data: With the increasing number of vehicles with different automated technologies being tested and some being sold to the public, standardized data elements, recording, and access to safety event data are necessary for the proper oversight and analysis of the performance of the driving automation systems. Safety and performance data should be made available to relevant stakeholders with appropriate privacy protections.

[1] These tenets are limited to vehicles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less unless otherwise noted; however, it is imperative that automated delivery vehicles (including those used on sidewalks and other non-roadways) and commercial motor vehicles be subject to comprehensive regulations, including rules regarding the presence of a licensed, qualified driver behind the wheel.

[2] Partially automated vehicles (SAE International Level 2) and conditional / highly automated vehicles (SAE International Levels 3, 4, 5).

Manufacturer Submissions to NHTSA: Any submission to NHTSA by AV manufacturers or developers must be mandatory, publicly available and include thorough and adequate data and documentation. Additionally, NHTSA must be directed to review and evaluate all submissions to assess whether an approach to automated driving system (ADS) development and testing includes appropriate safeguards for operation on public roads.

Proper Oversight of Testing: AV testing is already underway in many localities. Fundamental and commonsense safeguards must be instituted for testing on public roads including the establishment of independent institutional review boards (IRBs) to certify the safety of the protocols and procedures for testing of AVs on public roads.

Additional Resources and Enforcement Authorities for NHTSA: Ensuring NHTSA has adequate resources, funds, staff, and enforcement authority is essential for the Agency to successfully carry out its statutory mission and address the multiple challenges presented by the testing and deployment of self-driving technologies.

Guaranteeing Accessibility for All

Access for Individuals with Disabilities and Older Adults: Autonomous driving technology has the potential to increase access and mobility for everyone including older adults and individuals with disabilities, including those with sensory, cognitive, and physical disabilities, wheelchair users, and people with neurological conditions, who have varying needs as well as traditionally underserved communities. This goal must be realized with appropriate federal action.

Access for Underbanked Populations: Access to on-demand transport services is often predicated on the ability to make digital payments. AV-based transport services must consider a variety of ways in which payment for service can be made to ensure that this technology supports equitable access and the inclusion of all.

Equity: As new modes of transportation continue to grow and evolve, investment and development must include a process where all people can safely participate.

Accessibility, Passenger Safety, and Transportation Services: There must be clear plans to ensure the safe transportation for all people, in particular for those who currently require assistance to do so or are part of marginalized communities, in the implementation of these transportation services.

Preserving Consumer and Worker Rights

Consumer Information: Consumer information regarding AVs should be available at the point of sale, in the owner's manual, and in any OTA updates. The vehicle identification number (VIN) should be updated to reflect whether certain features were built into the vehicle, either as standard or optional equipment. NHTSA must establish a website accessible by VIN with basic safety information about the AV level, safety exemptions, and limitations and capabilities of the AV.

Privacy: All manufacturers of passenger motor vehicles, including AVs, should be required to comply with robust data privacy safeguards and policies. The ability of NHTSA, the NTSB, and local law enforcement to access critical safety performance data, while preserving the integrity of personal, private or identifying data, in a timely manner for research, crash investigation and other governmental purposes must be preserved.

Workforce Protections: Absent strong leadership, AV technology risks worsening severe inequalities already inherent in our society, predominantly for blue collar workers. Existing and foreseeable issues which stand to be greatly exacerbated by this technology must be addressed before this technology is broadly deployed on our roads. Similarly, unforeseeable issues throughout deployment will need to be resolved with input from stakeholders.

Whistleblower Protections: Employees or contractors who want to report safety defects to NHTSA should not be prevented from doing so as the result of a non-disclosure agreement (NDA).

Consumer and Worker Rights[3]**:** The well-established rights of consumers to seek accountability in a court of law for injuries suffered as a result of AVs must be preserved. Moreover, exploitative independent contractor relationships that shield AV companies from liability and deny workers basic workplace rights should be explicitly prevented.

Ensuring Local Control and Sustainable Transportation

Local, State and Federal Regulatory Roles: In keeping with existing law and practice, the federal government should prescribe regulations for the performance of these vehicles, leaving regulation of the operation of these vehicles to the states.

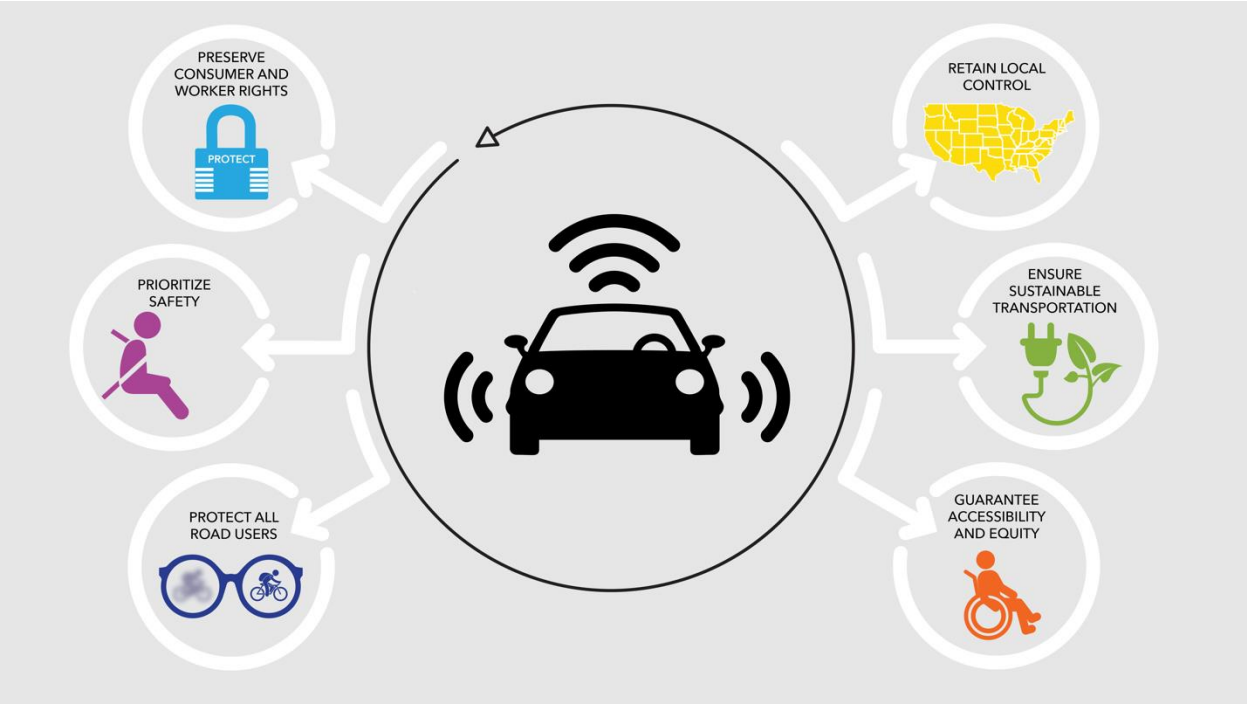
In-Depth Study of AV Impacts on Transportation Systems and Environment: DOT must undertake a comprehensive study to inform policymakers and the public about how these vehicles will impact our existing transportation systems and ensure effective mitigation of problems identified.

NOTE: **The AV Tenets outlined in this document do not constitute the entirety of each supporting organization's policy priorities related to AVs.**

[3] Advocates for Highway and Auto Safety does not take a position on this issue.

Supporters of Autonomous Vehicle (AV) Tenets

As of October 5, 2022



Active Transportation Alliance (Metro Chicago)
Advocates for Highway and Auto Safety
America Walks
American Association for Justice
American Motorcyclist Association
American Public Health Association
American Trauma Society
Association of Pedestrian and Bicycle Professionals
Bicycle Coalition of New Mexico
BikeNWA
BikeOklahoma
Bike Pittsburgh
BikeSD
BikeWalkKC
Brain Injury Association of America
California Association of Bicycling Organizations
Cascade Bicycle Club
Center for Auto Safety
Center for Disability Rights, Inc.
Citizens for Reliable and Safe Highways
Consumer Action
Consumer Federation of America
Consumers for Auto Reliability and Safety
Consumer Reports
Disability Rights Education and Defense Fund
Emergency Nurses Association
Empire State Consumer Project, Inc.

Environmental Law & Policy Center
Families for Safe Streets
Federal Law Enforcement Officers Association
GorgePedal.com
Health by Design
Idaho Walk Bike Alliance
International Brotherhood of Teamsters
Joan Claybrook, President Emeritus, Public Citizen, Former Administrator, National Highway Traffic Safety Administration
KidsAndCars.org
LA Walks
League of American Bicyclists
Missouri Bicycle and Pedestrian Federation
National Association of City Transportation Officials (NACTO)
National Coalition for Safer Roads
National Consumers League
New Urban Mobility Alliance
Parents Against Tired Truckers
Public Citizen
Owner-Operator Independent Drivers Association
Rails-to-Trails Conservancy
Ride Illinois
San Francisco Families for Safer Streets
Shenandoah Valley Bicycle Coalition
Skilled Motorcyclist Association–Responsible, Trained and Educated Riders (SMARTER) Inc.
SoCal Families for Safe Streets
The Daniel Initiative
Transport Workers Union
Transportation Alternatives
Transportation for America
Transportation Trades Department, AFL-CIO
Trauma Foundation
Truck Safety Coalition
Virginia Citizens Consumer Council
Walk SF
Washington Bikes
Whirlwind Wheelchair International
Wyoming Pathways

Rich Fitzgerald and Farnam Jahanian: Autonomous vehicle testing bill essential to regional economy

RICH FITZGERALD AND FARNAM JAHANIAN

JAN 26, 2022 | 12:00 AM

Pennsylvania is synonymous with innovation.

For more than a century, we have forged innovative solutions that change the world. Pennsylvanians perfected steel production.

When our troops needed a rugged new vehicle to navigate the battlefields of World War II, we answered their call and built the Jeep. Our scientists invented the life-changing polio vaccine and developed Kevlar and built the first digital computer.

And now here in Pittsburgh, we've created an entirely new, potentially trillion-dollar industry. Working together, scientists and engineers at Carnegie Mellon, world-class entrepreneurs and the region's one-of-a-kind

workforce have partnered with industry and federal research agencies to bring the dream of self-driving vehicles to reality.

From ending the scourge of traffic accidents to expanding opportunities for independent living, and from combatting transit deserts to revolutionizing how goods and services are delivered, self-driving vehicle technology has the potential to truly change the world.

Further, our region can create new manufacturing jobs by building an autonomous vehicle and robotics supply chain.

According to the recent Forefront report published by the Regional Industrial Development Corporation and the Greater Pittsburgh Chamber of Commerce, this industry already includes 71 companies that provide 6,300 jobs here in the region. And as the autonomous vehicles systems industry grows and matures over the course of this decade, it is estimated to reach a $1 trillion market size.

A region that captures even 1% of this market will realize $10 billion of economic output with an estimated total of 5,000 jobs.

For Western Pennsylvania to capitalize on a meaningful portion of this opportunity, we have work to do.

Collaboration and innovation helped bring us to the cutting edge of this transformative technology, and that same spirit of partnership — among local companies, university researchers, workers and citizens — will be critical to creating the broadest impact in this next phase of development.

A key step in meeting the challenges and opportunities that lie ahead is to ensure that self-driving vehicles can be safely tested in Pennsylvania. Competing states have moved ahead of us, and technologies developed in our region are now being more readily tested and deployed in states such as Texas and Florida.

But a bipartisan team in the Pennsylvania Senate is working with PennDOT to address this competitiveness gap.

The Pennsylvania Senate Transportation Committee will soon consider Senate Bill 965 to set rules of the road for self-driving vehicles. This would cover basic topics like insurance, registration, inspection and meeting

federal safety standards — just the same as you'd expect for a vehicle an individual would drive.

Passage of SB 965 would give PennDOT the ability to play a stronger role in overseeing autonomous vehicle testing and deployment. In short, SB 965 aims to ensure the continued safe development of this homegrown industry that is already creating thousands of jobs in Pennsylvania.

We applaud the work of SB 965's author, Sen. Wayne Langerholc, R-Cambria, for collaborating with PennDOT Secretary Yasmin Gramian to write a bill that is supported by many regional leaders including Sen. Jay Costa, D-Allegheny, Sen. Wayne Fontana, D-Allegheny, Sen. Pat Stefano, R-Somerset, Sen. Devlin Robinson, R-Allegheny/Washington, and Sen. Elder Vogel, R-Beaver.

Providing a roadmap for the testing and deployment of self-driving vehicles is critically important to the future of Pennsylvania, and to the Pittsburgh region's leadership in this transformative industry.

Rich Fitzgerald is the Allegheny County executive. Farnam Jahanian is the president of Carnegie Mellon University.

First Published January 26, 2022, 12:00am

Popular in the Community

July 20, 2023

Innovation, Data, and Commerce Subcommittee
United States House of Representatives
Room H154
Washington, D.C. 20515-6601

Dear Chairman Bilirakis, Vice Chair Walberg, Ranking Member Schakowsky, and Committee Members:

As your subcommittee takes up the issue of autonomous vehicles, we, the undersigned leaders and advocacy organizations dedicated to promoting free markets and pro-consumer policies, urge you to consider working on a legislative framework to protect the data of all drivers — autonomous or not — as a users' private property right.

AVs are equipped with various sensors, cameras, and communication systems that continuously capture and transmit information about their surroundings and occupants. As the nation approaches a future where autonomous vehicles may become an integral part of its transportation landscape, it is crucial that Congress address the significant concerns surrounding the collection, storage, and usage of the vast amounts of personal data generated by their vehicles, particularly autonomous vehicles.

In March, the House Energy and Commerce Committee passed the American Data Privacy and Protection Act on an almost unanimous basis. However, although this bill would strengthen the American people's data privacy in many respects, it would do little to protect their car data.

A legislative solution to this matter can take many forms. All we ask is that you consider establishing clear guidelines regarding ownership and control of the data generated by their cars, ensuring that consumers retain ultimate authority over their personal information. This should include their ability to access, delete, and correct their data, as well as control the sharing of it with fleet owners and third parties.

Sincerely,

Ed Martin
Phyllis Schlafly Eagles

Ruth Susswein
Consumer Action

Stephen Moore
Committee to Unleash Prosperity

Saul Anuzis & James Martin
60 Plus Association

Dr. Ed Longe
James Madison Institute

Terry Schilling
American Principles Project

Dr. Jianli Yang
Citizen Power Initiatives for China

Brian Balfour
John Locke Foundation

Richard Manning
Americans for Limited Government

Nisha Whitehead
The Rutherford Institute

Seton Motley
Less Government

Chuck Muth
Citizen Outreach

Mike Stenhouse
Rhode Island Center
for Freedom & Prosperity

Dan Perrin
HSA Coalition

Judson Phillips
Tea Party Nation

Paul Boardman
Decouple China PAC

CC:

United States House Committee on Energy and Commerce

United States Senate Committee on Commerce, Science, and Transportation

ADVOCATES FOR HIGHWAY & AUTO SAFETY

July 25, 2023

The Honorable Gus M. Bilirakis, Chair
The Honorable Jan Schakowsky, Ranking Member
Committee on Energy and Commerce
Innovation, Data, and Commerce Subcommittee
United States House of Representatives
Washington, D.C. 20515

Dear Chairman Bilirakis and Ranking Member Schakowsky:

As you prepare for tomorrow's hearing, "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China," Advocates for Highway and Auto Safety (Advocates) urges you to advance proven solutions to reduce the historically high numbers of deaths and injuries on our Nation's roads. Conversely, legislation which erodes current federal motor vehicle safety standards (FMVSS) by allowing the unchecked deployment of tens of thousands of unproven autonomous vehicles (AV) instead of advancing critically needed regulations and protections will compound the dangers being experienced by all road users, as evidenced by real-world occurrences in San Francisco, California. Innovation and ensuring public safety are not incompatible nor irreconcilable goals. Legislation to accommodate the development of new vehicle technologies should never sacrifice safety. We respectfully request this letter be included in the hearing record.

Motor Vehicle Crashes are a Devastating and Costly Public Health Crisis Which Demands Immediate Action

Our tragic and costly highway fatality and injury toll requires focused federal actions advancing vehicle, driver, road user and infrastructure safety. On average, 118 people were killed every day on roads in the U.S. in 2021, totaling nearly 43,000 fatalities for the year.[1] An additional 2.5 million people were injured.[2] This represents a 27 percent increase in deaths in just a decade.[3] Early projections for 2022 show traffic fatalities remain high.[4] Other road users experienced increases in deaths as well. Pedestrian fatalities increased 18 percent, and bicyclist deaths were up 12 percent from 2019 (pre-pandemic) to 2021.[5] Large truck crashes killed nearly 5,800 people in 2021.[6] Conservatively, the annual economic cost of motor vehicle crashes is approximately $340 billion (2019 dollars).[7] This means that every person living in the U.S.

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1 Overview of Motor Vehicle Traffic Crashes in 2021, NHTSA, Apr. 2023, DOT HS 813 435. (Overview 2021).
2 Overview 2021.
3 Traffic Safety Facts 2020: A Compilation of Motor Vehicle Crash Data, NHTSA, Oct. 2022, DOT HS 813 375, (Annual Report 2020); and Overview 2021; [comparing 2012 to 2021].
4 Traffic Safety Facts: Crash Stats, Early Estimate of Motor Vehicle Traffic Fatalities in 2022, NHTSA, Apr. 2023, DOT HS 813 428. (Early Estimates 2022).
5 Overview 2021, Annual Report 2020.
6 Overview 2021.
7 The Economic and Societal Impact of Motor Vehicle Crashes, 2019, NHTSA, Dec. 2022, DOT HS 813 403. (Economic and Societal Impact 2019).

essentially pays an annual "crash tax" of over $1,000. Moreover, the total value of societal harm from motor vehicle crashes in 2019 was nearly $1.4 trillion.[8]

Federal Safety Standards Have Saved Hundreds of Thousands of Lives

The promising news is that we have a highly effective strategy to reduce the death and injury toll – requiring proven and available safety technologies that meet minimum performance standards. The National Highway Traffic Safety Administration (NHTSA) has estimated that between 1960 and 2012, over 600,000 lives have been saved by motor vehicle safety technologies.[9] Advocates always has enthusiastically championed this approach. In 1991, Advocates led the coalition that supported enactment of the bipartisan Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991[10] which included a mandate for front seat airbags as standard equipment. As a result, by 1997, every new car sold in the United States was equipped with this technology and the lives saved have been significant. Airbags have saved an estimated 50,457 lives from 1987 to 2017, according to NHTSA.[11] Advocates continued to support proven lifesaving technologies as standard equipment in all vehicles in other federal legislation and regulatory proposals. These efforts include: tire pressure monitoring systems;[12] rear outboard 3-point safety belts;[13] electronic stability control;[14] rear safety belt reminder systems;[15] brake transmission interlocks;[16] safety belts on motorcoaches;[17] rear-view cameras;[18] safer power window switches;[19] advanced driver assistance systems (ADAS);[20] impaired driving prevention technology;[21] enhanced vehicle hood and bumpers to better protect vulnerable road users;[22] and, advanced head lamps.[23]

Experimental Autonomous Driving Technology Remains Unproven

In stark contrast to the effectiveness of federal standards and proven safety technology, cars equipped with autonomous technology, which is unregulated, have already been involved in numerous serious and deadly crashes, many of which have been subject to investigation by the National Transportation Safety Board (NTSB) and NHTSA. In addition, *The Washington Post* reported last month that according to NHTSA data, there have been 17 fatal incidents, five serious injuries and 736 crashes involving Tesla vehicles operating in Autopilot mode since

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[8] Economic and Societal Impact 2019.
[9] Lives Saved by Vehicle Safety Technologies and Associated Federal Motor Vehicle Safety Standards, 1960 to 2012, DOT HS 812 069 (NHTSA, 2015); See also, NHTSA AV Policy, Executive Summary, p. 5 endnote 1.
[10] Pub. L. 102-240 (Dec. 18, 1991). Statistics are from the U.S. Department of Transportation unless otherwise noted.
[11] Traffic Safety Facts 2018, A Compilation of Motor Vehicle Crash Data, DOT HS 812 981, NHTSA (Nov. 2020).
[12] Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, Pub. L. 106-414 (Nov. 1, 2000).
[13] Anton's Law, Pub. L. 107-318 (Dec. 4, 2002).
[14] Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Pub. L. 109-59 (Aug. 10, 2005).
[15] *Id.*
[16] *Id.*
[17] Moving Ahead for Progress in the 21st Century (MAP-21) Act, Pub. L. 112-141 (Jan. 3, 2012).
[18] Cameron Gulbransen Kids Transportation Safety Act of 2007, Pub. L. 110-189 (Feb. 28, 2008).
[19] *Id.*
[20] Infrastructure Investment and Jobs Act, Pub. L. 117-58 (Nov. 15, 2021).
[21] *Id.*
[22] *Id.*
[23] *Id.*

2019.[24] Furthermore, according to data collected by NHTSA's Standing General Order (SGO) 2021-1 requiring manufacturers to report certain crashes involving vehicles equipped with automated driving systems (ADS) or SAE Level 2 ADAS, there have been approximately 330 crashes involving ADS and 1,040 with ADAS. These include 25 crashes resulting in a fatality.

In addition, several San Francisco transportation agencies submitted comments to the California Public Utilities Commission in May detailing numerous dangerous incidents involving AVs operating in the city.[25] These events include:

- Interfering with emergency response operations including 18 incidents documented by the San Francisco Fire Department in which AVs put firefighters and the public at risk.
- Making planned and unplanned stops in travel lanes that have interfered with transit service and blocked traffic.
- Intrusions into construction zones where City employees were working.
- Obstructions caused by AVs having to interpret and respond to human traffic control officers.
- Erratic driving.[26]

These treacherous incidents are also on the rise. The agencies indicate that during this year reported monthly incidents involving AVs have increased six-fold.[27] In fact, last month an AV blocked San Francisco police from responding to a shooting.[28]

Recently, Advocates' staff had the opportunity to take several rides in an AV operating in San Francisco and witnessed firsthand the concerning and potentially dangerous failures the vehicle suffered throughout the trip. During the first ride the AV abruptly pulled to the side of the road without warning and stopped barely out of the adjacent travel lane. The riders were informed the AV was having operational issues and they would need to exit the vehicle and wait for another AV. However, the riders were subsequently told that AVs were no longer servicing the area anymore, stranding the riders on the side of the road. During the second trip, the vehicle, despite being in a clear left travel lane, turned abruptly into the right travel lane before stopping behind a double-parked vehicle. Later in the same trip, the vehicle reacted so abruptly to a potential pedestrian crossing that it caused the buckled staff member to make contact with the vehicle's interior divider. At several points during both the second and third trips, the vehicle required outside assistance to navigate an intersection or other situation for which it was unprepared.

What San Francisco has been experiencing must not be replicated across the Nation by continuing to allow for the proliferation of AVs that do not comply with any federal safety regulations setting minimum performance standards for driverless systems. Many promises have

[24] Faiz Siddiqui and Jeremy B. Merrill, *17 fatalities, 736 crashes: The shocking toll of Tesla's Autopilot*, Wash. Post (Jun. 10, 2023).

[25] San Francisco Comments to the Draft Resolution Approving Authorization for Waymo Autonomous Vehicle Passenger Service Phase I Driverless Deployment Program, R.12-12-011 (May 31, 2023). Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://sfstandard.com/wp-content/uploads/2023/06/SF-Comments-on-Waymo.pdf

[26] *Id.* at pgs. 9-11.

[27] *Id.* at p. 3.

[28] Self-driving car blocks police responding to San Francisco shooting, KTVU (Jun. 11, 2023). Available at: https://www ktvu.com/news/self-driving-car-blocks-police-responding-to-san-francisco-shooting

been touted about AVs bringing reductions in motor vehicle crashes and resultant deaths and injuries, lowering traffic congestion and vehicle emissions, expanding mobility and accessibility, improving efficiency, and creating more equitable transportation options and opportunities. However, as Transportation Secretary Buttigieg and others within the auto industry have acknowledged, these outcomes are far from certain.[29]

Supporters of AVs often assert that these vehicles will improve roadway safety by inaccurately stating that 94 percent of crashes are due to human error pointing to a report from NHTSA as support for this misleading claim. However, the agency stated in the same document with this statistic that "[a]lthough the critical reason is an important part of the description of events leading up to the crash, **it is not intended to be interpreted as the cause of the crash nor as the assignment of the fault to the driver, vehicle, or environment** (*emphasis added*)**."**[30] In addition, NTSB Chair Jennifer Homendy has declared that using the statistic in such a manner is "dangerous" and "[a]t the same time it relieves everybody else of responsibility they have for improving safety, including DOT."[31] Proponents of AVs also have made the claim that these vehicles will prevent 90 percent of crash fatalities.[32] Yet, there is no research cited supporting such an assertion.

In sharp contrast to what is happening in the U.S., other countries are taking a more calculated, careful, and cautious approach to the development of AVs.[33] Often-repeated claims about the U.S. "falling behind" other countries in the "race" for AVs are simply not true nor supported by research. For example:

- China continues to require permits or restricts operations of AVs on its roads to only those areas approved by the authorities.[34]
- Germany continues to require permits, approvals, and limits areas of operation for AVs.[35]
- In Japan, the introduction of Level 4 vehicles will be controlled and limited to specific, lightly populated areas.[36]
- Even the latest United Nations Economic Commission for Europe (UNECE) regulations will limit operations to restrict risks and oversee approval through testing and other requirements.[37]

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[29] Nilay Patel and Andrew J. Hawkins, Pete Buttigieg is Racing to Keep Up with Self Driving Cars. The Verge (Jan. 6, 2022); Rebecca Fannin, Where the billions spent on autonomous vehicles by U.S. and Chinese giants is heading, CNBC (May 23, 2022).

[30] Singh, S. (2015, February). Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey. (Traffic Safety Facts Crash Stats. Report No. DOT HS 812 115). Washington, DC: National Highway Traffic Safety Administration.

[31] Hope Yen and Tom Krisher, NTSB chief to fed agency: Stop using misleading statistics, Associated Press (Jan. 1 8. 2022).

[32] Iyad Rahwan and Azim Shariff, Self-Driving Cars Could Save Many Lives. But Mental Roadblocks Stand in the Way. Wall Street Journal (Apr. 6, 2021).

[33] Autonomous vehicles: cross jurisdictional regulatory perspectives update, Oct. 7, 2022.

[34] China drafts rules on use of self-driving vehicles for public transport; Aug. 8, 2022, Reuters; and Baidue bags China's first fully driverless robotaxi licenses, Aug. 7, Reuters. Real driverless cars are now legal in Shenzhen, China's tech hub, Jul. 25, 2022, TechCrunch+.

[35] Germany completes legal framework for autonomous driving | Federal Cabinet approves new ordinance, Apr. 2022, Malterer, M.

[36] Japan to open roads to autonomous vehicles in 2023, Nov. 28, 2022, Wessling, B., The RobotReport.

[37] New rules to improve road safety and enable fully driverless vehicles in the EU, Jul. 6, 2022, UNECE.

In sum, no country is selling fully automated vehicles for unfettered use to the public and by many accounts, none will be for a significant amount of time.[38] According to the most recent KPMG analysis, the U.S. ranks fourth in the world for AV readiness, while China stands at number twenty. In short, the U.S. is not lagging other countries in allowing AVs to go to market, but we are behind in establishing comprehensive regulations to ensure public safety will not be jeopardized or diminished. As Dr. Missy Cummings, Professor, George Mason University, College of Engineering and Computing, and a well-respected expert on autonomy and robotics, stated during a briefing convened by Advocates in March 2023:

> I was a military officer; I spent three years on the Defense Innovation Board advising the Secretary of Defense. China is a real threat, a real problem that we have to address from a national security perspective. What it [China] is not is a threat to our commercialization of autonomous vehicles. And any insistence that it actually takes away from the emphasis that we need to place on national security. So, what I would really like everyone to do is back off the China fear mongering. China is not beating us to the commercialization of autonomous vehicles…[39]

Legislation Addressing Autonomous Driving Technology Must Protect Public Safety

A Caravan public opinion survey commissioned by Advocates in February 2023 showed Americans across the country and across generations are concerned with driverless cars and trucks on our roadways. In fact, four of five respondents reported being concerned about sharing the roads with driverless cars. In addition, while there is widespread concern about the use and deployment of driverless vehicles, 64 percent of those polled feel that their concerns could be adequately addressed by minimum government safety requirements.[40]

Any federal legislation that is advanced by Congress will set AV policy for decades to come and must include minimum standards to improve safety on our Nation's roads before these vehicles are sold in the marketplace. It is essential that NHTSA continues to collect and evaluate the data obtained through the SGO involving these technologies, as well as improve the reporting requirements in the SGO. It is not essential that Congress takes action to more broadly permit AVs to be deployed unchecked, unaccountable, and unbridled.

Currently, AVs are being tested throughout the country, and companies are collecting data on their performance every day. AVs used solely for testing do not have to comply with current FMVSS, including those that provide occupant protection. Additionally, companies already can apply for exemptions from FMVSS.[41] In fact, two petitions from Ford and GM are currently pending before NHTSA.[42] Companies are seeking legislation to allow mass blanket exemptions

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[38] Lawrence Ulrich, Driverless Still a Long Way From Humanless, N.Y. Times (Jun. 20, 2019); Level 5 possible but "way in the future", says VW-Ford AV boss, Motoring (Jun. 29, 2019).

[39] Advocates for Highway and Auto Safety, Virtual Capitol Hill Briefing: Expert Panel on Autonomous Vehicle Safety (Mar. 7, 2023). See: https://saferoads.org/briefing-expert-panel-on-autonomous-vehicle-av-safety-3-7-23-public/

[40] Online CARAVAN Survey (Feb. 2023). See: https://saferoads.org/wp-content/uploads/2023/03/Advocates-Caravan-AV-Poll-Report-.pdf

[41] 49 CFR 555.

[42] 87 FR 43602 (Jul. 21, 2022); 87 FR 43595 (Jul. 21, 2022).

from FMVSS in order to monetize AVs by selling these vehicles to consumers, deploying them as "robotaxis" or using them in ride shares. In the absence of FMVSS that apply to the autonomous driving system, there are no assurances, other than a completely inadequate voluntary self-reported safety assessment, that AVs will meet any level of safety. Consequently, all road users, motorists, pedestrians, bicyclists, and others, are at substantial risk with the testing "science experiment" happening on our roads now.

It is fundamentally necessary that manufacturers be required to provide more detailed safety data than is currently required in the SGO to NHTSA and to consumers, as was stated by Ranking Member Schakowsky and Subcommittee Members Reps. Kathy Castor and Lori Trahan in their February 28, 2023, letter to NHTSA and by U.S. DOT's Automated Vehicle Voluntary Guidelines (AV 4.0).[43] Allowing companies to voluntarily submit to NHTSA incomplete data and "descriptions" of AV systems akin to slick marketing brochures, does not accurately inform the regulator or the public. After NHTSA issues standards and AVs are sold to the public, consumers should have appropriate information about the performance of the vehicle at the point of sale and in the owner's manual. It is essential that NHTSA be required to establish a publicly available AV database with basic safety information for consumers and for safety research.

Additionally, state and local regulatory action on AVs, even though the federal government has not taken regulatory action, must not be prohibited. Prior to NHTSA issuing safety standards, states must retain their traditional legal authority to protect public safety. As the incidents noted above in San Francisco demonstrate, fundamental and commonsense safeguards must be instituted for testing on public roads including the establishment of independent institutional review boards to certify the safety of the protocols and procedures for testing of AVs on public roads.

Moreover, current law prohibits manufacturers from rendering safety systems inoperable without first getting an exemption from U.S. DOT. Congress must not permit manufacturers to unilaterally "turn off" safety systems related to the driving task, such as the steering wheel and brake pedals, during autonomous operation.

Advisory committees are unacceptable substitutes for NHTSA fulfilling its statutory mission and issuing safety standards through open public rulemakings. The work of an advisory committee should in no way impair, constrain or supplant the authority of the Secretary or NHTSA to issue timely regulations for AVs. For example, DOT should not delay or defer regulatory actions on AVs pending any report, recommendations or approval from any advisory committees. In fact, advisory committees that include membership of the regulated industry or any individual or organization that receives monetary compensation from the auto and tech industries should not be charged with informing or recommending any regulatory action whatsoever by the agency.

To offer a safe and sustainable path forward on AVs, Advocates and numerous stakeholders developed the "AV Tenets," These are sound and sensible policy positions which should be a foundational part of any national AV policy. It has four main, commonsense categories including: 1) prioritizing safety of all road users; 2) guaranteeing accessibility and equity; 3)

[43] Letter from Reps. Schakowsky, Castor and Trahan to Ann Carlson, Acting Administrator (Feb. 28, 2023); available at: https://schakowsky.house.gov/sites/evo-subsites/schakowsky.house.gov/files/evo-media-document/final-23.02.23-letter-to-nhtsa-on-sgo-recommendations-002.pdf

preserving consumer and worker rights; and, 4) ensuring local control and sustainable transportation. The AV Tenets are supported by a coalition of more than 65 groups representing numerous stakeholders including consumers, public health and safety experts, pedestrians, bicyclists, disability rights activists, emergency responders, law enforcement, labor and others and are based on expert analysis, real-world experience, and public opinion. Requiring that AVs meet minimum performance standards, including for cyber security, and that operations are subject to adequate oversight, including a comprehensive database accessible by vehicle identification number (VIN) with basic safety information are fundamental prerequisites and will save lives and boost consumer confidence in this burgeoning technology.

Conclusion

The current void of regulations for ADAS renders all road users at unacceptable and preventable risk. Furthermore, these technologies are some of the essential building blocks for the potential of AVs in the future and can save lives now.

The provisions in the bipartisan Infrastructure Investment and Jobs Act (IIJA directing agency actions to require as standard equipment lifesaving technologies on all new vehicles is the template Congress should follow in promoting the safe development and deployment of autonomous technologies. We commend Congress for those safety advances.[44] Since enactment of the IIJA, Advocates has been urging DOT to meet its deadlines and issue comprehensive rules for ADAS including automatic emergency braking (AEB). DOT's recently published Notices of Proposed Rulemakings that would require AEB on passenger vehicles as well as heavy vehicles with a gross vehicle weight greater than 10,000 pounds[45] is a consequential development in our efforts to prevent or mitigate crashes.

Thank you for your consideration of these critically important safety issues. As always, we are ready and willing to be of assistance to you in furtherance of our shared goal of improving safety for all road users.

Sincerely,

Catherine Chase, President

cc: Members of the Subcommittee on Innovation, Data, and Commerce

[44] Pub. L. 117-58 (2021).

[45] 88 FR 38632 (Jun. 13, 2023); 88 FR 43174 (Jul. 6, 2023).

July 24, 2023

The Honorable Gus Bilirakis, Chair
The Honorable Jan Schakowsky, Ranking Member
Committee on Energy and Commerce
Innovation, Data, and Commerce Subcommittee
United States House of Representatives
Washington, D.C. 20510

RE: Lack of consumer protection from forced arbitration clauses in SELF DRIVE Act

Dear Chair Bilirakis and Ranking Member Schakowsky:

We the undersigned, on behalf of the members of each of our groups individually, and all drivers nationwide, write today about a vital consumer protection that should be a part of the proposed SELF DRIVE Act – protection from forced arbitration clauses.

Car makers say autonomous vehicles (AVs) promise a future absent of driver and pedestrian fatalities, cars without steering wheels or brakes, and commutes lacking stress or traffic. Yet, those of us who are focused on consumer safety and rights have at least one more "freedom" to add to this list: AVs should be free of forced arbitration clauses.

An existing clause in the bill, Section 3, prohibits the preemption of existing state common law. This provision should act to protect the rights of consumers if something were to go horrifically wrong due to the design of these futuristic machines. However, at a time when so much is unknown about the safety performance of these vehicles in the real world, there is no provision which prohibits the inclusion of a mandatory arbitration clause into contracts with consumers using these vehicles. Whether they are in the terms of service of autonomous vehicle rideshare companies or in future potential ownership or leasing agreements, mandatory arbitration clauses should not be allowed as a means to shield irresponsible AV companies from civil claims.

As you know, forced arbitration contract terms require consumers to adjudicate claims in forums that do not have the protections of the legal system—the rules of evidence and discovery do not apply, there is no requirement that arbitrators follow the law, there are no juries, and there is little to no opportunity for witness depositions. Moreover, arbitration proceedings are secretive, and the findings of arbitrators are seldom appealable. Additionally, because arbitration firms rely on repeat customers for their profits, it is unlikely that arbitrators will find for a consumer over the corporation likely to provide additional business in the future.

The potential for inserting forced arbitration clauses into a contract between a manufacturer and an individual consumer is ever present and abets an alternate system of justice when the inevitable defects in new technology occur. Such a result would create yet another incentive for unscrupulous manufacturers to put shareholders' interests ahead of safety concerns.

Unfortunately, as safety advocates we have seen this scenario play out before with consumers and cars. One of the most recent examples has been in the context of lemon laws. It was a difficult fight to see every state and the District of Columbia enact statutes protecting consumers if they happen to purchase a defective automobile, commonly known as a "lemon." If a consumer can show that the car he or she bought is defective and the manufacturer fails to honor the warranty and repair the defect - lemon laws assist that consumer in getting fairly compensated in order to get a new, working, vehicle. Few would dispute that, under both federal and state laws, consumers have the right to go to court to enforce their warranty rights, particularly in such a situation. In states where arbitration is required, it must be non-binding in order to preserve the consumer's right to trial.

Despite these legal protections, for years now the auto industry has been emboldened by the intrusion of forced arbitration in other fields. As a result, it is all too common for consumers to be deprived of their federal and state rights by contracts conditioned on acceptance of forced arbitration as a means to resolve disputes. We have long believed that when a company makes a defective vehicle, they should use their engineers to build a better vehicle, and not their lawyers to find a legal loophole to avoid responsibility. To be clear, forced arbitration has no place in rideshare agreements or in the sale or lease of automobiles, be they used or new, human driven or autonomous.

Arbitration, when voluntarily consented to by both parties post-dispute is a fine dispute resolution mechanism. Yet, the use of binding arbitration clauses continues to proliferate. Waymo's recent partnership with Uber to provide autonomous rideshare raises significant questions in this area, since Uber has zealously defended binding arbitration clauses at the expense of consumers for many years now, and Waymo currently uses forced arbitration as well. Future self-driving vehicles may be purchased or leased directly by consumers from multi-national manufacturers, creating an even greater power imbalance than when buying from a local dealership, enabling foreign manufacturers to insert forced arbitration provisions directly into consumer sales contracts.

This moment presents an opportunity to ensure that a practice designed to deprive consumers of their constitutional rights not be allowed to continue into the next generation of vehicles. Importantly, there is precedent in the area of forced arbitration and cars:15 U.S.C. § 1226, the Motor Vehicle Franchise Contract Dispute Resolution Process Act. Passed into law in 2002, this law prevents auto manufacturers from forcing arbitration clauses on their franchisees, without consent. Consumers deserve the same rights when it comes to driverless vehicles.

Thank you for your attention to this important matter,

Michael Brooks
Executive Director
Center for Auto Safety

Joanne Doroshow
Executive Director
Center for Justice & Democracy

Ruth Susswein
Director of Consumer Protection
Consumer Action

Ralph Nader
Consumer Advocate

Erin Witte
Director of Consumer Protection
Consumer Federation of America

Justin Kloczko
Advocate
Consumer Watchdog

Rosemary Shahan
President
Consumers for Auto Reliability and Safety

Tracy Rezvani
Board Member
DC Consumer Rights Coalition

Teddy Basham-Witherington
Deputy Director
Impact Fund

Christine Hines
Legislative Director
National Association of Consumer Advocates

Lauren Saunders
Associate Director
National Consumer Law Center (on behalf of its low-income clients)

Sally Greenberg
Chief Executive Officer
National Consumers League

Joan Claybrook
President Emeritus
Public Citizen

Robert Weissman
President
Public Citizen

Paul Bland
Executive Director
Public Justice

Ware Wendell
Executive Director
Texas Watch

Andre Delattre
Senior Vice President
U.S. Public Interest Research Group

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July 26, 2023

The Honorable Gus Bilirakis
Chairman
Committee on Energy & Commerce
Subcommittee on Innovation, Data, and Commerce
U.S. House of Representatives
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The Honorable Jan Schakowsky
Ranking Member
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The Honorable Tim Walberg
Vice Chair
Committee on Energy & Commerce
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U.S. House of Representatives
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Washington, D.C. 20515

Dear Chairman Bilirakis, Vice Chair Walberg, and Ranking Member Schakowsky:

Competitive Carriers Association ("CCA")[1] respectfully submits this Letter for the Record for today's Energy and Commerce Subcommittee on Innovation, Data, and Commerce's hearing "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China." As vehicle innovations and technologies continue to advance, a greater number of vehicles depend on reliable mobile and wireless networks to support a broad range of services, including aspects of various levels of automation. Without ubiquitous mobile network infrastructure throughout the U.S., certain capabilities of self-driving vehicles may be limited or simply unavailable in areas lacking sufficient mobile connectivity. As Congress considers a legislative framework to support self-driving vehicle innovation, policies that advance mobile broadband connectivity and reliability, including in rural America, are essential to supporting new services nationwide.

Accordingly, in addition to issues specific to advanced vehicle technologies and automation, CCA urges focus on the issues needed to maximize mobile connectivity in support of self-driving vehicle innovation and American competition, as well as the important goal of closing the digital divide.

[1] CCA is the nation's leading association for competitive wireless providers and stakeholders across the United States. Members range from small, rural carriers serving fewer than 5,000 customers to regional and national providers serving millions of customers, as well as vendors and suppliers that provide products and services throughout the wireless communications ecosystem.

Spectrum
Spectrum is the lifeblood of wireless networks. Carriers fundamentally depend on access to low-, mid-, and high-band spectrum to preserve and expand broadband services. The current lapse of FCC spectrum auction authority has stalled efforts to provide needed spectrum and impacts strategic competition internationally. Congress must reauthorize the FCC's spectrum auction authority immediately and identify additional mid-band spectrum that can be made available for licensed, terrestrial use.

Permitting and Siting
Permitting and siting reforms are critical to overcome major potential barriers to wireless broadband deployments. Streamlining processes and removing uncertainty regarding communications infrastructure permitting and siting would allow faster and more efficient wireless network upgrades and expansion. Congress should consider permitting policies to expedite broadband deployment at the local, state, and federal levels.

Universal Service Fund ("USF")
Many CCA carrier members rely on USF to deploy, maintain, and upgrade wireless networks in hard-to-serve and high-cost areas. USF must be sustainable and sufficient to ensure reasonably comparable services in urban and rural areas, including access to both fixed and mobile services. While recent Congressional funding will expand fixed broadband deployment, further support is needed to ensure ubiquitous mobile connectivity and avoid a "5G Gap" – including the mobile connectivity that vehicle technologies rely upon.

Secure Networks
Network security is paramount for all wireless operations. America's national security and competitiveness are threatened by the $3.08 billion shortfall in the FCC's "Rip & Replace" program, which was created by Congress to fund the removal and destruction of Chinese equipment from U.S. networks, and its replacement with equipment from trusted vendors. Affected networks are in jeopardy of serious degradation or shutting down completely. Congress must immediately provide the funds necessary to complete this program.

Robust, secure wireless networks are a key part of the development and sustainability of self-driving vehicle innovations. Keeping the U.S. at the forefront of these incredible innovations requires investment and commitment in wireless networks serving not just along the highways of America but extending to rural backroads across the country as well. CCA thanks the Subcommittee for its leadership on this important issue and appreciates the opportunity to assist your efforts on such a critical issue. We welcome any questions or comments you may have.

Sincerely,

Tim Donovan
President and CEO

Competitive Carriers Association

cc:
The Honorable Cathy McMorris Rodgers, Chair, House Committee on Energy & Commerce
The Honorable Frank Pallone, Jr., Ranking Member, House Committee on Energy & Commerce

Tuesday, July 25, 2023

Chairwoman Cathy McMorris Rodgers
House Committee on Energy and Commerce
2188 Rayburn House Office Building
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Ranking Member Frank Pallone
House Committee on Energy and Commerce
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Chairman Gus Billirakis
House Energy and Commerce Innovation, Data, and Commerce Subcommittee
2306 Rayburn HOB
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Ranking Member Jan Schakowsky
House Energy and Commerce Innovation, Data, and Commerce Subcommittee
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Dear Chairs and Ranking Members,

As representatives of a coalition committed to curbing 'Big Tech' influence, we express our deep concerns over the rapidly emerging deployment of artificial intelligence (AI) and other technology platforms in the automated vehicle (AV) industry. How we approach AV regulation today will define the future of influence tech giants have in the industry.

Big Tech's aggressive involvement in the AV sector is creating a market dominated by a handful of players, exacerbating the threat of consolidation in the automotive industry. Big Tech is expanding laterally, aiming to leverage their current market dominance into a new sector. This growing influence on the trillion-dollar transportation industry threatens our safety, privacy, labor rights, and economic health.

While Big Tech lobbies for new, relaxed regulations, we must scrutinize the impact on public safety and international competition. Unchecked adoption of AVs poses significant risks, including fatal safety hazards, societal disruptions, and job losses. Meanwhile, China's stringent regulations for automated vehicles suggest that public-oriented rules do not necessarily impede AV adoption. In turn, we believe that careful, public-oriented policy making is necessary to counter Big Tech's selfish dominance and orient AV development in the public interest.

Our specific areas of concern include:

1. **Monopolistic Dominance:** The high costs of Automated Driving Systems (ADS) development and scale advantages risk monopolistic tendencies. This is exacerbated by the fact that many of the key players already engage in monopolistic tactics like Google (Waymo) and Amazon (Zooxs). ADS developers are already dominating the sensor market, including the pivotal LIDAR technology, to limit competition. As a result, LIDAR companies are merging and adopting drastic measures to survive in the increasingly consolidated AV industry. Such aggressive monopolistic tactics are likely to get worse as this technology matures.

2. **Digital Gatekeeping:** AV manufacturers are already adopting the gatekeeping strategies of Big Tech. By controlling the vehicle driving platforms, they threaten competition and third-party app integration. This control extends beyond the physical roads to the digital interfaces within the vehicles, mirroring how tech giants like Apple and Google exploit their authority over their respective app stores to levy excessive fees and engage in anti-competitive behavior.

3. **Invasive Data Collection:** Echoing Big Tech's notorious data practices, companies operating automated vehicles are already amassing vast amounts of data from the vehicles and consumer apps. This data may be stored for years, as Chinese owned TuSimple is doing with its data going back to 2015. This collection includes sensitive personal and location information, ostensibly for vehicle training, but could be used for other, more nefarious, purposes. For example, Tesla's recent lawsuit, concerning employee access to highly sensitive, personal data, underlines the risks of data privacy exploitation. Big Tech's expansion into the AV market will extend their intrusive surveillance capacities to include license plate tracking and facial recognition, not only extending their market dominance but also posing significant public privacy concerns.

4. **Big Tech's Lack of Accountability:** Big Tech's market dominance has fostered a self-serving approach, often favoring their own services at the expense of competitors and consumers while eluding public accountability. Their use of proprietary algorithms, previously implicated in discriminatory practices, not also carries serious physical safety concerns as they navigate heavy vehicles on public roads. Legal protections and practices that have historically shielded Big Tech, like Section 230 and forced arbitration, will be strategically used to insulate themselves from liability for automated vehicles as well.

In response to these concerns, we believe Congress must intervene to protect the public. Congress should set a safe and effective precedent for AI regulation by steering automated vehicles toward operating in the interest of public welfare rather than just corporate gains:

1. **Set an Effective Precedent for AI Regulation**: AV regulation is a crucial instance of AI regulation with direct human life implications. This extends beyond automated vehicles—it's about crafting a regulatory environment promoting safe and aligned AI use. If Congress neglects AV safety in favor of Big Tech interests, we risk a hazardous precedent for future AI technologies. We need regulations that clarify responsibility, facilitate justice for harm, and ensure public understanding of potential risks. Ultimately, it's about steering AI's future to prioritize human safety, accountability, and transparency over corporate interests.

2. **Ensure Accountability and End Forced Arbitration:** Big Tech's history of evading platform impacts, often leaving consumers to shoulder the burden, signals a cautionary tale for the automated vehicle realm. Accountability for harms must squarely fall on the companies creating this new technology, and Congress must prevent forced arbitration from taking root. Survivors should maintain their right to pursue public litigation, both to seek justice for harm caused to them and serve as a deterrent to reckless AV development.

3. **Avoid Consolidation by Prompting Data Sharing and Open Standards:** Through control of the automated driving system, Big Tech can potentially monopolize a vital part of our infrastructure. Beyond being an antitrust issue, this threatens diversity, competition, and fairness in the future of transportation. Regulatory bodies like the NHTSA and FTC should be empowered to enforce data sharing rules, develop open standards, and prohibit unfair mergers and acquisitions. This not only enhances the safety and reliability of ADS, but also secures a competitive and diverse market.
4. **Ensure AV's Operate for the Public Interest**: A laissez-faire stance on automated vehicles risks overlooking the public interest that should be at the heart of Congressional regulation. AVs, more than a tech or automotive product, represent a significant shift in public infrastructure. Their regulation must go beyond safety to include public welfare. Given the considerable societal implications and risks of AVs, their development and deployment demand legislative foresight.

In conclusion, Congress must guide the development of autonomous vehicles towards public benefit rather than merely satisfying Big Tech's interests. America is stronger when we regulate with an eye towards consumer welfare, accountability, and public interest. The future of transportation and AI should be dictated by public interest and not by Big Tech.

Sincerely,

The Tech Oversight Project
Accountable Tech
Demand Progress
Bull Moose Project

U.S. Chamber of Commerce
Technology
Engagement Center

Innovation Highway:

Unlocking the Social and Economic Benefits of Autonomous Vehicles

Robert Shapiro, PhD and Isaac Yoder

July 2023

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Executive Summary

This report examines the potential social and economic benefits of autonomous vehicles (AVs). The U.S. and global markets for AVs will be extensive, and companies in the United States, China, Japan, and elsewhere are competing to develop and market them. The appeal and benefits of AVs rest on their potential to sharply reduce traffic accidents, enhance people's mobility and access (especially for those who have physical or visual limitations), reduce greenhouse gas emissions, and provide substantial economic benefits for the public. This report presents econometric models to estimate those potential benefits.

Estimates of when AVs will be widespread vary, depending on one's views about the pace of technological progress, consumer acceptance, the development of a conducive regulatory framework, and other factors. Most analysts expect high-level AVs (Levels 4 and 5) to enter the market in the next decade, and forecasts for widespread sale and adoption of these vehicles range from 2035 to the 2050s. Today, numerous companies across the United States are testing and deploying AVs on public roads. Because we cannot know precisely when and to what extent Americans will adopt AVs, our models project the likely effects when AVs constitute 25% or 50% of the U.S. motor vehicle fleet. We focus mainly on the nearest-term scenario, a 25% adoption rate. Because we also do not know the precise technologies of those AVs, our models project the likely effects for three stages of AV operations and technology based on the multimodal traffic flow model developed by the European Union's AV project.

1. Here, the European Union project's terms for the three levels of AV technology are retitled as Basic in place of "Cautious," Standard in place of "Normal," and "Advanced in place of "All-Knowing."

1. Basic AVs: Programmed to take a safe approach on braking distances, maintain sizable gaps for lane changes, and travel through intersections without signals.

2. Standard AVs: Programmed to follow traffic laws and operate like an unimpaired human driver with sensors to determine distances and speeds of other vehicles.

3. Advanced AVs: Programmed with high levels of sensor awareness and predictive capacity and the capability to cooperate with other AVs, resulting in smaller gaps in all maneuvers.

Safety and Health Benefits:

We found that accident rates would fall sharply (compared with accident rates in 2021) if AVs represented 25 percent of U.S. motor vehicles.

- With Basic AVs, we estimate 571,000 fewer accidents with 5,000 fewer fatalities and economic savings of $38 billion. With Standard AVs, we estimate 1,145,000 fewer accidents with 9,000 fewer fatalities and economic savings of $75 billion. With Advanced AVs, we estimate 1,442,000 fewer accidents, 12,000 fewer fatalities, and $94 billion in savings.

Mobility and Access Benefits:

We found that at a 25% adoption rate, Standard and Advanced AVs should markedly enhance mobility and access for elderly people and nondrivers, and Advanced AVs should also greatly enhance mobility for persons with disabilities.

- Although Basic AVs would not significantly enhance mobility, Standard AVs should increase annual vehicle miles traveled (VMT) by older people by a total of 2.5 billion miles and the VMT of nondrivers by 1.3 billion miles. Advanced AVs should increase the annual VMT of persons with disabilities by 4.6 billion miles, the annual VMT of older people by 4.9 billion miles, and the annual VMT of nondrivers by 2.4 billion miles.

Climate and Environmental Benefits:

We found that a 25% adoption of electric Advanced AVs should significantly reduce CO2 and NOx emissions, while also accounting for emissions associated with generating the electric power for AVs. Because electric vehicles produce no exhaust, the net benefits depend on those associated gains and the traffic and fuel efficiency of AV operations, less the emissions from the grid generating the electric power of AVs. We estimate the net benefits using three possible configurations for the grid based on the continued use of fossil fuels with greater or lesser use of substitutes:

1. Climate+: Grid with enhanced use of sustainable fuels and less use of fossil fuels.

2. Climate Neutral: Fossil fuels continue to dominate the grid without an enhanced role for sustainable energy.

3. Median Grid: The median between these alternatives.

We use motor vehicle CO2 and NOx emissions in 2021 as a baseline to estimate the net changes in emissions with a 25% adoption rate of electric-powered Advanced AVs. (Notably, emission reductions would be greater with Standard AVs or Basic AVs because Advanced AV operations require more electrical power than Standard or Basic AV operations).

- With a 25% adoption of Advanced AVs and a Climate + grid, CO2 emissions related to motor vehicles would be 8.2% lower, and NOx emissions would be 8.9% lower.

- With a 25% adoption of Advanced AVs and a Climate Neutral grid, CO2 emissions should fall 5.9%, and NOx emissions should fall 6.4%.

- With a 25% adoption of Advanced AVs and a median grid, CO2 emissions should be 7.1% lower, and NOx emissions should be 7.7% lower.

Economic Competitiveness:

The report also examines the economic importance of U.S. competitiveness in the production and adoption of AVs. The U.S. motor vehicle industry is a vital source of jobs for Americans. In 2021, American motor vehicle and parts manufacturers and dealers directly employed 2,922,000 people. In addition, their suppliers employed 1,270,000 people creating the industry's intermediate inputs, for a total 4,192,000 jobs. With the introduction of AVs, these employment numbers will increase.

We also expect the composition of that employment to shift toward more highly paid, technologically related jobs in software, computers, and telecom equipment and services.

The adoption of AVs will have other economic benefits. At a 25% adoption rate, annual savings from fewer accidents should total up to $94 billion (in 2021 dollars). The mobility benefits of AVs include gains in jobs and income for nondrivers, people with disabilities, and people living in areas with little access to public transit.

Further, many technologies developed for AVs can be used in other areas, from mining to spacecraft, creating jobs to support those activities.

As U.S. and global markets for AVs grow, American producers will face strong competition from state-subsidized Chinese manufacturers and other foreign competitors. In this rivalry, the United States has a technological edge because U.S. companies dominate the world's top producers of software, computers, and telecom equipment and services. China's advantage comes from its extensive state subsidies for Chinese AV makers. U.S. policymakers can level the playing field by actively promoting the safe and secure deployment of AVs in the United States.

Innovation Highway:

Unlocking the Social and Economic Benefits of Autonomous Vehicles[2]

I. Introduction and Summary of Results

This report explores the large potential social and economic benefits of autonomous vehicles (AVs). Investments in research and development and the initial commercialization of AVs and their underlying information and communications technologies have increased sharply over the past decade, and some automated driving technologies, such as lane-keeping assist systems and adaptive cruise control, are already common.[3] From extensive literature on the ways that automated driving could affect people's lives, we focus here on three areas: safety, mobility, and the environment. We also outline the economic importance of U.S. leadership in AVs.

Regarding safety, more than 90% of traffic-related deaths, injuries, and property damage arise from driver errors or failings, including driving under the influence of alcohol or drugs, distracted driving, excessive speed, and driver exhaustion. This report finds that AVs should dramatically reduce traffic accidents, fatalities, injuries, and property damage.

Regarding mobility, we found that shared-ride AVs linked to public transit systems should significantly expand access to employment, shopping, health care, and other activities for millions of nondrivers, persons with disabilities, older people, and people whose access to personal vehicles is limited by their incomes or location. Regarding the environment, adoption of electric-powered shared-ride AVs should substantially reduce greenhouse gas emissions and other pollutants.

To estimate the extent of these benefits, we also examine the potential costs associated with wide use of AVs. For example, as millions of mobility-impaired or restricted Americans gain greater mobility and access through AVs, their total vehicle miles traveled (VMT) will increase, resulting in more greenhouse gas and other emissions. Similarly, people traveling without the burdens of driving may find that they can relax during their trips and also increase their VMT.

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2. We gratefully acknowledge the U.S. Chamber of Commerce's support of our research. The analysis and conclusions are solely those of the authors.
3. Like, Chen, and Chen (2022).

Here, we assume the gradual acceptance and adoption of AVs over the next two to three decades. Public acceptance of AVs will also be helped by manufacturers that gradually introduce incremental automated driving features in conventional vehicles, a process now underway. Convincing many Americans that they can safely cede most or all their personal control over vehicles will depend on strict safety requirements and assurances, and the development of some of these features may require legislative and regulatory action. Similarly, the potential mobility benefits of AVs will be affected by local policies to route shared-ride AVs through areas now underserved by public transit and then intersect them with current transit routes. Another factor that increases the potential environmental benefits of AVs is providing incentives that favor shared-ride AVs and increased use of electric battery or other nonexhaust technologies in AV fleets.

We also consider the role of motor vehicle producers in employment. The manufacture and sale of motor vehicles and parts were responsible for nearly 4.2 million American jobs in 2021. Worldwide, 66 million vehicles were sold in 2022 for $4 trillion, and companies in China, Japan, the United States, Europe, and Korea dominated their manufacture.

The commercial introduction of AVs will quickly intensify competition among the United States, China, and others to lead the global market in AV production and sales, with large consequences for global leadership in many critical technologies.[4]

Key Results

To estimate the net benefits that AV adoption in the United States could provide in terms of enhanced safety, greater mobility and access, and reduced emissions, we created models that incorporate the primary factors that affect outcomes in those areas, informed by the findings from previous studies. Because we do not know the pace at which AVs will be accepted and deployed, we created baselines in which 25%, 50%, 75%, and 100% of motor vehicles have AV technologies. Our analysis emphasizes the 25% adoption rate because the accuracy of econometric models diminishes as the forecast period increases.

Because AVs are under development and their technologies continue to evolve, we also cannot confidently predict their precise capabilities. Rather than assume an artificial standard, we adopt an approach used by other researchers and examine three modes or stages based on technology and driver behavior: (1) “basic” AVs programmed to drive like a cautious driver who obeys speed limits and always maintains safe distances from other vehicles, (2) “standard” AVs programmed to drive like people who obey traffic laws but do not make mistakes or drive in any impaired way, and (3) “advanced” AVs with programming that communicates with other vehicles and road infrastructure and uses artificial intelligence (AI) to assess what other drivers will do before responding. The key results from these simulations follow.

4. Motor vehicle manufacturers and IT companies that develop AVs and their critical technologies include China, Japan, the United States, Germany, South Korea, Sweden, the United Kingdom, France, and Finland. See Nunno (2021).

Safety and Health

- Our analysis found that 25% adoption of AVs should produce significant safety and health benefits with major economic and taxpayer savings under all three modes of AV operations.

- Using 2020 accident rates and cost estimates and a 25% adoption rate, Basic AV operations should result in 571,000 fewer accidents (down 11%) with 5,000 fewer fatalities, economic savings of $38 billion, and $3.3 billion in taxpayer savings. Standard AV operations should bolster these benefits through 1,145,000 fewer accidents (down 22%), 9,000 fewer fatalities, economic savings of $74.8 billion, and $6.6 billion in taxpayer savings.

- Similarly, Advanced AVs with the 25% adoption rate should reduce accidents by 1,442,000 (down 28%), with 12,000 fewer deaths, and should result in $94.2 billion in economic savings and $8.3 billion in taxpayer savings.

Mobility

- At 25% adoption rates, Standard and Advanced AV technology and operations should produce meaningful mobility benefits for older people and nondrivers, and Advanced AV technology should produce those benefits for people with disabilities.

- Using 2017 population estimates for these groups and 2020 average VMT, access to Standard AVs should increase the total VMT of older people by 2.5 billion miles (2.4%) and the total VMT of nondrivers by 1.3 billion miles (1.7%).

- Similarly, access to Advanced AVs should increase the total VMT of people with disabilities by 4.6 billion miles (1.2 percent), the total VMT of older people by 4.9 billion miles (4.8%), and the total VMT of nondrivers by 2.4 billion miles (3.1%).

Greenhouse Gas Emissions and the Environment

- Assuming that AVs will be electric vehicles that do not produce carbon dioxide (CO2) and nitrogen oxide (NOx) exhaust, their environmental benefits depend on the fuel efficiency of their operations and the gains from their electric powertrains, less the emissions produced generating the electric power. As a result, the environmental benefits depend on the grid's use of sustainable energy versus fossil fuels.

- Assuming a 25% adoption rate of Advanced AVs, the baseline of current motor vehicle emissions, and a grid that uses significantly more sustainable sources of energy, we estimate that CO2 emissions will be 8.2% less, and NOx emissions will be 8.9% less.

- With the same assumptions and a grid that uses the current mix of sustainable energy sources and fossil fuels, CO2 emissions should be 5.9% less, and NOx emissions should be 6.4% less.

- The median of these results would be 7.1% less CO2 and 7.7% less NOx emissions.

AV Technology

Before examining the benefits of AV adoption in greater detail, we will review its basic features. The Society of Automotive Engineers and the National Highway and Traffic Safety Administration (NHTSA) distinguish five levels of automated vehicles, from cruise control to fully autonomous operations.[5] Today, Level 1 and Level 2 vehicles have automated features, as distinct from truly autonomous vehicles, and are on the roads in the United States and elsewhere. In addition, limited versions of Level 3 vehicles are becoming available, and more than 80 companies are testing and deploying AVs in 30 states and 120 cities across the United States.[6]

- Level 1: Vehicles with one or more automated basic features, such as cruise control, and the driver performs all other tasks.
- Level 2: Vehicles with two or more automated features that work together, such as lane keeping and adaptive cruise control, and the driver performs all other tasks.
- Level 3: Vehicles capable of driving themselves under certain traffic and other conditions, and the driver takes control when signaled to do so by the vehicle's systems.
- Level 4: Vehicles capable of driving themselves under certain traffic and environmental conditions and continue to operate if the driver does not intervene when signaled.
- Level 5: The vehicle is fully autonomous.

AVs need to account for variations in weather, natural light, geography, road conditions, and the placement and movements of other vehicles and pedestrians. To do so, Level 4 and Level 5 AVs use an array of sophisticated technologies to transmit, collect, and analyze large streams of data accurately. These technologies often include next-generation GPS to precisely triangulate a vehicle's positions; 360-degree radar and LiDAR sensor systems using radio waves and light beams to determine exact distances between obstacles and a vehicle's sensors; advanced camera systems that use algorithms to interpret image data; infrared sensors for objects difficult to detect under certain weather and nighttime conditions, including lane markings, pedestrians, bikes, and board-based personal transport; and systems that enable these sensor- and camera-based technologies to communicate between vehicles and road infrastructure. AVs also require AI technologies to accurately interpret these streams of data and to direct the vehicle's responses in an environment in which other vehicles also respond to their streams of data and some other vehicles are controlled by drivers.

AVs can also be equipped with advanced connectivity technologies to communicate with other vehicles on the same roads and with roadside infrastructure and other devices.[7] Vehicle-to-vehicle connectivity can determine their locations, headings, and speed. Vehicle-to-infrastructure connectivity can interpret traffic signals, lights, and signage. Vehicle-to-everything connectivity can ensure 360-degree coverage for at least 1.5 miles.[8] Extensive connectivity will be essential for the safe operations of Level 4 and Level 5 AVs. Such extensive communication also will need access to radio spectrum.

5. National Academy of Sciences, Engineering, and Medicine (2021-A).
6. Engadget (2023); Alliance for Automotive Innovation (2022).
7. Ibid.
8. Ibid.

In 1999, the Federal Communications Commission set aside 75 MHz for intelligent transportation systems. In 2022, it reallocated 45 MHz for other purposes and added 45 MHz of lower spectrum for "intelligent transport."[9]

Through the development of Level 1, Level 2, and Level 3 AV technologies, many companies have accumulated considerable experience with these technical challenges. On this basis, some observers expect Level 4 and Level 5 AVs to become commercially viable in this decade and their widespread use to follow in the 2030s.[10]

Forecasts of When People Will Adopt AVs

The timeline for widespread adoption of automated vehicle technologies is uncertain, and projections vary widely depending on the analysts' views of the pace of technological

progress and consumer acceptance, regulatory frameworks, and other factors.[11]

Lux Research has forecast that by 2030, 92% of vehicles worldwide will have Level 2 technologies, and 8% will have Level 3 technologies.[12] Other analysts also expect Level 4 AVs to enter the market in the next decade, whereas Level 5 AVs may take longer to achieve broad adoption.

However, the Victoria Transport Policy Institute has predicted that high-level AVs will be commercially available by 2030 with rapid increases in sales thereafter, and a study from the University of Texas projects that 5% of U.S. vehicles will be Level 4 AVs by 2030.[13]

The projected timelines of major automakers currently investing in AV technologies also cover a wide range.[14] Half a decade ago, most expected to introduce varying levels of autonomy in their vehicles by the mid-2020s,[15] but many AV companies have since pushed back their timelines. Similarly, the European Road Transport Research Advisory Council (ERTRAC) forecast in 2019 that initial deployment of Level 3 and Level 4 vehicles for highway driving, truck platooning, and low-speed transport in urban areas in Europe will start phasing in by 2025, with widespread adoption of Level 3 and Level 4 AVs in complex urban environments by 2030.[16] Beyond 2030, ERTRAC envisions continued development and deployment of Level 5 vehicles, assuming that the technical, legal, and societal challenges associated with fully autonomous driving are resolved.

Longer-term projections also vary widely, from estimates that Level 4 AVs will account for only 10% of the global vehicle fleet by 2040[17] to the forecast by the International Transport Forum that 70% of vehicles worldwide will be AVs by 2050.[18]

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9. Intelligent Transportation Society of America *v.* Federal Communications Commission, August 12, 2022.
10. For example, Litman (2023).
11. The adoption rate of connected autonomous vehicles is likely to follow an S-shaped curve characteristic of the diffusion of many innovations, which makes predicting the timeline of mass adoption difficult. Initial adoption is predicted to be slow, followed by a rapid increase in uptake, and eventually leveling off as the technology reaches saturation (Talebian and Misra 2018).
12. Laslau, Frangoul, and Robinson (2014).
13. Litman (2021); Bansal and Kockelman (2017).
14. Walker (2019).
15. Some industry experts predict that automation will require a longer timeline for research, development, and testing. See Mervis (2017) and Ackerman (2017).
16. European Road Transport Research Advisory Council (2019).
17. Gartner (2020).
18. International Transport Forum (2018).

A literature review of AV adoption scenarios found that predictions for 2050 vary from 5% to 40% of the worldwide fleet.[19] By contrast, IHS Automotive projected that the global fleet would be fully autonomous by 2051, and the Rand Corporation has estimated that Level 4 and Level 5 vehicles will become dominant after 2040.[20] Other analysts have predicted rates of future sales of Level 4 and Level 5 vehicles, ranging from 10% of sales by 2035 to 25% of sales by 2030 and 55% of sales by 2050.[21]

Economic Benefits from Broader Application of New AV Technologies

AVs' enabling technologies will also likely generate significant benefits in many areas. As noted, their potential to sharply reduce traffic accidents will produce major economic savings and gains, including increased productivity of people spared injury or death and lower property damage, health care costs, and auto and health insurance premiums.

Also as noted, broad use of rideshare AVs will provide new access to jobs for people with disabilities who are unable to commute to find productive employment and will expand job opportunities for nondrivers and other people living in areas poorly served by public transit. And fleets of electric-powered AVs would reduce energy use, congestion, and the economic costs of responding to climate change.

Beyond those economic benefits, many technologies developed for AVs have other productive uses and create jobs to produce, operate, and maintain them.

For example, AVs will be equipped with 360-degree radar based on a network of multiple microwave radar systems at different places and orientations to provide narrow- and wide-beam and short- and long-range scans calibrated for any weather and lighting conditions.[22] The efficiency, resolution, and scope of these systems have many other applications. For example, the U.S. defense industrial base is applying these 360-degree radar technologies to develop the next generation of U.S. air defense systems.[23] These technologies can also be used to reduce workplace accidents by monitoring facilities where people work together with robots.

LiDAR, a remote sensing technology that emits infrared light beams from pulsed lasers, is another AV technology with broad applications. Working with other sensors, cameras, scanners, and specialized GPS receivers, LiDAR systems can produce millions of measurements in all directions that are combined to generate precise, three-dimensional information about the AV's environment, including the identities of objects such as pedestrians, other vehicles, and roadway abnormalities.[24] Current research and development (R&D) with LiDAR focuses on enabling AVs to see through, around, and beyond solid objects.

19. Shiwakoti, Stasinopolous, and Fedele (2020).
20. IHS Automotive (2014); Rand Corporation (2021).
21. Mosquet et al. (2015); Litman (2022).
22. Murray (2019).
23. Eshel (2019).
24. American Geoscience Institute (2022); also, Lawrence-Berkeley (2019a).

Three-dimensional LiDAR imaging has many other uses that can generate substantial job and income benefits—for example, mapping crops and determining soil properties from topographic analysis; measuring concentrations of atmospheric gases and aerosols; gauging diversity of species in various habitats; and assessing damage after earthquakes, landslides, and other destructive natural events.[25] Scientists can also use the technology to produce shoreline maps and elevation models for geographic information systems, estimate carbon absorption rates in forests, and measure changes in glaciers and beaches.[26]

Law enforcement can use LiDAR to enforce speed limits, detect fingerprints, and collect detailed evidence for forensic analysis.[27]

The Pentagon can use it in advanced ground surveillance, air defense systems, and spacecraft.[28] Similarly, mining companies can use LiDAR technologies in oil and gas exploration and to calculate underground ore volumes. Architectural firms can use it in designing buildings, and construction companies can use it to detect small structural faults in structures.[29]

Cellular network companies also use LiDAR to determine lines of sight and viewsheds for antennae, hospitals use it to help locate tumors, and entertainment companies use it to create digital objects for films and games.[30]

Other next-generation sensor technologies under development for AVs also have other uses that translate into more employment and other economic benefits. These sensor technologies detect the movements and locations of nearby objects by emitting infrared radiation that strikes them and bounces back to the sensors Integrated with radar and AI, infrared sensors can be used to track objects ranging from missiles to nanoparticles in living organisms, study the weather, detect gas emissions, examine the properties of minerals, and enhance the security of access control systems.[31] Further, the cellular vehicle-to-everything systems (C-V2X) developed for AVs have many other uses. These technologies, which give AVs the capacity to see around obstructions and to communicate with other AVs, highway infrastructure, and the cloud, can also be applied to electronic toll collections and vehicle safety inspections, monitoring supply chains, and detecting equipment problems in factories.[32]

25. Lawrence-Berkeley (2019b).
26. American Geoscience Institute (2022).
27. Ibid.
28. Ibid.
29. Lawrence-Berkeley (2019b).
30. Ibid.
31. Kisi (2022).
32. El Zorkany, Yasser, and Galal (2021).

II. U.S. and Global Markets for AVs and the Looming U.S.–China Competition

Motor vehicle manufacturers and information and telecommunications companies in many countries are developing AVs and associated critical technologies. Based on current competition for global sales of motor vehicles, we should expect the United States and China along with Japan to vie for leadership in the production of AVs. China has announced its intention to lead the world in developing and deploying AI and its application to AVs.

In 2017, China's government released a national strategy to lead the world in AI[33] and three years later announced new goals that 50% of cars produced by China's state-owned and private manufacturers will have Level 3 AV technologies by 2025 and 30% will have Level 4 AV capacities by 2030, all equipped with AI.[34] In 2021, the government's new five-year plan included directives that China's national laboratories intensify their R&D efforts in AVs and AI.[35] Moreover, Chinese companies are reportedly dedicating large sums to AV R&D, with vehicle makers such as Baidu, Pony.ai, and WeRide spending $15 billion on such R&D in 2021.[36]

China has also taken steps to prepare for entering the U.S. market by conducting research and testing of their AVs in California and by collecting data on U.S. transportation infrastructure.[37]

In addition, European countries have been developing regulatory frameworks for fully AV operations. In 2022, the European Union adopted the first multinational Level 4 vehicle certification ("type-approval") framework, the most comprehensive AV requirements to date covering robotaxis, hub-to-hub freight, and automated valet parking.

In addition, France and Germany have enacted a suite of national rules to govern the commercial operation of transport-as-a-service use cases.

Many American vehicle and technology manufacturers have also accepted the challenge. By one recent account, major U.S. companies heavily invested in developing AVs include General Motors, Tesla, Alphabet's Waymo, Nissan, Ford, Toyota's Woven Planet, Hyundai's robotaxi, Amazon's Zoox, Rivian, Cruise, and Aurora.[38] In addition, U.S. companies, such as Lyft, Microsoft, and nuScenes, are developing the data sets that AVs will need to learn to make decisions about how to navigate; others, such as Luminar Technologies and Innoviz, are developing sensor technologies for AVs.[39] In 2021, equity funding for new AV-related technology companies exceeded $12 billion, up more than 50% from 2020.[40]

33. Roberts et al. (2021).
34. Tabeta (2020).
35. Murphy (2021).
36. Kawakami and Shimizu (2023).
37. Tabeta and Shiraishi (2019).
38. Goncharov (2022); Fannin (2022).
39. Goncharov (2022).
40. Fannin (2022).

Given the Chinese government's aggressive steps to promote China's leadership in future AV markets, the U.S. government could respond with more support for the development and production of AVs by U.S. companies. Direct support has traditionally been limited. In 2020, for example, Congress called on the Department of Commerce and the Federal Trade Commission to report on how the United States can create the economic conditions needed to promote AV and other emerging technologies.[41] In 2022, Congress passed the CHIPS and Science Act that provides $53 billion to develop domestic capacity for semiconductors critical for the automotive industry and particularly AVs.[42]

Global Market for Motor Vehicles

Although AVs will produce significant safety, mobility, and environmental benefits wherever their use is widespread, the extent of the U.S. employment and income benefits will also depend on AVs being developed and produced in the United States. The competition around AV production and sales, especially between the United States and China, will be intense and economically consequential.

The current U.S. and global markets for conventional motor vehicles can provide a baseline to gauge the likely dimensions of that competition.

Motor vehicles are sold and used in every country, with 2021 worldwide sales of more than 66 million units and revenues of nearly $4 trillion.[43] With the exception of China's vehicle manufacturers, other major producers maintain global production networks based on the locations of their important suppliers and markets.

As a result, major motor vehicle production facilities are located not only in countries with global vehicle brands—the United States, Japan, Korea, Germany, France, and Britain—but also in places such as India, Brazil, Spain, and Thailand.[44]

Despite China's small global footprint in the production of motor vehicles, one-third of all worldwide vehicle production in 2021 occurred in China. Chinese and foreign vehicle companies manufactured 22,225,242 units, compared with the 8,825,100 vehicles produced in the United States. Japan made 5,566,500, Germany made 3,353,200, and South Korea made 3,351,100.[45] Notably, automakers in China also sold 1,850,000 units abroad, including 60% of worldwide exports of electric vehicles[46] or twice the volume of all U.S. motor vehicle exports.[47]

China is also now the world's largest market for motor vehicles, with 2021 domestic sales of 21,413,700 units.[48] China's 14 state-owned automakers and 40 independent producers accounted for more than 45% of those sales. Japanese, German, and American vehicle companies accounted, respectively, for 21%,

41. The American Competitiveness of a More Productive Emerging Tech Economy Act (2020).
42. The Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act (2022).
43. International Organization of Motor Vehicle Manufacturers (2022).
44. Ibid. All told, 50 countries produced passenger cars and commercial vehicles in 2021.
45. Marklines (2022a) and Marklines (2022b). In the United States, the three major American producers (General Motors, Ford, and Tesla) accounted for about 40% of total production (3,519,344 units). This was followed by three major Japanese manufacturers (Toyota, Honda, and Nissan), with about 28% of U.S. vehicle production, and two major Korean manufacturers (Hyundai Kia and Subaru), with nearly 12%.
46. Shen (2022).
47. Federal Reserve Bank of St. Louis (2022).
48. Marklines (2022c).

20%, and 10% of China's market.[49] The United States is the world's second largest market for motor vehicles, with Japanese and American producers accounting for nearly two-thirds of all U.S. new vehicle sales in 2021.[50] The Dutch group Stellantis (Chrysler, Dodge, Fiat, and Peugeot) was next, with nearly 12% of U.S. sales, followed by Korean producers with just under 9% and German manufacturers with less than 7%.[51] This global competition occurring principally among American, Chinese, European, and Japanese automakers will set the stage for the competition over AV production and sales.

Impact of the Motor Vehicle Industry on the U.S. Economy

The stakes for the United States in that competition can be gauged by the motor vehicle manufacturing industry's current impact on the U.S. economy, including employment, contributions to U.S. gross domestic product, exports, and R&D. For example, motor vehicle and parts manufacturers (MVPMs) in the United States employed 957,000 people in 2021, produced a gross output of $733 billion, and contributed $158.5 billion in value added to the gross domestic product.[52] Those manufacturers also had fixed business assets of $300 billion,[53] invested $19.5 billion in R&D, and accounted for $144 billion in U.S. exports.[54]

The economic impact of MVPMs is even greater because their U.S. operations also support revenues and jobs for many other industries through the MVPMs' large purchases of goods and services as intermediate inputs. Those input purchases totaled $574.5 billion in 2021, accounting for the difference between the industry's gross output and its value added or contribution to the gross domestic product.

Table 1. Motor Vehicle and Parts Manufacturing in the United States: Gross Output, Value Added, and Intermediate Inputs, 2021[55]

Gross output	Value added (GDP)	Intermediate inputs
$732,951 M	**$158,456 M**	**$574,495 M**

49. Wikipedia (2022). The big five state-owned automakers are SAIC Motors (2021, 5.4 million sales), FAW Group (3.5 million sales), Dongfeng Motors (3.3 million sales), Chang'an Group (2.3 million sales), and GAC Group (2.1 million sales).
50. Japanese producers accounted for 34% and U.S. producers accounted for 29% of those sales.
51. Marklines (2022d) and Marklines (2022e). In global sales outside China, Toyota led with sales of 10,496,000 units, followed by the VW Group with sales of 8,882,000 units, the Renault-Nissan-Mitsubishi Group with sales of 7,771,000 units, the Hyundai-Kia Group with sales of 6,668,000 units, General Motors with sales of 6,98,000 units, the Stellantis Group with sales of 6,41,000 units, Honda with sales of 4,121,000 units, and Ford with sales of 3,942,000 units.
52. Bureau of Economic Analysis (2022a).
53. Bureau of Economic Analysis (2022c).
54. Bureau of Economic Analysis (2022b).
55. Bureau of Economic Analysis (2022a).

The input purchases by MVPMs also have a disproportionate impact on other industries because they account for 76.5% of the motor vehicle industry's gross output, as compared with 59.6% for all manufacturing and 44.8% for all private industries.[56] These inputs also are dominated by goods and commodities rather than services. In 2021, material goods and commodities accounted for 92% of MVPM's inputs.[57]

We applied input–output analysis to identify the industries that most depend on their sales to MVPMs. For this analysis, we do not include inputs purchased from other companies in the MVPM industry, totaling $260.3 billion in 2021.

Apart from the intra-industry inputs, 23 industries sold at least $1 billion in inputs to MVPMs in 2021, with five industries accounting for nearly 72% of all of those inputs: $64.3 billion from primary metal producers, $55.1 billion from fabricated metal producers, $34.5 billion from plastic and rubber product makers, $33.5 billion from machinery manufacturers, and $32.7 billion from computer and electronic product makers. In addition, three industries are especially dependent on those input purchases because they accounted for more than 10% of their total output. MVPM purchases represented 24.5% of the total output of primary metals producers, 14% of the output of fabricated metal products manufacturers, and 14% of the output of plastic and rubber product producers. MVPM input purchases also constituted 8% to 9% of the total output of machinery manufacturers, computer and electronic product makers, nonmetallic mineral product producers, and apparel and leather product manufacturers. The economic impact of the U.S. motor vehicle industry also includes the dealers in its vehicles and parts.

Those dealers directly employed an additional 1,965,000 people in 2021,[58] and like vehicle manufacturers, their input purchases supported growth and jobs in many other industries. In 2021, motor vehicle and parts dealers (MVPDs) purchased $99.8 billion in inputs from other industries, including purchases of $1 billion or more from 23 other industries.[59] Their largest suppliers were service companies, including $18.4 billion in purchases from professional, scientific, and technical service providers; $15.0 billion in real estate services; $7.7 billion for warehousing and storage services; $5.4 billion for administration and support services; and $4.3 billion for utility services.

MVPDs' purchases accounted for 1% to 5% of the output of four of its supplier industries: warehousing and storage service companies (4.2%); plastic and rubber product manufacturers (1.5%); miscellaneous professional, scientific, and technical services companies (1.0%); and real estate companies (1.0%).

The manufacture of AVs and their parts will draw on different combinations of inputs than current motor vehicle production. For example, MVPMs of AVs will likely purchase greater quantities and shares of inputs from computer and electronic manufacturers, computer system design service providers, and telecommunications companies. However, the motor vehicle and parts industry's dependence on inputs from other industries and the associated impact on jobs and demand in those industries will continue as MVPMs shift some production to AVs. And as U.S. and global motor vehicle sales gradually come to include AVs, the industry's significance for the American economy and employment should increase.

56. Ibid.
57. Motor vehicle and parts manufacturing was relatively less energy dependent; its energy purchases accounted for 0.5% of its inputs compared with 2.2% for all manufacturing.
58. Bureau of Economic Analysis (2022d).
59. We exclude intra-sector inputs purchased by those dealers from MVPMs, totaling $7.6 billion in 2021, and focus on the $84.7 billion in purchases from those 23 other industries.

III. AVs and Public Safety: Impact on Accidents and Related Deaths, Injuries, and Property Damage

The Pew Research Center reports that AV safety is a major concern for many people.[60] Yet, their greatest potential benefits lie in their capacity to sharply reduce traffic accidents and their accompanying injuries, deaths, and property damage. In contrast to many drivers, AVs cannot be distracted by conversations, cell phones, or other diversions, nor can they become sleepy, exhausted, or impaired by alcohol, drugs, or other causes. AV sensors and software have a broader view of a vehicle's environment regardless of weather or day or night and should be able to adapt to novel driving situations.[61]

A Department of Transportation study put it this way: "Automated vehicles that accurately detect, recognize, anticipate and respond to the movements of all transportation system users could lead to breakthrough gains in transportation safety."[62]

Reducing the Human and Economic Costs of Motor Vehicle Accidents

Motor vehicle accidents entail enormous costs.[63] The NHTSA reports that 5,250,100 crashes were reported to police in 2020, and 31% involved serious personal costs, including nearly 35,800 fatalities and 1,594,000 injuries.

The remaining 69% or 3,621,700 accidents caused property damage, usually to the vehicles, without inflicting injury or death.[64]

The NHTSA further estimates that 94% of serious motor vehicle crashes resulting in injuries or deaths in 2018 involved driver-related factors, from impaired driving to speeding or illegal maneuvers.[65] Drivers are the dominant victims in fatal crashes, as 58% are single-car accidents:[66] In 2020, motor vehicle accidents killed 19,500 drivers and 5,800 motorcyclists, as well as 6,000 passengers, 6,500 pedestrians, and 940 bicyclists and other pedal cyclists.[67]

60. Rainie et al. (2022).
61. U.S. Department of Transportation (2018).
62. Ibid.
63. Our use of the term "accidents" is interchangeable with the Department of Transportation's use of vehicle "collisions" and the NHTSA's use of "crash" statistics.
64. National Highway Traffic Safety Administration (2022), Table 1.
65. Ibid.
66. Ibid., Table 28.
67. Ibid., Table 1. Fatal crashes are as likely to involve SUVs and other light trucks versus passenger cars: 20,600 of those accidents involved SUVs and light trucks compared to 20,900 involving passenger cars, 4,840 involving large trucks, and 5,715 involving motorcyclists (Table 3).

About 30% of those fatalities, or 11,654 people, including 1,952 pedestrians, involved drivers who were impaired by alcohol or other intoxicants.[68] Drivers also are the most frequent victims of accidents that result in injuries short of death. Crashes in 2020 involved injuries to 1,545,700 drivers and 82,500 motorcyclists, as well 546,800 passengers, 54,800 pedestrians, and 37,900 pedal cyclists.[69]

These accidents involve substantial economic costs. The Centers for Disease Control and Prevention reports that the medical and work-related costs arising from fatal motor vehicle accidents totaled $55 billion in 2018.[70] Similarly, the National Safety Council estimates that medical and work-related costs averaged $1,750,000 per motor vehicle fatality in 2020.[71] Based on these estimates, traffic fatalities in 2020 imposed $62.7 billion in one-year economic costs. The National Safety Council also estimates that the average economic cost per injury caused by motor vehicle accidents in 2020 ranged from $29,200 for "evident injuries" (those evident at the time of the accident and neither fatal nor incapacitating) to $101,000 for "incapacitating injuries" (those that prevent the victim from continuing normal activities at the time of the accident).

Because incapacitating injuries accounted for 8.1% of all accident injuries, we can estimate that economic costs associated with injuries totaled $79.9 billion in 2020.[72]

Apart from fatalities and injuries, motor vehicle accidents also involve large-scale property damage, primarily damage to the vehicles involved in the accidents. Based on earlier NHTSA estimates of the property costs from motor vehicle crashes,[73] we calculate that in 2020, property damage costs averaged $13,012 per fatal accident, $12,883 per accident involving injuries, and $4,164 per accident involving only property damage.[74] On this basis, property damages associated with motor vehicle accidents in 2020 totaled $36.1 billion—$465.4 million in property damages arising from 35,766 fatal accidents, $20.5 billion in those damages arising from 1,593,390 accidents involving injuries, and $15.1 billion in those costs for 3,621,681 accidents with only property damage.

So, all told, the economic costs arising from police-reported motor vehicle accidents totaled $178.7 billion in 2020, including the costs of medical care, lost work, and direct property damages. That estimate does not include other costs associated with crashes, including the pain and suffering caused by accidents, increased insurance costs, legal costs, and costs arising from congestion related to accidents.

AVs' Potential Impact on Safety

AVs cannot eliminate all motor vehicle accidents and their resulting costs. For a time, AVs will share highways and roads with conventional vehicles driven by fallible drivers, and AVs can break down or malfunction.

68. National Highway Traffic Safety Administration (2022), Table 13 and Table 20. Notably, 83% of fatal accidents occur under normal weather conditions (Table 26).
69. Unlike fatal accidents, these crashes were more likely to involve passenger cars (1,514,600) than SUVs and other light trucks (1,129,200); 107,000 large trucks and 79,700 motorcycles were also involved in accidents with injuries.
70. Centers for Disease Control and Prevention (2020).
71. National Safety Council (2022). The work-related costs include a victim's projected lifetime work-related income.
72. National Highway Traffic Safety Administration (2022). Table 54.
73. National Highway Traffic Safety Administration (2015). Table 1-4.
74. The inflation adjustment uses the Bureau of Economic Analysis GDP deflator.

Moreover, no technology can avoid crashes under anomalous conditions unanticipated by AV programming or situations in which all available responses result in accidents.[75] However, AVs could dramatically reduce the 30% of accident fatalities that today involve drunk drivers,[76] the 22% that involve high speeds,[77] and the 17.5% that involve collisions with fixed objects.[78] AVs would significantly reduce these types of errors by supplanting fallible drivers with advanced sensors and algorithms to detect and respond to road hazards, make decisions and take actions based on real-time data and inputs, and react quickly to changes in their environments.

Some analysts have already tried to evaluate the safety of AVs and to project their consequent impact on traffic accidents. Early studies did not produce a consensus. One 2016 study forecast that advanced AVs could reduce traffic accidents by 90%.[79] Another study published estimated that fatalities could fall by 25,000 per year, with annual benefits totaling more than $200 billion, if AVs represented 90% of all vehicles.[80] A third study suggested that AV crash rates could be comparable to conventional vehicles.[81]

A recent study, however, forecast that AVs could prevent or avert 34% of crashes,[82] and other analysts have argued that deployment of AVs would be justified if they can reduce crash rates by 10 percent.[83] Some recent evidence also suggests that AVs with current technologies are safer than human-operated vehicles. Waymo reports that its self-driving vehicles drove more than 10 million miles on public roads with only a handful of minor accidents, and all those accidents were caused by other human-operated vehicles.

The complete extent of AVs' impact on safety and health in the 2030s and 2040s will depend on their rate of uptake, the mode of their use and ownership, their engine types, and the extent to which AVs increase access. Under nearly all conditions, we find that the widespread use of AVs should make the roads safer. Beyond that, the deployment of fully electric shared AV fleets would also contribute to public health by reducing greenhouse gas emissions and other air pollution.

However, the widespread use of AVs may also entail some adverse health effects, such as possibly reducing physical activity, raising noise levels, and under certain conditions increasing congestion.[84]

Given AVs' potential to reduce accidents, their widespread adoption could reduce public perceptions of the risks associated with motor vehicles and could consequently lead to more risky behavior by some people, such as less seatbelt use, less attention to warnings from the AV's systems, or risky behavior by drivers in conventional vehicles who trust that AVs will prevent an accident.[85]

75. Bailey and Erikson (2019).
76. National Highway Traffic Safety Administration (2022). Table 20.
77. Ibid., Table 33.
78. Ibid, Table 42.
79. Arbib and Seba (2017); Gao et al. (2016).
80. Lutrell (2015).
81. Sivak and Schoettle (2015).
82. Mueller, Cicchino, and Zuby (2020).
83. Groves and Kalra (2017).
84. Rojas-Rueda, Nieuwenhuijsen, and Frumkin (2020).
85. Millard-Ball (2016).

This overtrusting of technology[86] could also dampen the investment and use of conventional safety strategies such as driver education and training programs and vehicle safety features and investment in road infrastructure improvements.[87]

AV designers and programmers will need to consider technologies to address roadway risks to nonautomotive travelers who may be difficult to quickly detect, identify, and accurately predict their course, such as pedestrians, bicyclists, skateboarders, and motorcyclists.[88] Those designers and programmers will also need to account for how human drivers in conventional vehicles may interact with AVs in mixed-traffic situations, especially if drivers assume that AVs can offset their own risky behavior.[89] And if the adoption of AVs results in more VMT, those increases could lead to more accidents.[90] Even considering these other factors, given the current dimensions of deaths, injuries, and property damage arising from motor vehicle crashes, even modest improvements from the deployments of AVs could yield significant advances in safety and health.

Risks Associated with Cybersecurity and Platooning

An AV's complex networks of sensors and algorithms raise safety issues based on the possible vulnerability of those systems to hacking or compromise from operational failures.[91] Given current technologies, interfering with the safe operations of AVs could be relatively simple.

One study found that that graffiti-like markings on a roadside stop sign resulted in an AV's 2018 software misreading the stop sign as "Speed Limit 45."[92] To mitigate these risks, AV designers could create multiple levels of security and redundancy, although the rapid rate of change in AI and AV technologies complicates efforts to predict and prevent potential cyberthreats to those technologies.

The introduction of new AV driving modes such as platooning, in which a convoy of AVs travel closely together to reduce drag and improve fuel efficiency, may also introduce novel safety risks.[93]

Although platooning can improve safety by reducing the distance between vehicles and providing for more rapid reaction times, it may also worsen some accidents if one of the vehicles leaves the convoy, the convoy encounters an obstacle unanticipated by its programming, or simply the proximity of AVs in a platoon increases the prospect that a single vehicle failure could affect multiple vehicles.[94]

To address these and other technology-related risks, government regulators and AV developers and producers will have to collaborate on solutions that can minimize risk.

86. Ackerman (2017).
87. Lawson (2018).
88. Pedestrian and Bicycle Information Center (2023).
89. Yu (2021).
90. Trommer et al. (2016).
91. Dawn Project (2022).
92. Eykholt et al. (2018).
93. Sha (2020).
94. Ibid.

Air Quality and Other Public Health Benefits of AVs

The deployment of AVs may enhance public health in ways unrelated to motor vehicle accidents. First, as explored in Section V of this study, AVs could significantly reduce greenhouse gas and particulate emissions and so help prevent an estimated 7 million premature deaths per year from air pollution.[95] This contribution to public health will depend on the energy sources that generate the electric power. AV developers will also have to consider pollution from other sources in AVs, such as brake wear particles with high oxidative content and perhaps noise pollution from AVs that operate at higher speeds.[96]

Second, the widespread adoption of AVs may also promote public health by freeing up green spaces in urban and suburban areas and by encouraging more physical activity.

For example, AVs should reduce demand for urban parking spaces because AVs can park more efficiently and use less space.[97]

Some studies suggest that significant reductions in urban parking spaces could encourage the greater use of public transit, cycling, and pedestrian infrastructure[98] and that more green spaces can have positive effects on people's mental health and well-being.[99]

As a potential countervailing factor, some studies suggest that if the deployment of shared-ride AVs ends up producing greater urban and suburban sprawl, that could increase total VMT and discourage pedestrian and cycling activity.[100] Finally, widespread use of AVs could have other, indirect effects on people's health and well-being. For example, people riding in AVs can relax, thus reducing the stress that often accompanies driving, but some AV riders may choose to work while riding, which could expand their working hours and perhaps increase stress.[101]

The health and other related effects of AVs also will depend on public spending decisions, such as increases in public support for green spaces, safe walking areas, and the application of environmental regulations to AVs. The impact on different populations will also be affected by whether public planning and spending ensure access to AVs for people with impaired mobility. Incomes may also matter because people with the means to access AVs will receive most of the benefits from reduced accidents. More generally, a survey of the literature on these issues found that differences in the health effects from various scenarios for AV use depend significantly on people's incomes and access to alternative means of transport.[102]

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95. World Health Organization (2022).
96. Nadafianshahamabadi, Tayaraini, and Rowangould (2021). Some analysts also have also raised questions about whether electric-powered AVs might expose their passengers to harmful electromagnetic fields. However, numerous epidemiological studies have failed to establish links between exposure to nonionizing electromagnetic fields and cancer and other health risks. See Rojas-Rueda (2020)
97. Harrison et al. (2022); Rojas-Rueda (2020).
98. Ibid.
99. Rojas-Rueda (2020).
100. Harrrison et al. (2022).
101. Almlöf et al. (2022).
102. Ibid.

Impact of AVs on the Insurance Sector

The principal health benefits of AVs from substantially reducing rates of motor vehicle accidents will also affect the health care and insurance industries. One analyst has estimated that the reduction in collisions arising from broad use of AVs would lower national health care costs by more than 16%,[103] and other studies similarly conclude that AVs could significantly reduce the size of the health care sector.[104]

In much the same way, the broad adoption of AVs could significantly affect the auto insurance and health insurance industries. Their initial adoption could increase insurance industry revenues if the cost of coverage for AVs is more expensive during the initial period of adoption and certification.[105] However, the expected reduction in accidents, especially serious collisions, should reduce premiums and lower industry revenues, a development that would be enhanced if AVs lead to fewer vehicles on the road.

AVs' Projected Effects on Public Health and Safety

We used our baseline model to evaluate the connections between AVs and public health. We applied the impact of transportation on public health and the impact of AVs on those transportation systems and then used those results and findings from other studies to estimate the likely impact of AV use on health and safety through traffic accidents.

Our model also draws from a 2020 study that analyzed 32 pathways through which AVs could affect public health, including negative and positive effects, adjusted for our baseline model's assumptions.[106]

The positive effects include reductions in collisions and other improvements in traffic safety; enhanced access to jobs, healthy food, and health care for certain populations; reduced stress associated with driving; fewer transportation-related emissions; more efficient traffic flows; and potential savings in transportation infrastructure. Some adverse effects cited by existing research include possible increases in VMT and associated pollution; reduced physical activity due to changes in the cost, comfort, and time spent traveling in a vehicle; and safety risks arising from malfunctioning AV sensors and devices, cybersecurity issues, and AV responses to conditions that lead to unavoidable accidents.

Our simulation for these matters focuses on the major safety benefits of AVs, reductions in accidents and deaths, and the associated economic and taxpayer savings from those reductions. Given that various developers of AVs plan to adopt a range of features, we chose not to assume what AV capacities and features will be standard in the future.

103. West (2016).
104. Alonso (202); Clements and Kockelman (2017).
105. Stanley, Grise, and Anderson (2020).
106. Sohrabi, Kreis, and Lord (2020).

Instead, we use three technological alternatives based on AVs' capacity to operate under a range of conditions, developed for the PTV Vissim traffic stimulator and the CoExist model for the European Union's AV project.[107] CoExist characterizes these alternatives as follows:

1. Basic: The AV observes traffic laws and always adopts safe behavior, including safe braking distances, safe behavior for lane changes and navigating intersections without signals, and speed limits. This alternative assumes large gaps between vehicles.

2. Standard: AVs operate like human drivers who obey traffic laws but also use sensors to accurately measure distances to other vehicles and objects and the speed of other vehicles.

3. Advanced: The AV's sensors and AI systems are aware of all surrounding features and can accurately predict the behavior of other vehicles and pedestrians. This alternative assumes small gaps between vehicles.

First, we simulated the impact on traffic accidents for each class of AV technology described previously under projected AV adoption rates. Using 2022 data as the baseline, we simulated the effects on accidents for each category of AV operating technology with AVs constituting 25%, 50%, 75%, or 100% of the U.S. motor vehicle fleet.

We also simulated those effects if AVs were connected through their capacity to communicate with each other—connected AVs or CAVs—and travel by "platooning" that reduces the distance between them. The results show significant reductions in accidents and deaths and significant economic and taxpayer savings (Table 2; Figure 1) The simulations show that the benefits increase with the degree of autonomous operations represented by the three categories of AV operating behavior, as expected. At 25% AV adoption, accidents decline by 11.1% with AV operations, 22.0% for Standard AVs, and 27.7% for Advanced AVs.

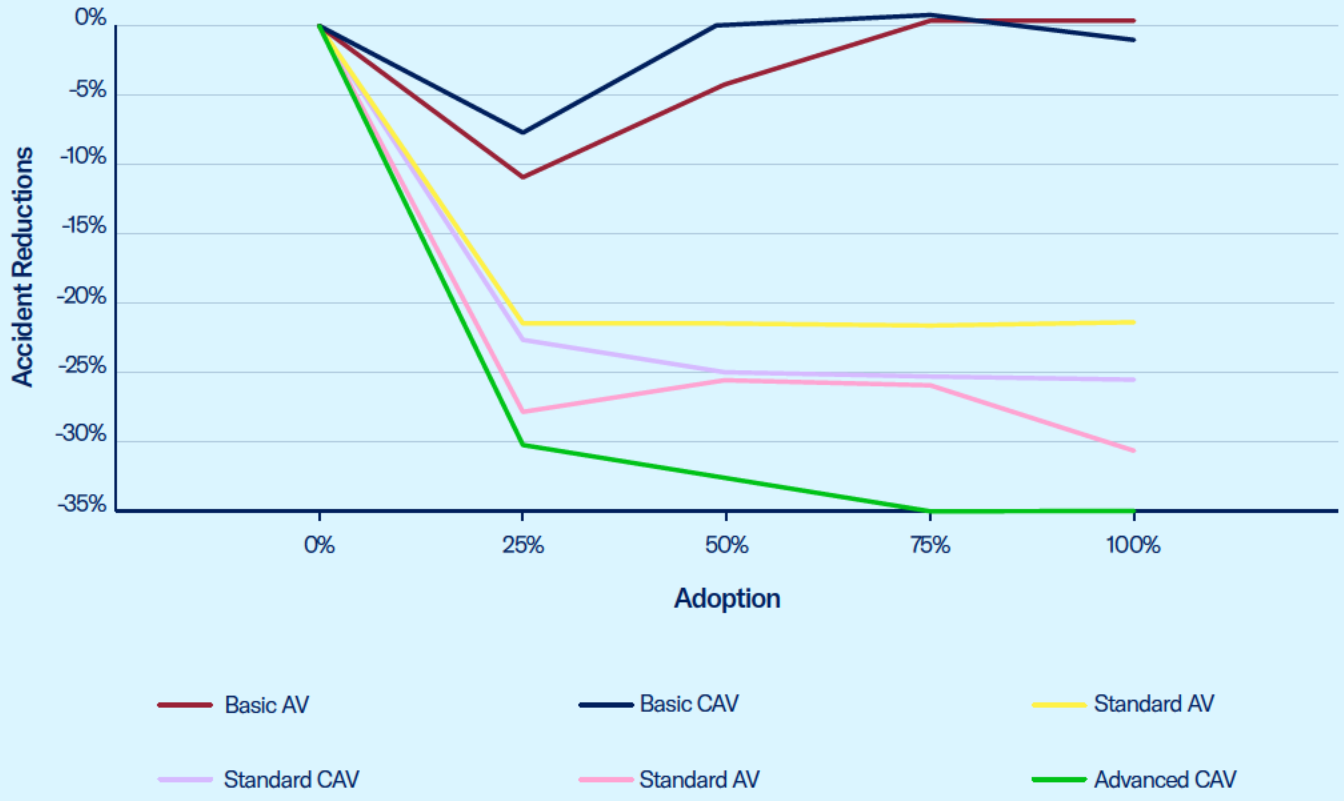
Table 2. Change in U.S. Traffic Accidents Based on AVs' and CAVs' Adoption Rates, by AV and CAV Operating Features

		AV fleet penetration			
		25%	50%	75%	100%
AVs	Basic	–11.1%	–3.9%	0.6%	0.6%
	Standard	–22.0%	–22.0%	–22.1%	–21.6%
	Advances	–27.7%	–25.6%	–26.3%	–30.7%

107. Sukennik (2018).

		AV fleet penetration			
		25%	50%	75%	100%
Connected AVs (CAVs)	Basic	–7.0%	0.1%	0.9%	–1.5%
	Standard	–23.3%	–24.6%	–25.3%	–25.6%
	Advanced	–30.2%	–32.3%	–34.9%	–35.0%

Figure 1. Changes in U.S. Traffic Accidents Based on AV and CAV Adoption Rates



The simulations show that reduction in accidents for Standard and Advanced operating behavior depends on initial AV penetration, represented here by 25% adoption, and does not increase significantly with higher adoption rates.

Strikingly, Basic AV technology and operations not only produce the smallest decline in accidents but might also increase crashes at high rates of adoption. Other analysts have found similar results,[108] which appear to reflect secondary

108. Shunxi, Pang-Chieh, Xiao, and Chahine (2019).

effects when two vehicles operating under these cautious driving parameters interact. AVs that operate cautiously maintain large distances from other vehicles. In situations such as changing lanes, when the two basic AVs approach each other, their systems that enforce braking distances may cause the vehicles to stop, thus increasing the risk of rear-end accidents in the simulations.

Next, we use the results when AVs represent 25% of the U.S. fleet of motor vehicles to estimate the likely reductions in accidents and associated deaths and the economic and taxpayer savings arising from those reductions. The projected economic savings draw on the latest data from the NHTSA on the impact of crashes on medical costs, foregone productivity, legal and court costs, costs for emergency services and insurance administration, property damage, and congestion costs.[109] Moreover, because taxpayers bear about 9% of those costs, we can also estimate the associated taxpayer savings.

These simulations drew from 2022 data and analyzed these effects by category of AV operations. We also simulated those effects for CAVs with systems that communicate with each other, some of which are platooning.

This analysis confirms the widespread expectation that eliminating human driver failings, such as distracted or drunk driving, in 25% of vehicles has dramatic effects on accident rates and that those effects increase sharply as the AVs' operations become more comprehensive (Table 3). Based on their levels of technology, 25% AV penetration would reduce traffic accidents by 578,000 to 1,442,000 and would save the lives of 50,000 to 12,000 people. Moreover, those benefits from Advanced AVs increase significantly as their adoption rate rises. The analysis also indicates that the economic savings from these reductions in accidents range from $37.7 billion to $94.2 billion, and the associated taxpayer savings range from $3.3 billion to $8.3 billion.

Table 3. Changes in U.S. Traffic Accidents and Deaths and Related Economic and Taxpayer Savings Based on 25% Adoption Rates for AVs and CAVs, by AV and CAV Operating Features

	AV technology	Reductions in accidents	Reductions in deaths	Economic savings	Taxpayer savings
AVs	Basic	578,000	5,000	$37.7 billion	$3.3 billion
	Standard	1,145,000	9,000	$74.8 billion	$6.6 billion
	Advanced	1,442,000	12,000	$94.2 billion	$8.3 billion
Connected AVs (CAVs)	Basic	364,000	3,000	$23.8 billion	$2.1 billion
	Standard	1,213,000	10,000	$79.2 billion	$7.0 billion
	Advanced	1,572,000	13,000	$102.7 billion	$9.1 billion

109. U.S. Department of Transportation (2023). These data cover police-reported crashes and estimates of unreported crashes.

IV. AVs and Mobility: Impact on Access for People Who Are Travel Impaired

The successful adoption of autonomous vehicles could substantially expand the mobility of people who are travel impaired, including older people, people with disabilities, and nondrivers. As a result, broad AV use would significantly increase their access to jobs, public services, health care, and retail. Our analysis found that a 25% adoption rate for AVs would result in increases in the annual distance traveled of 4.6 billion miles by adults with disabilities, 4.9 billion miles by older people, and 2.4 billion miles by adult nondrivers.

Accessibility to Low-Mobility Consumers and Regions

In 2018, 24.6 million Americans reported mobility-related disabilities that precluded their operating an automobile,[110] including 13.4 million adults of working age (18 to 64). Only 20% of those working-aged people (2.7 million) were employed. Notably, despite increases in remote work during the pandemic, access to transportation from home and the workplace remains a requirement for most jobs. In 2022, 72.5% of businesses reported that their employees rarely or never worked remotely, up from 60.1% in 2021 but nearly equal to the 76.7% before the pandemic.[111]

Public transit does not address the difficulties facing most people who have limited mobility. In most places, public transportation does not reach most residential and business areas—and low-income areas have disproportionately low shares of both public transit routes and job opportunities.[112] Even when public transit is available, one analysis found that people with personal cars can access six times as many jobs as those who depend on public transit.[113] These disparities help explain why more than 50% of adults with travel-related disabilities in 2021, numbering 6.9 million people, lived in households with incomes of less than $25,000.[114] AVs could reduce these barriers for many people unable to rely on traditional forms of transportation and could thus increase their ability to participate in the workforce.

Physical disabilities have large effects on people's mobility. The latest data (2017) show that working-age Americans (18 to 64) who are not disabled and travel impaired made an average of 3.6 vehicle trips per day compared with 2.6 trips per day for persons with disabilities.[115] Further, among employed people without disabilities, those trips averaged 12 miles compared with 9.4 miles for working disabled people. Among nonworking people, those trips for people who were not impaired averaged 9.5 miles compared with 7.5 miles for nonworking people with disabilities.[116]

110. Brumbaugh (2018). In addition, 900,000 children have travel-related disabilities.
111. Goldberg (2023).
112. Ibid.
113. Ibid.
114. Ibid.
115. U.S. Department of Transportation (2022b).
116. Ibid.

As a result, employed people without disabilities traveled an average of 15,768 vehicle miles per year, 76% more than the average 8,921 VMT by workers with disabilities. Similarly, nonworking people without disabilities traveled an average of 12,483 vehicle miles per year, 75% more than the average 7,118 vehicle miles for nonworking people with disabilities.

AVs could also help millions of older Americans who have difficulties accessing transportation. More than 11.2 million Americans ages 65 and older had self-reported travel-related disabilities in 2021, representing 20% of the population ages 65 and older.[117] Some 22.8 million Americans are 75 years old or older, and the Census Bureau projects that the continuing aging of the large baby boom cohort will increase this older group to 34.5 million by 2030 and to 45.0 million by 2040.[118] According to the National Institute on Aging, factors impairing the ability of many older Americans to drive safely include difficulties seeing or hearing, the effects of arthritis and medications, and the fact that most people's reaction times and reflexes deteriorate with age.[119]

The impact of age on people's mobility is also large. The most recent data (2022) show that drivers ages 20 to 34 and ages 35 to 65 averaged, respectively, 15,098 and 15,291 VMT per year, nearly double the average 7,646 VMT by people ages 65 and over.[120]

Some of the difference reflects younger people who commute to work, whereas most older people are retired, and some of it reflects the challenges and burdens of driving for older people. Moreover, nearly 3 million Americans ages 65 and over currently cannot access public transportation services because of factors such as distance or wheelchair accessibility, issues that AVs could address through first-and last-mile mobility services. With coordination with transit agencies, AVs used for first- and last-mile transport could also help reduce the operating costs and could increase service quality for public transport systems.

Shared AVs could be a boon for the nearly 21 million Americans (7% of all adult Americans) who do not have driver's licenses[121] and the 14.5 million U.S. households (9.2% of all households) that have no access to automobiles.[122] Cost is a primary factor. In 2022, maintaining and operating a car costs an average of $10,728[123] or nearly three-quarters of the median income of the lowest-earning 20% of Americans. Shared-ride AVs are expected to be less expensive, with one analysis estimating that their use will cost a person 21 cents per mile compared with 59 cents per mile for privately owned automobiles.[124] Pilot programs provide further support for this argument indicating that shared AVs can reduce the financial barriers of older people and people with disabilities who are unable to rely on traditional forms of private or public transportation. In one case, a ride-hailing and sharing program serving Florida retirees reduced their transport costs by an average of 20%, and trials in Boston involving riders with disabilities who use ride-hailing vehicles similarly suggest that AVs can provide significant savings compared with standard taxi transport.

117. Census Bureau (2021).
118. Census Bureau (2017).
119. National Institute on Aging (2023).
120. U.S. Department of Transportation (2022c).
121. Statista (2022).
122. Ezike et al. (2019a).
123. Vandiver and Bradley (2022).
124. Ezike et al. (2019b).

Our analysis found that of the 21.1 million adults who are nondrivers, 7.1 million are older and 5.3 million have disabilities.

Among younger adults without disabilities, 8.7 million cannot drive because they are not licensed. As expected, that status has significant effects on their mobility. Data from the Bureau of Transportation Statistics show that although drivers average 4.5 trips per day, nondrivers average only 2.6 trips daily.[125] This suggests that nondrivers travel by vehicle 57.8% as much as drivers do. Earlier, we found that adult drivers averaged 15,195 VMT per year, so the disparity in trips suggests that nondriving adults without disabilities averaged 8,783 VMT annually.

Networks of shared AVs with flexible routes will play a significant role in increasing mobility, but they cannot solve all mobility challenges. Networks of shared-ride AVs operating in areas not served by public transit could benefit millions of people who have limited mobility. The broader impact could be far reaching. Americans who are unable to work today because they cannot commute easily to jobs that do not offer remote work could become productive employees, and millions more whose job opportunities are limited to businesses along established public transit routes could find new opportunities and higher-paying jobs.

In addition, based on studies showing that access to rideshare services increased access to medical care for Medicaid patients, shared AVs also will increase access to medical care for millions of people with impaired mobility.[126]

Significant challenges will need to be addressed. Some people with disabilities and older people require assistance getting from their homes to vehicles and from the vehicles to their destinations. Maximizing the mobility benefits of AVs also will partially depend on public policies to offset some of the costs related to their initial adoption, including new software, hardware, and maintenance technologies,[127] and planning to ensure that AVs complement existing public mass transit systems.[128] Based on an examination of existing literature, if rollouts of AV services are not coordinated with the schedule and routings of an area's transit system, AVs could end up competing with existing buses and subways and could undermine the mobility benefits of public transit systems. With federal support, local governments may be able to reduce barriers to intermodal transport and to give AV companies incentives to offset the high costs of serving customers with low mobility and operating in low-density and low-income areas at night. Otherwise, AV services could end up serving mainly higher-income people without mobility issues. In addition, public outreach may be required to address any concerns about the safety and reliability of AV transport. Public education about AVs may be important for people with disabilities, as researchers have found that they adopt new technologies more slowly and less often than others.[129]

125. U.S. Department of Transportation (2005).
126. Chaiyachati, Hubbard, Yeager, Mugo, Shea, Rosin, and Grande (2018).
127. Littman (2022).
128. Ibid.
129. Perrin and Atske (2021).

Selected Case Studies

Numerous communities have conducted pilot programs to explore how ride-hailing services or transportation network companies (TNC), including experimental AVs in some cases, could affect mobility, traffic management, and the need for incentives.

These case studies generally found that programs with subsidies can produce substantial benefits and, in some cases, savings over current operations.

In 2017, Innisfil, Ontario, contracted with Uber to subsidize rides to selected bus stops, train stations, and central city locations. Innisfil was one of the first cities to subsidize Uber rides in lieu of traditional bus transit. Riders paid a fee of $3 to $5 to travel to community hubs or received a $5 discount on fares to other destinations around the city. In the program's first year, it supported 8,000 trips per month at a cost of $150,000 compared with an $8 million cost to provide comparable bus services.[130] The results suggest that shared-ride services at subsidized rates can be less expensive and more equitable than comparable service using public buses.

Those findings were replicated in a one-year pilot program by the public bus system Wheels in Dublin, California, which provided subsidized Uber and Lyft rides in two neighborhoods in place of low-ridership bus routes. The subsidized rides cost $3 to $5 versus a $2 regular bus fare, and an average of 50 passengers per day used the subsidized rides, or roughly the ridership of the low-ridership bus routes.

The program concluded that the system "may carry an equal or greater number of people than buses do at less cost to the public agency."[131] The program encountered pushback from drivers employed by the bus authority.

The Waymo company and the Valley Metro Board in Phoenix, Arizona, conducted a first- and last-mile pilot project in 2018.[132] The goal was to explore how AV technology could address the mobility challenges of ADA paratransit-certified people with disabilities and seniors ages 65 and older. This group currently has access to a subsidized door-to-door service that provides easier access to a larger network of rideshare providers. Participants thought that AVs could improve road safety and could help address mobility challenges, especially for people with special needs. Among participants in the pilot, only 29% strongly agreed that traditional RideChoice services were safe, whereas 70% strongly agreed that AVs were safe. AV rides were used considerably more than non–Waymo RideChoice options during the core months of the pilot.

The AV company Voyage conducted a trial program using AVs as public transit in the Villages retirement community in Florida. The Villages span 40 square miles with 750 miles of roads and 125,000 permanent residents, thus providing a slower and less high-traffic environment than most pilot programs. Early results suggest that AVs can provide improved transportation services for seniors in a slow-paced, enclosed environment.

130. The program costs increased to $640,000 in 2018 and to $900,000 for 2019.
131. Cuff (2016).
132. Randazzo (2018); Boehm (2018); Stern (2018); Schutsky (2018); and Templeton (2019).

An MBTA Boston Paratransit pilot program provided subsidies to customers of ride-hailing services for trips to MBTA facilities. Users who took Uber paid the first $1 and anything above $41, and those who used other services, such as Lyft and Curb, were responsible for the initial $2 plus anything above $42. In the first five months, the program provided 10,000 rides and increased transit use by customers of ride-hailing companies by 43% at an average cost of $9 per ride to MBTA. The program also registered high customer satisfaction.

In the Denver metropolitan area, the public shared mobility service Go Centennial contracted with Lyft and Via to provide fully subsidized rides to and from major transit hubs.

An independent audit found that the program increased ridership by 11.6% from January 2017 to May 2018, including a 5% increase in first- and last-mile riders,[133] and regional VMT fell by 2,925 miles over the six months. The subsidies averaged $4.70 per trip, and although an audit found that the benefit-to-cost ratio was low (from 0.50 to 0.37), the program produced significant cost savings over public transit last-mile services.

133. Centennial Innovation Team and Fehr & Peers (2017).

AVs' Projected Effects on Access for People with Restricted Mobility

To estimate the impact of AVs on mobility by older people, persons with disabilities, and other nondrivers, we used a system dynamics model to simulate scenarios based on AV adoption rates (25%, 50%, and so on) and AV technology levels (Basic, Standard, and Advanced). The model examined how these factors affect the VMT, and we then converted the percentage of effects to miles per year. The results show, for example, that 25% and 50% adoption of Advanced AVs lead to increases in annual VMT, respectively, of 4.8% and 16.1% for older people, 3.1% and 8.0% for nondrivers, and 1.2% and 2.7% for people with disabilities. Those results translate into increases in the annual VMT by all older people of 2.5 billion miles and 4.9 billion miles, 2.4 billion miles and 6.1 billion miles for all nondrivers, and 4.6 billion miles and 10.4 billion miles for all people with disabilities.

The simulations found, as expected, that the capacity of AVs to increase mobility for people who are travel impaired increases as AV adoption increases and as AV technologies advance, from Basic to Standard to Advanced. As the results suggest, rising adoption rates lead to greater access to transportation, which in turn raises travel demand and VMT—and then leads to further adoption of AVs. We also assume that subsidies will be available for older people and people with disabilities for shared-ride services to bridge gaps in public transit, such as first-mile and last-mile service. The simulations found that such support increases demand, which again leads to greater adoption of AVs.

The results also suggest that AVs operating as cautious drivers (Basic) by always obeying speed limits and maintaining recommended distances between cars have unexpected effects. Such risk-averse operations increase congestion and thereby raise the cost of AVs, which in turn reduces the mobility benefits of AVs. Although we include the Basic category here, because many existing AVs currently used in pilot programs have this risk-averse driving technology, we expect that as AVs become widely available, they will use the Advanced or at least Standard technologies.[134]

Results

The results suggest that AVs will have significant effects for the mobility of older people, nondrivers, and drivers with disabilities (Tables 4A, 4B, and 4C).

For example, at a 25% adoption rate, Advanced AVs would increase VMT by 4.8% for older drivers, 3.1% for nondrivers, and 1.2% for disabled drivers (Table 4A). The lower result for persons with disabilities may reflect the difficulties they can face when moving from their homes to the street or in places where AVs or public transit would be available. Setting aside Basic AVs, the model found that at adoption rates of 25% and 50%, AVs will significantly enhance the mobility of older people and nondrivers, and Advanced AV technology will also significantly increase the mobility of people with disabilities.

134. We also do not provide results for platooning CAVs because they would provide little if any additional utility for people with disabilities, older people, or nondrivers.

Table 4A. Impact of AVs on Vehicle Miles Traveled by Drivers Who Are Travel Impaired and Nondrivers, by AV Technology and Fleet Penetration (percentage change)

AV technology	Fleet penetration			
	25%	50%	75%	100%
Drivers with disabilities				
Basic	–1.8%	–3.7%	–4.8%	–5.4%
Standard	–0.1%	–0.1%	0.7%	1.6%
Advanced	1.2%	2.7%	3.8%	4.6%
Older drivers				
Basic	–8.7%	–18.2%	–26.5%	–32.8%
Standard	2.4%	5.2%	3.9%	9.6%
Advanced	4.8%	16.1%	20.0%	27.9%
Nondrivers				
Basic	–3.9%	–7.1%	–12.9%	–17.3%
Standard	1.7%	1.4%	4.0%	4.7%
Advanced	3.1%	8.0%	10.3%	14.9%

Applying the Department of Transportation estimates of VMT for each group in 2017 (the latest data available), this enhanced mobility from 25% adoption of Advanced AVs would increase annual VMT by 85 miles for an average person with disabilities, 367 miles for an older person, and 272 miles for a nondriver.[135]

With a 50% adoption rate, the mobility gains increase to 192 miles for a person with disabilities, 1,231 miles for an older person, and 703 miles for a nondriver (Table 4B).

135. For people with disabilities, we use the miles traveled by nonworking (and younger) people with disabilities because 80% of working-age people with disabilities are not employed.

Table 4B. Impact of AVs on Vehicle Miles Traveled by Drivers Who Are Travel Impaired and Nondrivers, by AV Technology and Fleet Penetration (miles per year)

AV technology	Fleet penetration			
	25%	50%	75%	100%
Drivers with disabilities				
Standard	–7	–7	50	114
Advanced	85	192	271	327
Older drivers				
Standard	184	398	298	734
Advanced	367	1,231	1,529	2,133
Nondrivers				
Standard	149	123	351	413
Advanced	272	703	905	1,309

Notably, the results for older people and people with disabilities understate the total impact because the available data require that the model focus on drivers in each category. In 2020, 47 million of 54.1 million older Americans had driver's licenses, and the remaining 13% did not. Similarly, of the 13.4 million working-age adults who have travel-impairing disabilities, 39.6% are not drivers. This suggests that the total impact could be up to 13% greater for older people and up to nearly 40% greater for people with disabilities.

Finally, we apply the average VMT for people in each of these travel-impaired groups to the number of people in each cohort to estimate the total increase in mobility for each group. Based on 2017 VMT data (the latest available) and a 25% adoption rate for AVs, access to Standard AVs by older people would increase their total annual VMT by nearly 2.5 billion miles, and access to Advanced AVs would increase their total mobility by more than 4.9 billion miles (Table 4C).

Table 4C. Impact of AVs on Vehicle Miles Traveled by Drivers Who Are Travel-Impaired and Nondrivers, by AV Technology and Fleet Penetation (million miles per year)

AV technology	Fleet penetration			
	25%	50%	75%	100%
Adults with disabilities				
Standard	–388	–388	+2,705	+6,167
Advanced	4,599	10,387	+14,661	+17,691
Older people				
Standard	2,466	5,333	3,993	9,836
Advanced	4,918	16,495	20,489	28,582
Adult nondrivers				
Standard	1,296	1,070	3,054	3,593
Advanced	2,366	6,116	7,874	11,388

Similarly, at a 25% adoption rate, although access to Standard AV technology by disabled people could reduce their annual VMT by 388 million miles, access to Advanced AVs would increase their total annual mobility by nearly 4.6 billion miles. Finally, for the 8.7 million working-age Americans without disabilities who are nondrivers, at a 25% AV adoption rate, access to Standard AVs would increase their total annual mobility by nearly 1.3 billion miles, and access to Advanced AVs would increase their mobility by nearly 2.4 billion miles.

These results strongly suggest that AV service will provide significant mobility benefits for millions of Americans, including people with disabilities, older people, and nondrivers.

V. AVs and the Environment: The Impact on Greenhouse Gas Emissions

The use of AVs could result in significant reductions in greenhouses gases and other pollutants. Federal regulations in place since 1975 have mandated reductions in motor vehicle pollution, and vehicle manufacturers have met those requirements mainly by applying a range of technological innovations, including variable valve timing, direct injection, new materials to reduce mass and weight, and the use of alternative fuels, especially electric batteries and fuel cells.[136] However, transportation continues to account for a substantial share for 38% of the country's CO2 emissions, 58% of which come from the use of personal vehicles.[137]

The extent of the environmental benefits from AV use will depend on several factors. Most importantly, will AVs be powered by electric powertrain systems and fuel cell technologies that produce zero or near-zero tailpipe emissions or by conventional fossil fuel engines?[138] Some analysts have reasoned that AVs will require electric or fuel cell powertrains because the safe operation of their sensor, communication, and AI technologies will depend on stable and reliable electric power.[139] AVs' impact on the environment will also depend on a range of other factors, including whether they are used for personal transportation or shared rides, the extent of their use, and whether their use reduces dependence on private combustion engine vehicles.

By providing on-demand transport services linked to public transit, AVs could generate environmental benefits by reducing personal car use and by increasing public transit ridership, thereby reducing total vehicle miles driven. AVs could also reduce emissions compared with personal vehicles because they will be programmed to operate more efficiently and avoid congestion. Finally, public acceptance of electric-powered AVs could accelerate the transition to electric vehicles (EVs).

Under certain conditions, the use of AVs could increase emissions. For example, total miles driven could well rise as AVs enhance mobility for people unable to use personal vehicles and enable people to relax or work in transit once freed of any responsibility for driving. AVs will also likely produce other contaminants such as brake dust, and fossil fuels to generate the electric power for AVs will offset some of the environmental benefits of EVs.[140] However, private and public investments to link AVs to public transit routes could mitigate some of these effects.

AVs as EVs

There are compelling reasons why AVs are likely to be predominantly EVs. An AV's extensive computing hardware will require substantial electrical power that can be provided most

136. National Academies of Sciences, Engineering, and Medicine (2021).
137. Congressional Budget Office (2022).
138. Ibid. Future possible technological improvements include variable valve life, variable compression ratio, cooled EGRvariable geometry turbine turbocharging, electric intake cam phasing, and increased fuel injection pressure.
139. Nunno (2021).
140. Nadafianshahamabadi, Tayarani, and Rowangould (2021); Sha (2020).

efficiently and reliably by all-electric battery packs, whereas the electrical power produced by an internal combustion engine is less stable.[141] The safety of AVs will also depend on low latency—brief intervals between a program's decision regarding a maneuver and carrying it out—and electric propulsion systems have a lower latency and more consistent responses than internal combustion systems when accelerating.[142]

Electric fleets are easier to manage and require less maintenance than gasoline-powered fleets, so the introduction of electric-powered AVs could present an opportunity for companies and governments to undertake fleet-wide changes. And because the government already provides subsidies to accelerate the transition to EVs, those subsidies will extend to AVs when they move into production.

The climate benefits of fleets of electric-powered AVs supplanting the use of other vehicles should be substantial. Although producing the lithium-ion batteries for EVs creates significant CO2 emissions, operating EVs is more climate friendly than internal combustion engines. MIT researchers report that battery EVs emit an average of 200 grams of CO2 per mile, and hybrids and plug-in hybrids emit an average of 260 grams per mile, compared with more than 350 grams per mile by gasoline-powered automobiles.[143] Similarly, the Department of Energy reports that EVs create 3,932 pounds of CO2 equivalent per year, compared with 5,772 pounds for plug-in hybrids and 11,435 pounds for gasoline vehicles.[144]

Vehicle Behaviors and Efficiency

Apart from AVs as EVs, much of the initial adoption of Advanced passenger AVs will be for shared use, and studies of pilot partnerships between ridesharing companies using the current generation of AVs and local governments in Arizona, California, Colorado, and Texas suggest that their use should significantly reduce CO2 and NOx emissions as well as congestion in other ways.[145] One study found that by reducing the number of vehicles in traffic, rideshare AVs reduced emissions by up to 15%,[146] and a survey of 429 studies concluded that in an environment dominated by passenger vehicles, the use of shared-ride AVs could result in an average 20% reduction in CO2 and PM2.5 emissions.[147] AVs can also be programmed to optimize their energy efficiency by optimizing the speed and routes they follow; accordingly, researchers have found that AVs lowered emissions by improving fuel efficiency and by encouraging the use of public transit. More advanced AVs will be able to communicate and coordinate with each other, and this capacity should enable them to decrease sudden braking and acceleration, improve traffic flow, and reduce congestion.

In addition, the National Renewable Energy Laboratory notes that AVs could reduce energy demand by rendering many current safety features unnecessary and could thereby substantially reduce the vehicles' weight.[148]

141. Lempert (2021).
142. Ibid.
143. Massachusetts Institute of Technology (2019).
144. U.S. Department of Energy (2022).
145. Lempert (2021).
146. Ibid.
147. Preston et al. (2020).
148. Brown, Repac, and Gonder (2013). The weight of large batteries, however, could offset some of these benefits.

The judicious use of shared-ride AVs could lower emissions by enhancing efficiency and reducing congestion in other ways. An estimated 25% of traffic congestion is associated with accidents, and the majority of collisions involve human errors that AVs could avoid.[149] Another 30% of urban congestion is related to drivers who search for parking, but shared-ride AVs can discharge their riders without parking and can wait in uncongested areas for the next riders.[150] AVs' expected ability to communicate and coordinate with other AVs and parts of transportation infrastructure could produce smoother traffic flows that should also reduce emissions. However, these benefits could require significant financial investments in uniform road infrastructure that can communicate with the vehicles,[151] dedicated lanes for CAV platooning, and perhaps construction of AV loading and docking points.[152]

Careful planning also will be necessary to avoid secondary effects that could reduce the environmental benefits. After AV passengers disembark at their destinations or public transit spots, planners will have to figure out how to minimize travel by unoccupied AVs. To maximize emission reductions, AV travel will have to be broadly affordable, a consideration that their shared use should address. Some uncertainty exists about how the interactions of AVs and conventional vehicles will affect congestion.[153] Perhaps most importantly, AV routing may need to favor connections to current public transit networks.[154]

Other aspects of AV adoption could present environmental challenges. Widespread adoption could reduce the burdens of living farther from urban centers and could thereby contribute inadvertently to urban sprawl and development in rural areas that threaten deforestation and fragile habitats.[155] As noted earlier, AVs will require considerable energy drawn from the electric grid to power and operate their onboard systems. And as natural gas and other fossil fuels generate about 63% of U.S. electricity, transportation that includes electric-powered AVs could be a major source of greenhouse gas emissions for decades to come.[156]

AVs will play an important role in reducing emissions and urban congestion, given appropriate planning and management. Their net environmental benefits will depend on their fuel source, their rate of adoption, the public's acceptance of shared mobility, and how they interact with public transit and private vehicles.[157] Shared-ride AV networks will produce the largest environmental benefits, especially in dense urban areas with moderate public transit systems.[158]

In this regard, the Environmental and Energy Study Institute estimates that by 2050, shared-ride AVs used as public transit could reduce total VMT by 25% and could cut urban pollution by as much as 80%.[159]

149. Fagnant and Kockelman (2015).
150. Shoup (2007).
151. Lawson (2018).
152. Marsden, Docherty, and Dowling (2020); Zhang and Wang (2020); Guhathakurta and Kumar (2019); Heaslip et al. (2020).
153. Cumins, Sun, and Reynolds (2021).
154. Littman (2022).
155. Nogues, Gonzalez-Gonzalez, and Cordera (2020).
156. Nunno (2021).
157. Silva, Cordera, Gonzalez-Gonzalez, and Nogues (2022).
158. Ibid.
159. Nunno (2021).

AVs' Projected Effects on the Environment and Congestion

The use of internal combustion engines and the generation of their fuels are significant sources of CO2 emissions, the primary greenhouse gas contributing to climate warming, and NOx emissions, the gas that produces atmospheric ozone. To estimate the environmental impact of networks of AVs, we use a system dynamics model that incorporates insights from previous research and leverages the Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES) to analyze CO2 equivalent emissions and NOx emissions from transportation sources.[160] The model's emission estimates account for the age, energy consumption, cold start and operational emissions, vehicle occupancy rates, and acceleration and deceleration profiles of AVs and conventional vehicles, thus highlighting the traffic and consequent fuel efficiencies of AVs. We also adopt from the recent literature the assumptions about the weight of AVs, the electric grid's CO2 intensity, and how cost affects travel choices.

Given AVs' demand for stable, steady electric power to run their computer and sensor networks, we also assume that AVs will have electric powertrains rather than internal combustion engines. Electric-powered vehicles do not emit CO2 or NOx exhaust, but the electric power they use must be generated and distributed through the electric grid fueled by fossil fuels or other more sustainable sources of energy. The impact of electric-powered AVs on greenhouse gases, therefore, will depend on types of energy used to generate the electric power. Therefore, we posit three mixes of fuels for the grid: (1) Climate+: an increasing role for sustainable fuels and declining use of fossil fuels, thus lowering greenhouse gas emissions; (2) Climate Neutral: a continuing predominant role for fossil fuels with more modest use of sustainable fuels; and (3) Median: the median case between these two alternatives. The simulation examined the impact of electric Advanced AVs on motor vehicle emissions of CO2 and NOx based on the mix of fuels used to generate the grid's power.

Because no one can say with any confidence precisely when the adoption of AVs will reach 25% or more, we measured the estimated reductions in CO2 and NOx emissions against their current emissions from the use of motor vehicles. Therefore, the question examined here is this: What would be the environmental benefits today if 25% of the U.S. motor vehicle fleet were Advanced AVs? Notably, the environmental benefits of Advanced AVs may be less than those from Standard or Basic AV operations because the technologies of Advanced AVs require more electrical power. The estimated emission reductions therefore should be considered the minimal benefits to be expected from the use of AVs.

160. Environmental Protection Agency (2022).

The results show that in all cases, the adoption of Advanced AVs would produce significant environmental benefits relative to the current CO2 and NOx emissions associated with the use of motor vehicles based on their greater efficiencies in traffic and their use of electric powertrains instead of internal combustion engines (Table 5). At a 25% adoption rate, the use of Advanced AVs would decrease current CO2 emissions related to motor vehicle use by 5.9% to 8.2%, with a median reduction of 7.1% (Table 5). Similarly, they would reduce the current NOx emissions related to motor vehicle use by 6.4% to 8.9%, with median reductions of 7.7%. At a 50% adoption rate, these AVs would reduce current CO2 emissions related to motor vehicle use by 15.7% to 22.0%, with a median reduction of 19.1%, and would reduce NOx emissions associated with motor vehicles by 17.1% to 23.8%, with a median reduction of 20.6%.

Table 5. Change in Total Motor Vehicle CO2 and NOx Emissions with All Electric AVs, Based on the Mix of Fuels to Power the Electric Grid

	Fleet penetration			
	25%	50%	75%	100%
Grid mix: climate+ (enhanced reliance on sustainable fuels)				
CO2	–8.2%	–22.0%	–36.0%	–37.2%
NOx	–8.9%	–23.8%	–38.7%	–39.8%
Grid mix: climate neutral (continuing reliance on fossil fuels)				
CO2	–5.9%	–15.7%	–25.7%	–26.6%
NOx	–6.4%	–17.1%	–27.8%	–28.6%
Grid mix: median case				
CO2	–7.1%	–19.1%	–31.2%	–32.0%
NOx	–7.7%	–20.6%	–33.6%	–34.5%

Overall, the adoption of AVs should produce significant environmental benefits. Although many challenges will have to be addressed, these potential benefits of AVs should indicate that policymakers, the business community, and environmental leaders need to collaborate to help realize those challenges.

VI. Employment Implications of AVs

The adoption of AVs here and around the world could have significant effects on American jobs. AVs used as personal vehicles may displace demand for conventional vehicles with little aggregate effect on employment, but shared-ride AVs used to enhance mobility for people who are travel impaired may add to overall demand for motor vehicles and the jobs to produce them. The adoption of AVs will also affect the composition of the industry's employment, thus creating more jobs for technical and mechanical specialists for both AV manufacturers and the producers of their intermediate inputs, including increased jobs in electronics and computer manufacturing, telecommunication equipment and services, and infrastructure and construction. Jobs in manufacturing and assembling major components, such as vehicle bodies, chassis, drive trains, and interior features, may be affected, although increases may be offset by reductions in jobs that help manufacture and assemble conventional components that become unnecessary for AVs.

The aggregate employment effects from these dynamics are not completely known at this time, as AVs' technologies and components continue to evolve, and the pace of their adoption remains unknown. Nevertheless, AVs represent a significant new market, and the companies and countries that establish strong positions in that market will see significant job gains.

Apart from employment, the use of AVs could boost efficiency and productivity. Broad use of shared-ride AVs will lower people's travel costs and so enable them to travel farther, which in turn will both increase their access to jobs and expand talent pools for businesses.[161]

As noted earlier, the motor vehicle industry has been a major source of American employment, accounting for 2,922,000 jobs in 2021, or more than the total employment in real estate (2,125,000) and information services (2,650,000).[162] Motor vehicle and parts manufacturers (MVPMs) directly employed 957,000 Americans, and vehicle and parts dealers employed another 1,965,000 people.[163] The U.S. motor vehicle industry is also a major source of demand and jobs for the industries that supply their inputs.

We analyzed how these input purchases in 2021 affected employment in each of the industries producing them by applying the relationship between an industry's production and its employment, which economists measure by the number of jobs created for each $1 million in an industry's final demand.[164] We found that the input purchases by MVPMs in 2021 supported an additional 871,310 jobs in the industries that produced them.[165] MVPM input purchases were responsible for more than 100,000 jobs in three of those supplier industries: 181,305 jobs in the fabricated metal products industry, 142,715 jobs in computer and electronic

161. Mudge et al. (2018).
162. Bureau of Economic Analysis (2022d). Information services include broadcasting and telecommunications, publishing, software, and data processing.
163. Bureau of Economic Analysis (2022d).
164. Bivens (2019). Appendix Table A2.
165. Bureau of Economic Analysis (2022d).

products manufacturing, and 104,871 jobs in plastic and rubber product production.[166]

The inputs purchased by motor vehicle and parts dealers also supported jobs in many other industries. Our input–output analysis found that those dealers purchased $99.8 billion in inputs in 2021, including inputs of $1 billion or more from 23 other industries.[167] Our analysis further found that those input purchases directly supported another 398,542 jobs in the industries that produced them, including 112,000 jobs in professional, scientific, and technical services, and 71,000 jobs in warehousing and storage companies.[168]

All told, U.S. motor vehicle and parts manufacturers and dealers were responsible for 4,191,852 American jobs in 2021, directly employing 2,922,000 people and directly supporting the jobs of another 1,269,852 people through their purchases of inputs from other industries (Table 6). These motor vehicle industry and related jobs exceeded all direct employment in the education sector (3,457,000) and nearly equaled civilian and miliary employment by the federal government (4,304,000).

Table 6. Direct Employment by Motor Vehicle and Parts Manufacturers and Dealers and Employment Directly Supported by their Purchases of Intermediate Inputs, 2021

	Direct jobs	Input supplier jobs	Total
Motor vehicle and parts manufacturers	957,000	871,310	1,828,310
Motor vehicle and parts dealers	1,965,000	398,542	2,363,542
Total	**2,922,000**	**1,269,852**	**4,191,852**

166. MVPM input purchases also supported 94,876 jobs in machinery manufacturing, 54,615 jobs in management services, and 52,095 jobs in primary metals production.
167. We exclude intrasector inputs purchased by those dealers from MVPMs, totaling $7.6 billion in 2021, and focus on the $84.7 billion in purchases from those 23 other industries.
168. Those purchases also supported 10,000 to 20,000 jobs in other transportation services, other retail services, food services and drinking places, plastic and rubber product manufacturing, insurance carriers, and wholesale trade services.

An important issue raised by the development of AVs is whether American motor vehicle companies and their suppliers will be more competitive or less competitive than they are today in the emerging U.S. and worldwide markets for AVs. As seen with other major innovations, the emergence of AVs could disrupt current motor vehicle market competition in significant ways. For example, China currently has certain advantages as by far the largest national market for motor vehicles and the largest producer for that market. However, China is much less competitive in the world's three other major markets—the United States, Europe, and Japan. However, China's greatest advantage in the coming competition for AV markets is political. Its government's stated policy is to generously support and promote R&D in AVs through its 14 state-owned motor vehicle companies and many of the 40 privately owned Chinese domestic vehicle producers. China's government also aggressively supports the state-owned and private Chinese enterprises that are developing computers, telecom equipment, and software for AVs, and is making the early investments in roadway infrastructure that advanced AVs will need.

The United States has important competitive advantages. American motor vehicle companies have established the most extensive global networks of suppliers, production facilities, and customers, thus creating efficiencies that Chinese producers can only try to offset through government subsidies. Moreover, American companies generally dominate most markets for the types of new technologies that AVs require. The United States is the world's preeminent developer of software, with 8 of the world's 10 largest software development companies,[169] and the preeminent producer of telecom equipment, with 5 of the world's top 10 producers.[170] In addition, 5 of the world's top 10 computer manufacturers are American.[171]

The United States, along with Europe and Japan, remains committed to promoting competition rather than simply providing government subsidies to serve the country's long-term economic interest. Given China's aggressive government support for its domestic private and state-owned producers and the substantial stakes at play in the coming global and U.S. markets for AVs, the American government can and should consider measures to promote continuing innovation and leadership in AVs.

169. Bizvibe (2021a).
170. Value.Today (2023).
171. Bizvibe (2021b).

VII. Conclusion

This study examined the potential social, economic, and environmental benefits from the large-scale adoption of AVs. We found that their widespread use—constituting 25% of motor vehicles—should lead to significant reductions in traffic accidents and associated deaths, injuries, and economic costs. We also found that large-scale use of AVs should substantially increase mobility and access for millions of people with disabilities who are travel impaired, older people, and nondrivers, with potentially substantial economic and social benefits. Finally, such broad adoption of electric-powered AVs should produce meaningful reductions in greenhouse gas emissions, even taking account of emissions produced to generate their electric power.

Given the size of the global and U.S. markets for motor vehicles, intense international competition over AV production and sales will accompany their widespread adoption. Today, many motor vehicle and technology companies around the world are invested in developing AVs, led by companies in the United States and China, the two leading countries for the production and sale of conventional motor vehicles. Looking ahead to this competition, Chinese companies have the advantage of aggressive subsidies and other government support for their efforts to develop commercially viable AVs. American companies have the advantage of global leadership in most areas critical to AV technology. Given the large economic stakes in this competition, U.S. policymakers should consider measures that would support the continuing innovation and technological leadership of American companies in this critical and emerging market.

Appendix: The Models

We employed a multimethod approach to evaluate the safety, mobility, and environmental implications of AVs across various system variables, including the vehicle and user level, transport system level, and societal level. This methodology integrates the frameworks of conceptual modeling and existing transportation models. Given the general absence of empirical data on AVs, we use causal system dynamics models to investigate long-term processes and the influence of key variables on the societal effects of AVs. For this purpose, we used Vensim software for system dynamics modeling. We also draw on results from Motor Vehicle Emission Simulator (MOVES), Vissim, and EnViVer models that address current transportation concerns. These models, which have been used to analyze Transportation Network Companies (TNC), congestion, and greenhouse gas emissions, provide a more accurate foundation for simulating the effects of AVs.

Our scenarios represent a future in which technology and government support address U.S. mobility to benefit the American public. We assume that public investments, incentives, and regulations enable more people to share rides without cannibalizing public transit service and allow riders to transfer fluidly between modes of transit. These transportation policy assumptions were selected using six criteria: (1) transit ridership changes, (2) congestion levels, (3) financial impact on federal and municipal budgets, (4) equity in access to mobility, (5) political feasibility and public acceptance, and (6) technical feasibility and implementation ease.

Our underlying adoption rates are a modified version of scenarios and parameters presented by Litman (2022) and Stasinopoulos (2021), adjusted to reflect certain differences in assumptions such as the proportion of shared versus private fleets, public investment, and transportation management policies. We assume a broad use of rideshares and 100% adoption of electric vehicles. We also assume aggressive public investment in infrastructure and R&D to support the adoption of AVs, which we believe will be necessary to achieve their potential benefits. Further, we assume a federal AV TNC data-sharing policy to help maximize the benefits of AVs and to ensure their safe deployment.

These transportation and mobility policies would promote and support specific AV-enabled TNC routes and areas, for example, by subsidizing trips that fill gaps in public transit service, such as first- and last-mile connections and areas with limited access to public transit, as well as transit hubs.

We also assume the removal of barriers to intermodal transit through multimodal trip planning options. To limit congestion and prevent competition with public transit, we also assume limits on route authorization through geofencing. Finally, we assume three relatively optimistic projections of lower greenhouse gas intensity for the U.S. electric grid, as related to the environmental benefits of electric AVs.

Data Sources

We drew on a wide range of data sources to develop the mobility model, including the U.S. Department of Transportation (USDOT) and NHTSA. The USDOT's Transportation National Household Travel Survey and the Federal Highway Administration's Highway Performance Monitoring System provided critical data on daily travel behavior and highway performance. To estimate the economic savings from reducing traffic accidents, fatalities, and injuries, we relied on the most recent NHTSA data on the impact of crashes on medical costs, foregone productivity, legal and court costs, emergency services, insurance administration, property damage, and congestion costs. We also used the National Transportation Atlas Database and Transportation Economic Trends data sources from the Bureau of Transportation Statistics to inform our analysis of the U.S. transportation system's geospatial data, transportation demand, capacity, and performance. Last, we incorporated data from the Statewide Transportation Improvement Program and Metropolitan Planning Organization transportation plans to inform our view of long-range transportation planning in specific states and metropolitan areas.

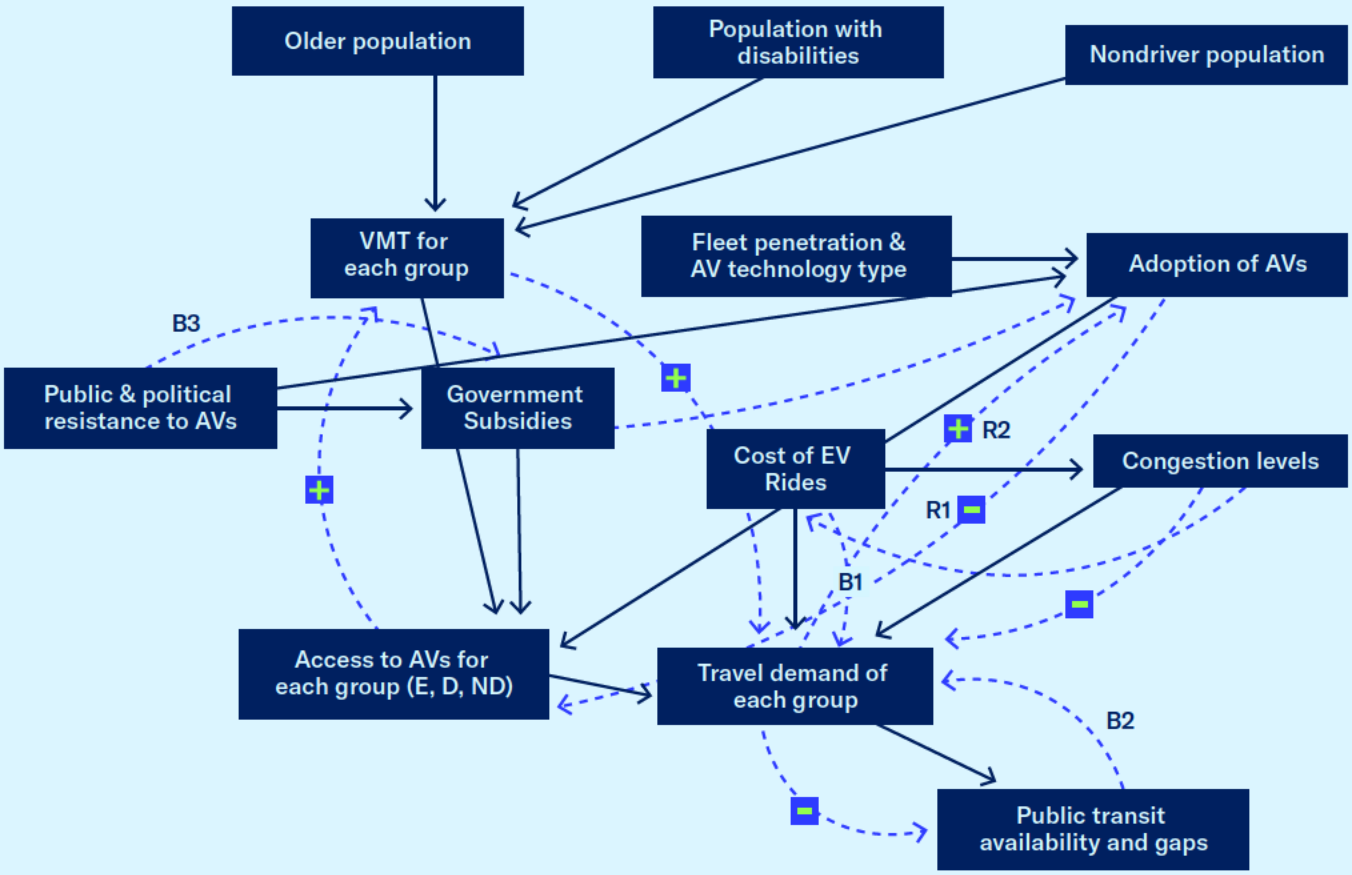
Demographic data were gathered from the U.S. Census Bureau, the Department of Health and Human Services, and USDOT. We relied on the Census Bureau's American Community Survey and Decennial Census for the demographic and housing characteristics at various geographic levels. The study also draws on USDOT estimates of vehicle miles traveled (VMT) for each mobility-restricted group in 2017.

For our greenhouse gas emissions submodel, we employed data from USDOT on daily travel behavior and occupancy rates gathered under the National Household Travel Survey, including information on trip purpose, mode choice, and travel time and distance. We also used the Federal Highway Administration's Highway Performance Monitoring System and the NHTSA's Vehicle Inventory and Use Survey for data on highway mileage, travel, and performance, including VMT by different vehicle types and on different road types. Data regarding vehicle age, energy consumption, and emissions came from the Environmental Protection Agency's (EPA) National Emissions Inventory and the MOVES model available from the EPA website. The Energy Information Administration provided our data on the electric grid's energy mix in its Annual Energy Outlook and the Electric Power Monthly, and the data on population and vehicle ownership are derived from the Census Bureau's American Community Survey and Vehicle Inventory and Use Survey.

Mobility Submodel

To analyze the potential impact of AVs on the mobility of older people, people with disabilities, and nondrivers, we used a system dynamics model to simulate various scenarios based on different AV adoption rates (25%, 50%, 75%, and 100%), AV technology levels (Basic, Standard, and Advanced), and subsidies for shared-ride AV trips by those with disabilities and older people. Our model examined how these factors affect the VMT by each group to provide quantitative estimates of their increased mobility. The model generated estimates of the percentage change in VMT for each target group based on various combinations of AV adoption rates and technology levels. These percentage changes were converted to miles per year to calculate the overall impact on each group's total VMT. Figure A.1 is a visual representation of the organization of this model.

Figure A.1. Simplified Causal Loop Diagram of Mobility Submodel



Our mobility analysis relies on the assumptions regarding AV adoption rates, technology levels, and government subsidies noted earlier, which may or may not capture future real-world conditions. First, we assume that AVs do not operate on routes currently served by public transit to avert direct competition between shared-ride AVs and public transit systems. We assume that subsidies are available for shared-ride AV trips that bridge gaps in public transit service, including subsidies for shared-ride AV trips that serve areas with limited access to public transit and first-mile and last-mile service. The model does not account for factors such as the spatial distribution of the target populations, variations in regional transportation infrastructure, or potential exogenous changes in public transit availability. Future research could explore these factors and their potential impact on AV use by people with restricted mobility.

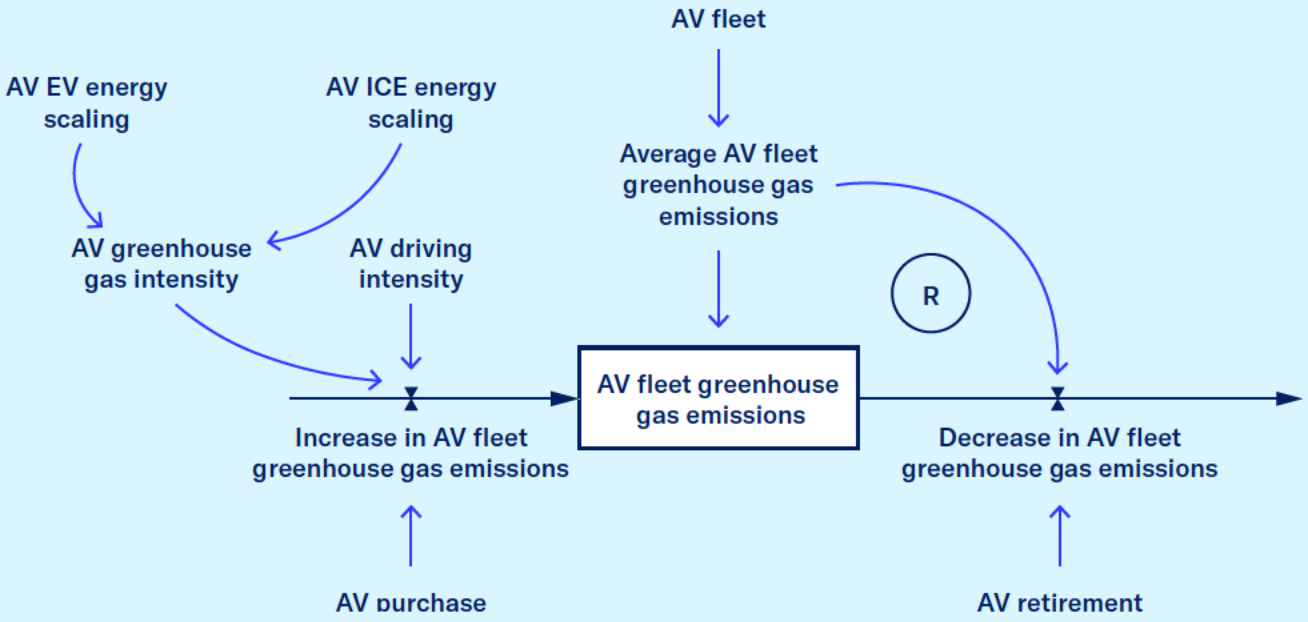
We identified several major causal loops in this analysis. The first such loop connects the adoption of AVs, access to AVs, VMT, and travel demand for each group. As the availability of AVs increases and adoption rates rise, access to transportation for these groups also increases, leading to higher travel demand and VMT, which in turn leads to further adoption of AVs, thus creating a reinforcing loop. Another reinforcing loop occurs among government subsidies for shared-ride AV trips, the adoption rates of AVs, and access to AVs for each group. As subsidies for shared-ride AV trips become available, more people in these groups will be able to afford and use AVs, which leads to increased adoption rates and further access to AVs that in turn reinforces the availability and use of the subsidies for these groups.

We also identified a balancing loop among the cost of AV rides, travel demand, congestion levels, and VMT for each group. As the cost of AV rides increases, travel demand decreases, which leads to reduced VMT and less congestion. This in turn leads to lower costs for AV rides, creating a balancing loop. We identified another balancing loop between public transit availability and gaps, travel demand, and VMT for each group. As public transit availability increases, travel demand decreases and leads to lower VMT and congestion levels. This in turn leads to less need for public transit and creates a balancing loop.

Emissions Submodel

To evaluate the environmental effects of AVs and the implications for congestion, we used a system dynamics model to simulate scenarios for varying degrees of AV adoption. The model is based on previous research and uses the EPA's MOVES and results from EnViVer to estimate CO2 equivalent emissions and NOx emissions from transportation sources. The simulation accounts for factors such as vehicle age, energy consumption, cold start and operational emissions, vehicle occupancy rates, and acceleration and deceleration profiles. We calibrated the model to ensure its reliability by comparing its outputs with historical data. We ran simulations for the varying levels of AV fleet adoption and different grid energy mix scenarios (Climate +, Climate Neutral, Median).

Figure A.2. Simplified Causal Loop Diagram of Emissions Submodel



Traffic Safety Submodel

We used a system dynamics approach that integrates many factors to simulate various scenarios for assessing the impact of AVs on transportation systems, traffic accidents, fatalities, injuries, property damage, and associated economic effects. We incorporated several considerations to evaluate the potential impacts of AVs in various driving environments. This approach required a meta-analysis based on microsimulation results derived from the use of VISSIM traffic modeling software, which has proven to be a valuable tool in traffic simulations and assessments. We further refined our model by considering conflicts arising from different time-to-collision thresholds such as 1.5, 1.25, 1.0, and 0.75 seconds. By accounting for these variations, we could capture a broad range of potential interactions between AVs and other road users. We also conducted simulations at multiple traffic speeds, and the final results represent a weighted average of those simulations. Our model further accounts for the diverse ways that AVs may affect public health and safety in both positive and negative ways. That analysis considers multiple pathways through which AVs can affect traffic based on 32 public health pathways drawn from the literature. We estimated the potential impact of AVs on health and safety through accidents by combining these pathways with the model's assumptions.

This model simulated the effects of AV adoption on traffic accidents based on different AV operating technologies, adoption rates, and platooning (connected AVs, or CAVs, that communicate with each other). We use the three alternatives for AV driving logic and behavior noted earlier based on

parameters developed for the PTV Vissim traffic simulator to represent different levels of AV performance under varying conditions.

Our analysis revealed several causal loops related to the adoption and impact of AVs. The first is a positive feedback loop in which an increase in AV adoption leads to a reduction in accidents, which increases adoption rates and improves the effectiveness of AV technology. These dynamics can also lead to a negative feedback loop in which the increased accessibility and convenience of AVs cause increases in VMT, potentially leading to more accidents. Increases in AV adoption may lead to a reduction in physical activity because of increased reliance on the vehicles, potentially leading to negative public health outcomes. We also observed another positive feedback loop related to adoption of CAVs. As their use increases, their capacity to communicate and platoon improves, which leads to more efficient traffic flow and fewer accidents.

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About the U.S. Chamber

Who We Are

The Chamber of Commerce of the United States is the world's largest business organization. Our members range from the small businesses and chambers of commerce across the country that support their communities, to the leading industry associations and global corporations that innovate and solve for the world's challenges, to the emerging and fast-growing industries that are shaping the future. For all of the people across the businesses we represent, the U.S. Chamber of Commerce is a trusted advocate, partner, and network, helping them improve society and people's lives.

What We Do

Since our founding, the U.S. Chamber has advocated for policies that help businesses create jobs and grow our economy. Building on a strong legacy of trust and track record of success, we help today's businesses start, grow, and thrive in a complex and constantly changing macro environment. We inform our members with timely policy analysis and legal advice, connect them with leaders in business and government through world-class events and intimate gatherings, and equip them with tools and resources to help them succeed. Above all, we serve as their ally and champion on Capitol Hill, in the courts, in the state houses, and in markets around the world. No matter who or where our members are, we are their seat at the table and voice in the debate.

We advocate, connect, inform, and fight for business growth and America's success.

What We Believe

While the country has changed since the U.S. Chamber of Commerce was established over a century ago, our foundational belief has not. We believe in the ability of American businesses to improve lives, solve problems, and strengthen society. And throughout the years, a clear pattern has emerged. When citizens, business leaders, and government officials work together, America works. There are greater opportunities for better jobs, new industries, and fairer laws. Communities thrive, the economy grows, and our nation's positive influence in the world increases. When that partnership breaks down, those opportunities and the country's optimism fade.

To us, the choice is simple. The future we want to build gives everyone the opportunity to build a better future for themselves. It's why our job today—and every day—is to build the strongest relationship possible among the American people, business leaders, and elected officials in Washington, state capitals, and countries around the globe. This empowers business to play a vital and needed role in a healthy democracy. It allows us to shape and deliver the bold policies that matter most to our members. And it enables millions of businesses to create the jobs and economy that offer every American the chance to pursue their goals.

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National Safety Council

July 25, 2023

The Honorable Gus Bilirakis
Chair, Innovation, Data, and Commerce Subcommittee
U.S. House of Representatives
Washington, DC 20515

The Honorable Jan Schakowsky
Ranking Member, Innovation, Data, and Commerce Subcommittee
U.S. House of Representatives
Washington, DC 20515

Dear Chair Bilirakis and Ranking Member Schakowsky:

The National Safety Council (NSC) applauds you for holding this timely hearing on ensuring improved safety outcomes on our roadways from tested and validated vehicle safety technology. NSC appreciates the opportunity to submit this letter for the record.

NSC is America's leading nonprofit safety advocate and has been for nearly 110 years. As a mission-based organization, we work to eliminate the leading causes of preventable death and injury, focusing our efforts on the workplace and roadways. We create a culture of safety to keep people safer at work and beyond so they can live their fullest lives. Our more than 13,000 member companies represent nearly 41,000 U.S. worksites.

Since the1980s, the automotive industry, partnering with research universities and government agencies, has rapidly developed technology which automates several distinct phases of the driving experience.[1] While much time exists before fully autonomous vehicles (AVs) are commercially available to the public, American consumers have already become accustomed to receiving advertisements for highly automated features such as: automatic emergency braking (AEB), automatic roadway lane changing, and electronic speed adjustment.[2]

NSC supports technological innovation in the automotive and other sectors to improve safety. However, any technology development must be vigorously tested to ensure there is no added burden to the already troubling rates of motor vehicles crashes and fatalities in this country. The cost is too great to get this wrong. In April, NHTSA estimated that 42,975 people died in 2022 due to motor vehicle crashes, representing a 10% increase over the 2019 numbers.[3] These crashes are preventable, and technology can help save lives. NSC welcomes the opportunity to work with Congress and NHTSA to implement proven strategies to end roadway deaths in the U.S. by 2050.[4]

NSC has reviewed the draft SELF DRIVE (Safely Ensuring Lives Future Deployment and Research In Vehicle Evolution) Act and offers the following comments on the draft and on concepts that should be incorporated into AV policies.

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[1] https://www.mobileye.com/blog/history-autonomous-vehicles-renaissance-to-reality/
[2] https://gmauthority.com/blog/2022/01/2022-chevy-equinox-shows-off-automatic-emergency-braking-in-taco-truck-ad-video/
[3] https://www.nhtsa.gov/press-releases/traffic-crash-death-estimates-2022#:~:text=NHTSA%20Estimates%20for%202022%20Show,Two%20Years%20of%20Dramatic%20Increases&text=The%20National%20Highway%20Traffic%20Safety,in%20motor%20vehicle%20traffic%20crashes.
[4] https://www.nsc.org/road/resources/road-to-zero/road-to-zero-home

National Safety Council

Federal Motor Vehicle Safety Standards (FMVSS). A pressing safety concern for many organizations and consumers is the increasingly outdated FMVSS. We know the FMVSS save lives. A report by NHTSA estimates FMVSS implemented from 1960-2012 have saved 613,501 lives.[5] Because of the FMVSS evaluated in the study, the risk of fatality in crashes in 2012 fell by 56% from 1960.[6]

NSC believes that the time is now for NHTSA to update the FMVSS to include many of the safety technologies available today as options that are the building blocks for AVs of tomorrow. FMVSS should include minimum performance standards for Advanced Driver Assistance Systems (ADAS), such as automatic emergency braking, lane departure warning, blind spot monitoring and others.[7] New, minimum standards would ensure that both Americans driving motor vehicles equipped with ADAS and Americans who are sharing the roadways with ADAS-enabled vehicles are better protected.

However, with people keeping their cars for an average of 12.2 years, meaningful fleet penetration of FMVSS takes decades after being required as standard features on vehicles.[8] This means additional solutions must occur concurrently for there to be meaningful change in eliminating motor vehicle crashes and fatalities.

Other remedies that can be implemented concurrently with new FMVSS include Congress granting NHTSA the ability to require pre-approval for ADAS and fully automated driving technologies and Congress revising NHTSA recall authority to include elements of automated driving such as over-the-air updates.

Lastly, NHTSA should make public AV testing data and safety records from AV manufacturers. Transparency will not only increase public trust but also encourage safety innovation and ultimately improve AV safety.

Exemptions. NSC encourages both Congress and NHTSA to carefully consider the impacts of exemptions in this burgeoning field of technology development. While Congress may see a difference between "dedicated highly automatic vehicle[s]" and a "motor vehicle [in] operation by a human driver"' now, much of ADAS technology that will enable dedicated highly automatic vehicles in the future is being deployed today in vehicles where there are human drivers. Most AVs testing on public roads today continue to have a driver's seat and all FMVSS incorporated. Safety must be the preeminent concern when allowing a vehicle to be exempt from FMVSS. Understanding that AVs will share the roadways with a mixed fleet of vehicles, allowing for exemptions from safety standards will result in more dangerous outcomes.

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[5] Kahane, C.J., Lives Saved by vehicle Safety Technologies and Associated Federal Motor Vehicle Safety Standards, 1960 to 2012, NHTSA, DOT HS 812 069, January 2015.
[6] Ibid.
[7] NSC applauds NHTSA proposed automatic emergency braking proposals for both light and heavy vehicles.
[8] Weykamp, George, "Average age of U.S. light vehicles rises for fifth straight year," Automotive News, May 23, 2022.

National Safety Council

Consumer education: In today's market, 93% of new vehicles offer at least one ADAS technology, and the terminology used by manufacturers often seems to prioritize marketing over clarity.[9] In 2019, NSC, AAA, Consumer Reports, and J.D. Power released "Clearing the Confusion: Recommended Common Naming for Advanced Driver Assistance Technologies" to address this issue and an updated version was created in 2022.[10] The organizations presented standardized naming that is simple, specific and based on system functionality in an effort to reduce consumer confusion. While safety features may change over time as software and hardware updates in turn modify the operational parameters for vehicle systems, the language used to describe them does not necessarily have to change.

The U.S. Department of Transportation (DOT) endorsed the "Clearing the Confusion" recommendations, and we urge this administration to continue the commitment to use them and call on other safety organizations, automakers, journalists, researchers and policymakers to adopt these terms.[11] NSC also urges the Committee to use these terms in ADAS and AV proposals moving forward to ease understanding.

Additionally, NSC welcomes the proposed directive in the SELF DRIVE Act to submit research for the record which "inform[s] consumers for each highly automated vehicle or a vehicle that performs partial driving automation about the capabilities and limitations of that vehicle."[12]

Finally, NSC greatly appreciates the proposed establishment of the Highly Automated Vehicle Advisory Council (Advisory Council) and the opportunity for subcommittees listed in the SELF DRIVE ACT. The statutory inclusion of "safety and consumer advocates" is welcome as these organizations are on the forefront of ensuring our roadways remain safe as more vehicles contain highly automated features. Given the increase in deaths on the roads of vulnerable road users (VRU), NSC recommends the addition of VRU representatives to the Advisory council as well.

An opportunity exists for lawmakers to further expand on the safety remit tasked to the Advisory Council in the SELF DRIVE Act. Currently, the legislative text focuses solely on safety within the "cabin". Highly automated vehicles will not operate in isolation. Congress must expand its view of safety to include how highly automated vehicles will interact with other motor vehicles on the road, pedestrians, bicyclists, motorcyclists, and other road users.

Today, we have millions of drivers behind the wheel and spend millions of dollars on education and enforcement campaigns. Yet, we still recognize billions in economic loses as a result of motor vehicle crashes. The integration of and investment in AV technologies will likely be messy as we deal with a complex and ever-changing human-machine interface. That is why federal leadership is needed, but we can't compromise safety in developing this technology. The U.S. should always lead on safety.

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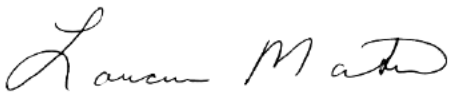
[9] https://www.aaa.com/AAA/common/AAR/files/ADAS-Technology-Names-Research-Report.pdf
[10] https://newsroom.aaa.com/wp-content/uploads/2023/02/Clearing-the-Confusion-One-Pager-New-Version-7-25-22.pdf
[11] https://www.transportation.gov/briefing-room/us-transportation-secretary-elaine-l-chao-announces-new-initiatives-improve-safety
[12] SELF DRIVE Act

National Safety Council

NSC appreciates this Committee's leadership on vehicle technology and safe roadway transportation. If safety for the traveling public is the ultimate goal, advanced technology provides a promising opportunity to achieve that outcome and will go a long way to take us down the road to zero fatalities.

Sincerely,



Lorraine M. Martin
President and CEO

CONSORTIUM FOR CONSTITUENTS WITH DISABILITIES

July 26, 2023

The Honorable Gus Bilirakis
Subcommittee on Innovation, Data and Commerce
2125 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Jan Schakowsky
Subcommittee on Innovation, Data and Commerce
2125 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Cathy McMorris Rodgers
House Energy & Commerce Committee
2125 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Frank Pallone
House Energy & Commerce Committee
2125 Rayburn House Office Building
Washington, D.C. 20515

RE: Hearing on "Self-Driving Vehicle Legislation Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China"

Dear Chairs Bilirakis and Rodgers and Ranking Members Schakowsky and Pallone:

The undersigned members of the Consortium for Constituents with Disabilities (CCD) Transportation Task Force and fellow advocates thank you for holding today's hearing on autonomous vehicle (AV) legislation. CCD is the largest coalition of national organizations working together to advocate for Federal public policy that ensures the self-determination, independence, empowerment, integration and inclusion of people with disabilities. The hearing is being held on July 26th which marks the 33rd Anniversary of the Americans with Disabilities Act (ADA) which sought to "provide a clear and comprehensive national mandate for the elimination of discrimination against individuals with disabilities." Today Congress has the opportunity to lead, to uphold the ADA's mandate, enhance safety, and improve lives and mobility for all.

The CCD Transportation Task Force has adopted cross-disability Autonomous Vehicle Principles [1] and provided feedback on past AV legislative drafts.[2] Signatories to the Principles included 20 national organizations. Many of our members also participated in 3 days of AV accessibility workshops in 2019 hosted by the Alliance of Automobile Manufacturers (an organization preceding the Alliance for Automotive Innovation) with government, industry and disability stakeholders,[3] and U.S. Department of Transportation (USDOT) and U.S. Department of Labor (USDOL) listening sessions.[4] As you discuss an AV legislative framework we urge you to consider our comments below on the proposed legislative drafts and provisions. AVs can improve mobility and quality of life for the disability community, including for those with physical, sensory, intellectual and developmental disabilities and neurological conditions such as epilepsy. For the full potential of AVs to be realized any AV legislative framework must: explicitly include consideration of accessibility and the needs of disabled travelers of all disability types in each

rulemaking, including federal motor vehicle safety standards (FMVSS) updates; ensure exemptions granted based on improved access address the biggest challenges to accessibility; ensure preemptions do not prohibit state or local accessibility requirements or performance metrics; ensure AV-related ADA or other civil rights claims can be filed in court; ensure AVs complement and improve public transit; and ensure USDOT and the US Access Board have the resources and staffing to adopt and implement necessary research, rulemaking and standard setting.

Background

Nearly 1 in 5 people in the U.S. has a disability (more than 57 million). As a result of the passage of the ADA, 99% of public buses are equipped with ramps, curb ramps benefit the public, and there is improved provision of accessible transit to people with sensory disabilities. Yet, significant barriers to accessible, affordable transportation remain across modes.

Many people with disabilities cannot drive because of their specific disability, are currently unable to obtain a driver's license, or cannot afford to purchase a vehicle that would be accessible with the installation of a wheelchair ramp or other modifications. It's critical that ride-share and on-demand services provide disability access yet there are not adequate wheelchair accessible vehicles and trip denials for service animal users and other people with disabilities are rampant. A Bureau of Transportation Statistics (BTS) study of adults with disabilities found that roughly half of respondents 18 to 64 reported living in a household with income under $25,000.[5] In addition, there are no purpose-built wheelchair accessible passenger vehicles on the market today. Currently wheelchair users who travel in their wheelchair often pay nearly double the price of the vehicle for necessary aftermarket accessibility modifications, including to have a ramp installed or other features that require exemptions from the FMVSS.[6]

Without affordable, accessible transportation people with disabilities are unable to travel to work, to school, to contribute to and participate in their communities, to support and spend time with family and friends, and live their lives to the fullest. A recent report by the National Disability Institute found that a critical barrier to competitive integrated employment and entrepreneurship is a lack of accessible transportation options. Accessible, affordable, and sustainable AVs could lead to an additional 4.4 million jobs for people with disabilities, an additional $867 billion in U.S. GDP and $1.6 trillion in U.S. output.[7]

Manufacturers and transportation providers are developing, testing and deploying autonomous shuttles and passenger vehicles. The present and future of mobility is changing. AVs have the potential to drastically improve access for people with disabilities, including members of the blind and low vision, intellectual and developmental disability communities, people with physical disabilities, including wheelchair users, and people with neurological conditions such as epilepsy and seizure disorders. However, **the promise and safety of AVs will *only* be realized if the vehicles and the surrounding infrastructure are fully accessible, and the safety elements consider the needs of all people with disabilities**.

Regarding any AV legislative framework we urge you to:

Retain the Following Provisions

Licensing and Insurance - Legislation should prohibit discrimination on the basis of disability by states and any other governmental authorities in licensing and insurance. We strongly support the provision in Congressman Latta's SELF DRIVE Act and Congresswoman Dingell's text that prohibit discriminatory licensing laws nationwide.

Highly Automated Vehicles Advisory Council – An Advisory Council comprised of industry, consumer, safety, labor, civil rights and other stakeholders is necessary to continue discussions and identify barriers, unintended impacts and solutions. Disability representation is critical and should be included within any advisory council and such council should also be required to consider accessibility needs.

Include Accessibility in and Strengthen the Following

Safety Framework Rulemaking – Any safety framework rulemaking must also include a requirement for USDOT to consider the needs of disabled travelers, including people with physical, sensory (those that are blind or low vision or Deaf or hard of hearing) and intellectual and developmental disabilities. USDOT is not precluded from including accessibility in their rulemaking. However, a mandate from Congress for all AV-related rulemakings would ensure its inclusion. Object detection outside the vehicle and the vehicle's human machine interface (HMI) are critical in any safety framework. HMI must be accessible to people with sensory and cognitive disabilities for AVs to reach their full potential. A Disability Rights Education & Defense Fund brief on ableism in AV AI and algorithms recommends standards be set to ensure AVs can detect all people with disabilities and other members of marginalized communities outside the vehicle.[8] Current research suggests that not all AVs are being taught to detect people seated in their wheelchairs or people with darker skin tones, among others.

Safety Self-Assessment Rulemaking – Proposed manufacturer self-assessment rulemaking requires USDOT to identify risks to motor vehicle safety and steps taken to mitigate such risks during the design, development and introduction into interstate commerce. Accessibility and how the needs of disabled travelers, including non-visual access and access for wheelchair users, are being met must be included in safety self-assessments provided by manufacturers and in any publicly available database. In order for an AV to be safe it must also be accessible for people with a variety of disabilities and include wheelchair securement solutions and object detection of people with disabilities, older adults, cyclists and other vulnerable road users.

Updating Existing FMVSS Standards – Existing FMVSS will be updated to ensure the safety of AVs, including level 4 and 5. We strongly encourage Congress to require USDOT to include a review of how updated FMVSS will ensure the safety of fully accessible AVs, including those that are both electric and autonomous, and are built with wheelchair ramps and will require testing

and deployment of automatic securement systems.[9] The federal safety framework must assume deployment of and advance progress toward fully accessible passenger vehicles (both large and small) as well as accessibility standards. These standards will provide not only peace of mind for the public, but also a roadmap for those in the industry seeking to develop and deploy the safest, most accessible vehicle.

Of note, we strongly believe the AV safety framework must lead toward a fully accessible vehicle that is safe for all, including wheelchair users and all people with disabilities. Yet, any updates to the FMVSS must maintain the current exemptions to crashworthiness for modified vehicles to install a ramp until vehicles are fully accessible and such modification is no longer required for access.

Exemptions for Vehicles that Benefit People with Disabilities – We note the provision allowing AV manufacturers to apply for exemptions from FMVSS if the vehicle would promote transportation access for individuals with disabilities. We urge you to strengthen the existing language to incentivize manufacturers to address the more difficult accessibility challenges such as a vehicle that can effectively communicate with people who are blind or Deaf, is accessible for wheelchair users who remain in their wheelchair, and provides automatic wheelchair securement. Please consider requiring vehicles eligible for this exemption to be accessible for all people with disabilities and for the exemption to entail a minimum level of accessibility that advances true access.[10]

Exemption Database – A public database of exempted vehicles has been proposed. We urge you to include in the database whether the vehicle was granted an exemption because it would promote access for individuals with disabilities and how it promotes such access.

Public Transportation – We encourage any bill to allow use of and permit exemptions of vehicles used in public transportation. We note the ADA requires transportation provider's personnel to assist with the use of securement systems, lifts and ramps.[11] We recommend legislation require research into whether a transit employee should be on every transit vehicle to also focus on additional customer service including emergency response. AV use in public transportation ensures AV rideshare providers are under clear civil rights law obligations, including the ADA. Without transit and paratransit providers adopting accessible AVs, a significant market for AVs is lost. It is worth noting that assisting people with disabilities is a universal value consistently expressed by the AV industry.

In addition, permitting AVs to be used in public transit could create opportunities for AV rideshare and transit to work together to ensure on demand service is complementing rather than replacing transit. Studies have shown that when rideshare service enters a market and provides what some view as a more convenient alternative to public transit, transit ridership can decrease.[12] Transit agencies are already struggling.[13] Additional decreased ridership could lead to cuts in fixed bus routes and service hours which also leads to potential cuts in required paratransit service provided for people with disabilities that cannot access traditional transit because of access barriers within the system or their disability. Additionally, even rideshare

services can benefit from partnerships with public transit systems as pairing the two services can improve scale, affordability, and efficiency across the whole system.[14] Finally, many AVs are likely to be electric vehicles. We must ensure that transit and paratransit riders can fully realize the health benefits of zero-emission, all-electric vehicles. Prohibitions on the use of certain electric vehicle types by transit agencies may create an additional barrier to electrification of paratransit and transit fleets, leaving people with disabilities behind.

Preemption – There is currently a provision that preempts state or political subdivisions of a state to maintain, enforce, prescribe or continue in any effect any law or regulation regarding the design, construction or performance of AVs. We are concerned this provision may unintentionally preempt AV accessibility or equity performance measures or requirements at the state or local level, including state laws that would mandate vehicle environmental standards to mitigate harm. While we understand the need for federal standards of vehicle design and construction, we also encourage allowing states and local jurisdictions to seek higher performance requirements that also ensure the greatest access and benefits for disabled and other historically underserved travelers.

Forced Arbitration – We strongly encourage inclusion of a prohibition on forced arbitration clauses in any AV framework. AV providers must be held accountable for injuries and property damage, and remedies available under applicable civil rights must be made available.[15] Disabled passengers repeatedly face discrimination from rideshare services today. The rights of travelers with disabilities should be protected to ensure a safe and quality experience. In order to fully protect their rights, all passengers must have the option to take their claims to court.

USDOT Personnel and Staffing, Resources for Development – Congresswoman Dingell's draft requires a report on the staffing and resource needs for USDOT including additional personnel or resources needed in the 10-year period following the bill's passage. The Secretary is to consider the staffing of the Highly Automated Systems Safety Center of Excellence. We strongly encourage including in the report the staffing and resource needs required to ensure accessibility and safety are prioritized in the development of AVs, as well as creating a department within the Center for Excellence, or a separate center focused on accessibility of AVs. We also encourage the hiring of experts with disabilities who bring their own lived experience and informed perspective.

<u>Add the Following</u>

US Access Board AV Standards Mandate – There are currently no federal accessibility standards for fully accessible AV passenger vehicles. USDOT has on their Inclusive Design Challenge webpage a list of existing standards, e.g. wheelchair securement, that may be used as a guide for the time being.[16] There is also a summary report from the Alliance of Automobile Manufacturers-hosted AVs and Increased Accessibility workshops that identifies accessibility needs in detail.[17] However, these do not hold the same weight nor are they enforceable. Accessibility standards must be developed by the US Access Board which has also developed standards for public buildings and public rights-of-way among others.[18] A mandate for the US

Access Board to draft AV standards is critical in any legislative framework. In addition, including a deadline within which the Department of Justice and USDOT must adopt the standards and providing sufficient funding for the Access Board to develop the standards is necessary.

Thank you for your consideration and for all you do on behalf of people with disabilities. Please contact Carol Tyson at ctyson@dredf.org and the CCD Transportation Task Force Co-Chairs with questions. We are eager to support your efforts to enhance safety and mobility for all.

Sincerely,

CCD Transportation Task Force Co-Chairs

Danica Gonzalves, Paralyzed Veterans of America, danicag@pva.org
Sarah Malaier, American Foundation for the Blind, smalaier@afb.org
Swatha Nandhakumar, American Council of the Blind, snandhakumar@acb.org
Claire Stanley, National Disability Rights Network, claire.stanley@ndrn.org

Signatory Organizations

Access Ready
American Association of People with Disabilities
American Council of the Blind
American Foundation for the Blind
American Printing House for the Blind
Autistic Women & Nonbinary Network
Christopher & Dana Reeve Foundation
Disability Rights Education & Defense Fund
Epilepsy Foundation
National Disability Institute
National Disability Rights Network
New York Lawyers for the Public Interest
Paralyzed Veterans of America
Perkins School for the Blind
United Spinal Association

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The Consortium for Constituents with Disabilities (CCD) is the largest coalition of national organizations working together to advocate for Federal public policy that ensures the self-determination, independence, empowerment, integration and inclusion of children and adults with disabilities in all aspects of society free from racism, ableism, sexism, and xenophobia, as well as LGBTQI+ based discrimination and religious intolerance.

[1] Consortium for Constituents with Disabilties Transportation Task Force Autonomous Vehicle Principles, updated May 2022. Available at https://www.c-c-d.org/fichiers/CCD-Transpo-TF-AV-Principles-May-2022.pdf.
[2] CCD Transportation Task Force August 23, 2019 feedback on AV Bill Issues, including disability access, advisory committees, rulemakings, exemptions, privacy, safety evaluation reports and accessibility features, crash data, resources for NHTSA, consumer education, studies examining potential impacts, and infrastructure available at https://www.c-c-d.org/fichiers/CCD-Transpo-TF-Feedback-on-AV-Bill-Issues-082319.pdf. November 4, 2019 Feedback on AV Legislation Sections, including on a HAV advisory council, and disability exemptions available at: https://www.c-c-d.org/fichiers/CCD-Transp-TF-Feedback-on-AV-Sections-110419.pdf. December 9, 2019 Feedback on AV Legislation Sections, including on new FMVSS and licensing and insurance available at https://www.c-c-d.org/fichiers/CCD-Transp-TF-Feedback-on-AV-Sections-120919.pdf. February 21, 2020 Feedback on AV Legislation Sections, including on consumer education, cybersecurity, personnel and staffing, and additional considerations available at: https://www.c-c-d.org/fichiers/CCD-AV-Sections-Response-02-21-20.pdf.
[3] Autonomous Vehicles and Increased Accessibility Workshops (May 3, July 19, September 10, 2019). Hosted by the Alliance of Automobile Manufacturers (an organization preceding the Alliance for Automotive Innovation). Washington, D.C. Summary Report, agendas and presentations available at https://www.autosinnovate.org/avaccessibility.
[4] U.S. Department of Labor (October 2019). Autonomous Vehicles: Driving Employment for People with Disabilities. Available at https://www.dol.gov/odep/topics/AV-Info-Guide-Revised.doc.
[5] Bureau of Transportation Statistics (2018). Travel Patterns of American Adults with Disabilities. Available at https://www.bts.gov/travel-patterns-with-disabilities.
[6] The aftermarket modifications for wheelchair accessibility are vitally important for the ability of wheelchair users to travel outside their homes. However, wheelchair users face an uncomfortable tradeoff between that access and their safety since the modifications may decrease the overall crashworthiness of the vehicle. People with disabilities regularly choose access over safety. This tradeoff exists because neither manufacturers nor NHTSA have obligations to make today's passenger vehicles both safe and accessible to all people with disabilities and fail to do so voluntarily. As long as this tension exists, nothing in the proposed legislation should diminish access to after-market modifications of vehicles to provide vehicle access to people with disabilities.
[7] National Disability Institute (December 30, 2022). Economic Impacts of Removing Transportation Barriers to Employment for Individuals with Disabilities Through Autonomous Vehicle Adoption. Available at https://www.nationaldisabilityinstitute.org/reports/autonomous-vehicle-adoption/.
[8] Ian Moura for the Disability Rights Education and Defense Fund (November 2022). Addressing Disability & Ableist Bias in Autonomous Vehicles: Ensuring Safety, Equity & Accessibility in Detection, Collision Algorithms & Data Collection. Available at https://dredf.org/wp-content/uploads/2023/03/DREDF-Moura-AV-AI-Brief-Nov-2022-UPDATE.pdf.
[9] The industry's safety standards for independent wheelchair securement and passenger restraint should be adopted by NHTSA and integrated into the FMVSS.
[10] The Republican SELF DRIVE Act being considered in the hearing today includes the exemption for vehicles that would improve access for individuals with disabilities (subsection (vii)). The draft does not reflect how many vehicles could be exempted under this subsection.
[11] 49 CFR 37.165(f)
[12] UrbanismNext, University of Oregon (2021). Do Transportation Network Companies Increase or Decrease Transit Ridership? Empirical Evidence from San Francisco. Available at https://www.urbanismnext.org/resources/do-transportation-network-companies-increase-or-decrease-transit-ridership-empirical-evidence-from-san-francisco-2.
[13] Congressional Research Service (November 2022). Public Transportation Ridership: Implications of Recent Trends for Federal Policy. Available at https://crsreports.congress.gov/product/pdf/R/R47302.
[14] The Upshot (2018). Pave Over the Subway? Cities Face Tough Bets on Driverless Cars. New York Times. Available at https://www.nytimes.com/2018/07/20/upshot/driverless-cars-vs-transit-spending-cities.html
[15] We support the provision in Congresswoman Dingell's draft prohibiting some predispute arbitration claims. We also encourage remedies available under applicable civil rights laws be included.

[16] US Department of Transportation Inclusive Design Challenge Resources. Available at https://www.transportation.gov/inclusive-design-challenge/resources.
[17] Autonomous Vehicles and Increased Accessibility Workshops (2019). Available at https://www.autosinnovate.org/avaccessibility.
[18] The US Access Board is an independent federal agency that promotes equality for people with disabilities through leadership in accessible design and the development of accessibility guidelines and standards. Learn more and review the standards they have developed at https://www.access-board.gov/.

Statement

of the

National Association of Mutual Insurance

Companies

to the

House Energy and Commerce Committee

Subcommittee on Innovation, Data, and Commerce

Hearing Entitled

"Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China"

July 26, 2023

The National Association of Mutual Insurance Companies (NAMIC) is pleased to provide comments to the House Committee on Energy and Commerce Subcommittee on Innovation, Data, and Commerce regarding today's hearing: "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China."

NAMIC membership includes more than 1,500 member companies. The association supports regional and local mutual insurance companies on main streets across America and many of the country's largest national insurers. NAMIC members companies write $323 billion in annual premiums and our members account for 67 percent of homeowners, 55 percent of automobile, and 32 percent of the business insurance markets. Through our advocacy programs we promote public policy solutions that benefit NAMIC member companies and the policyholders they serve and foster greater understanding and recognition of the unique alignment of interests between management and policyholders of mutual companies.

NAMIC greatly appreciates the Subcommittee on Innovation, Data, and Commerce for holding today's hearing on self-driving vehicle legislative frameworks. This is a timely issue under consideration at the local, state, and federal levels, and it is crucial for lawmakers to make informed policy decisions that consider all affected stakeholders, especially insurers and their policyholders who will share roads with self-driving vehicles (SDVs) for decades to come. A data-driven approach is important as most questions surrounding SDVs still need to be answered.

Safety Must be Paramount

NAMIC supports automated driving system (ADS) innovation and technological advancements to the extent that they improve safety, save lives, and reduce injuries from vehicle crashes. These technologies continue to show great promise – and many in this space argue that unlike some humans, SDVs do not drive while intoxicated, distracted, or tired – arguments that carry great weight, especially in light of ongoing road safety challenges that result in more than 6 million crashes, 4.5 million injuries, and nearly 43,000 deaths in the United States per year. In addition to the tragic nature of these statistics, in many instances our policyholders are forced to deal with the financial stress of these crashes. The National Highway Traffic Safety Administration (NHTSA) estimates these crashes cost American society as much as $340 billion per year.[1]

Some industry analyses estimate that there may be as many as 3.5 million self-driving vehicles on U.S. roads by 2025, and 4.5 million by 2030 – a number that seems large until one considers that will still be

[1] National Highway Transportation Safety Administration: *The Economic and Societal Impact of Motor Vehicle Crashes, 2019.* https://www.nhtsa.gov/press-releases/traffic-crashes-cost-america-billions-2019

less than 1.5% of the nearly 300 million vehicles on those roads. Additionally, not all of these vehicles will be fully autonomous, but will instead likely have autonomous capabilities under certain conditions. Proper planning demands a consistent and precise framework of definitions, standards, and legal requirements to protect both SDVs themselves and the more than 200 million licensed drivers they will share the roads with.

NAMIC believes a better understanding of SDV safety and risks will be important for all stakeholders as the relevant technology, laws, and regulations mature. More research is needed to develop formal standards and analyze operations of SDV human machine interfaces, sensors, privacy, software, and cybersecurity. Further, it is necessary to develop predictable legal standards of duty and care; one key problem we continue to see in proposed legislation is the phrase "capable of safety." NAMIC believes this language is wholly inadequate, since merely being "capable" of operating safely or in compliance with applicable traffic and motor vehicle safety laws leaves significant room for error and allows for non-compliance.

It is important to understand that no self-driving vehicle exists today that has been truly proven to be safe. A typical SDV is composed of a sensor-based perception system, an algorithm-based decision system, and an actuator-based actuation system, as well as the interconnections between systems, where ideally, all components function well and consistently so that the SDV safety can be ensured. Without that assurance, SDVs may be less safe than human drivers.

Driver training and public awareness are key pieces of the puzzle. Drivers need to know what their vehicle can and cannot do. As more vehicles with self-driving features are deployed on the road, fully understanding the appropriate use of this technology should be prioritized as consumers and insurers deal with the impacts, especially when the technology does not function as intended. It is unfair to make other drivers on the road part of an experiment and subject them to these new risks if existing regulations and laws do not ensure and require that these vehicles operate safely.

NAMIC is first and foremost committed to road safety. In the last two years, we have joined the Governors Highway Safety Association, the National Alliance to Stop Impaired Driving, and the Partnership for Autonomous Vehicle Education, and adopted an updated set of policy principles affirming our efforts to reduce the frequency and severity of crashes to better protect policyholders and claimants. We were among the first to support the U.S. Department of Transportation's 2022 National Roadway Safety Strategy, and we are actively engaged in these discussions with stakeholders at the state level, where registration, licensing, and road operation laws are most appropriately enacted and enforced. Additionally, for years NAMIC has participated in industry efforts including serving on the boards of the Advocates for Highway and Auto Safety and the Insurance Institute for Highway Safety /Highway Loss Data Institute.

Fundamentals of Auto Insurance and Crash Liability

The introduction of SDVs onto public roads will affect the risk of using those roads for every driver and passenger, which in turn impacts every auto insurance policyholder in America. As background, it is important to understand a few fundamentals of auto insurance. First, insurance is regulated at the state level by more than 12,000 regulators across 56 insurance departments. While auto insurance is mandatory under state law in 49 states, the District of Columbia, and U.S. territories, required coverages, verification, and enforcement processes vary widely. Auto insurance is a highly regulated product whose rates and methodologies are filed with and approved or acknowledged by a state's department of insurance. Additionally, state legislators, the National Conference of Insurance Legislators (NCOIL) and the National Association of Insurance Commissioners (NAIC) closely monitor auto insurance availability and affordability.

An indispensable principle of all property/casualty insurance is matching risk to rate – the underwriting and rating of policies is a complex, sophisticated, and time-consuming exercise that aims to use data to correlate prices as closely as possible to the likely cost of claims.[2] The more accurately an insurer estimates actual costs, the better they are able to serve policyholders. Auto insurance rates respond to systemic changes and behavioral patterns over periods of years, are prospective, and are designed to be sensitive to claims frequency and severity. Accurate, data-based underwriting and pricing fuels competition and healthy markets, which in turn increases the availability of insurance and drives innovation to the benefit of all consumers.

When an auto insurance claim is made, assessing and allocating liability are critical components to its resolution. There is a spectrum of possible outcomes, including: the insured was liable, another party was liable, liability was shared, or no liability is found. Details of determining crash liability are often complicated, fact specific, and evaluated according to state and local laws. As SDVs are added to the fleet mix this becomes even more difficult due because insurance and traffic codes are currently built on the fundamental premise that the person behind the wheel is responsible to perform all dynamic driving tasks. In the absence of that foundation, the need for clear legal standards becomes even more important – the replacement of a person with an ADS performing dynamic driving tasks will trigger new and different sets of questions about system designs, operational boundaries, cybersecurity, products liability, and a potentially very "messy middle" between human and SDV drivers for insurers where responsibility for proper vehicle operation is concerned.

As Congress considers a federal framework of this new technology, we urge lawmakers to thoughtfully consider the growing set of questions that surround SDVs. Examples include:

- If there was a human operator in the car, did they exercise due care in relying on the vehicle's system? Does it matter if the human operator is in the vehicle or remotely located?

[2] https://www.namic.org/pdf/publicpolicy/210108_insurnace_cost.pdf

- How was the system designed to operate? Did the system make clear to a human operator if, when, and how an operator is required to act?
- Did a manufacturing, equipment, or software design function raise a product liability issue?
- Were any shared responsibilities understood and accepted? How was acceptance memorialized?
- Who had the "last opportunity" to avoid a crash, the operator or the SDV?

Ultimately, these questions make the current environment complicated for insurers and every American driver, whose risks will be changed by the very presence of SDVs on roads. One way insurers can show support for these technological advances is to perform their historical role of risk assessment and evaluation. To best accomplish this, there needs to be a greater understanding of the influence SDVs are likely to have on frequency and severity of crashes based on the data they generate.

Importance of Vehicle Data Ownership

As vehicles become more computerized, it is critical that the owner of the vehicle has timely access to the data they generate that is complete and useful. This includes not only general operational and behavioral data, but more specific crash and incident information and data to assist in determining at least some of the questions of liability mentioned above. Contemporary passenger vehicles generate an enormous amount of data and are stocked with as many as 200 onboard sensors critical to the maintenance and safe operation of vehicles; with their enhanced technology, SDVs generate and collect even more data, much of which would be of great assistance in better understanding the risks such vehicles do or do not create or contribute to.

Further, and more broadly, an essential part of ensuring consumers who experience an automobile crash involving an ADS equipped vehicle can make informed decisions about how their vehicles should be repaired is requiring comprehensive access to the information generated by and about their vehicle. As noted, this will become increasingly important as vehicles are making more "decisions" for drivers. The amount of data all vehicles generate only increases as we enter discussions and consider laws around SDVs and the effects they will have on how roads and drivers operate.

Currently, almost all vehicle generated data is wirelessly transmitted on a continuous basis to the manufacturer for their use. To improve road safety and promote data-driven fairness for consumers, any conversations going forward around vehicle technology should include consideration of not only how vehicle generated data is used, but who owns it and what meaningful access looks like. Whether it is repairing a vehicle correctly, preventing future crashes, improving driving patterns, etc., this information is important for safety and public confidence in technology, and at the end of the day, consumers should have clear legal ownership of the data that their vehicle produces. Such data, when meaningfully presented, will help consumers make sound choices about the use, care, and repair of their vehicles as they increasingly interact with other connected cars and SDVs on shared roads. Importantly, such access does not inherently infringe on the proprietary nature of specific mechanical or operational details of a

vehicle.

Bills Under Consideration

NAMIC appreciates that the two bills being considered at this hearing intend to create a practical federal framework for SDVs. With states and localities also taking a spectrum of actions on SDVs, Congress contributing a voice and vision for future rules of the road will be helpful. In 2019, NAMIC adopted a formal statement of principles for autonomous vehicles, which form the basis of our priorities for any proposed federal legislation:

- The federal government, through NHTSA, should have the authority to make determinations of performance and safety, as well as data integrity of ADS, and should build a framework for helping the public clearly understand expected performance and safety of various levels of ADS.
- States and localities should have the authority to make the determinations of the registration, licensing, and operation of ADS in that state/locality.
- States should retain the regulation of insurance for the vehicle and/or operator.
- States should retain the authority to define and address ADS liability issues in state/tort law and regulation in line with existing liability constructs.
- Vehicle generated data should be owned by vehicle owners.
- States and federal authorities working together should make clear and workable data security and privacy requirements.

Most importantly, it is critical in any legislative proposal that manufacturers attest that their autonomous vehicles will operate in compliance with all traffic laws and regulations. The relevant authority of NHTSA and state DMVs to regulate autonomous vehicle operation must be clear and explicit.

A Path Forward

NAMIC believes the development of answers to the questions raised in this testimony will be key as a federal framework for SDVs is developed and considered by the Energy and Commerce Committee. The property / casualty insurance industry is committed to performing its risk identification, assessment, and pricing role as this technology is developed. NAMIC member companies will serve as a resource to help inform and educate lawmakers and SDV manufacturers about how this technology and these vehicles are playing out on the ground, and what the current challenges are for policyholders and insurers alike.

NAMIC fully supports innovation and development that enhances safety. As the development of SDVs goes forward, the insurance industry will continue to play a leadership role as it has done historically to promote safety and the protection of persons and property. We applaud this Committee for acknowledging the technology and changes happening our roadways and hope to continue being a part of this important conversation.

Partnership for Transportation Innovation & Opportunity

July 26, 2023

The Honorable Gus Bilirakis
Chair
Subcommittee on Innovation, Data and Commerce
U.S. House of Representatives
Washington, DC 20515

The Honorable Jan Schakowsky
Ranking Member
Subcommittee on Innovation, Data and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Chair Bilirakis, Ranking Member Schakowsky, and Members of the Subcommittee:

On behalf of the Partnership for Transportation Innovation and Opportunity (PTIO), thank you for holding today's hearing, "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China." PTIO is pleased to offer the following background and resources regarding why a federal framework favorable to AV deployment is critical for workforce opportunity, domestic job growth, and boosting global competitiveness.

I. About PTIO

PTIO and its members[1] are focused on preparing workers for AV technology and understanding the interplay between AVs and the workforce. We are committed to pursuing policies that connect workers with AV-driven economic benefits and prepare them for new jobs and career pathways. At the same time, PTIO acknowledges that AVs will bring occupational shifts and is likewise committed to facilitating a smooth transition for those whose job may evolve alongside the technology.

II. AVs Will Deliver Societal Benefits and Economic Gains

PTIO supports pro-innovation policies that advance AV deployment in the United States given the technology's potential to grow the economy and deliver a host of societal benefits ranging from improved roadway safety to increased access to mobility. We appreciate the Subcommittee's efforts to consider legislative proposals that will maximize these benefits, which are discussed in greater detail below.

Safety

There were over 40,000 roadway deaths and 2.5 million injuries in 2021 alone,[2] and, as the U.S. Department of Transportation notes, human behavior is a contributing factor to the

[1] PTIO Members include the American Trucking Associations, Daimler Truck, FedEx, Ford, Toyota Motor North America, UPS, Waymo, Amazon, May Mobility, and Locomation

[2] See National Highway Traffic Safety Administration, Overview of Motor Vehicle Traffic Crashes in 2021 (April 2023). Available at: https://crashstats nhtsa.dot.gov/Api/Public/ViewPublication/813435#:~:text=1.37%20in%202021.-,The%20estimated%20number%20of%20people%20injured%20on%20our%20roadways%20increased,2020%20to%2080%20in%202021.

overwhelming majority of serious and fatal crashes.[3] Simply put, AV technology poses significant potential for radically improving traffic safety and addressing the public health and safety crisis playing out on our roads. Facilitating the continued and safe development and deployment of this technology is in the interest of the entire traveling public.

Economic growth and job creation
While AV technology and its use cases continue to develop and advance, numerous studies have found that widespread AV adoption will bring tremendous growth across the economy. A 2018 study found that widespread adoption of AVs could result in nearly $800 billion in annual social and economic benefits attributable to the technology's ability to improve roadway safety, increase access to mobility, and deliver environmental benefits.[4] More recently, a 2021 Volpe National Transportation Systems Center economic analysis found that Level 4 and Level 5 automation in the long-haul trucking industry would raise annual earnings for all U.S. workers by between $203 and $267 per worker, per year. The study additionally found that trucking automation would increase total U.S. employment by 26,400 to 35,100 jobs per year on average over 30 years.[5]

Access to mobility and job opportunities
AVs will facilitate greater economic opportunity for communities that lack access to viable transit options and those who face mobility limitations. The availability of transportation – or lack thereof – is a critical piece of daily life and impacts the ability to access food, receive health care, and pursue education. Likewise, communities without adequate transportation access can encounter barriers to securing jobs and/or face a limited pool of work opportunities.

Recent research estimates that 197 million Americans in urban communities lack accessible and affordable transportation options. As that report notes, "shared autonomous vehicles (SAVs) — minivans, low-speed shuttles, and new purpose-built, light-duty vehicles equipped with Automated Driving Systems (ADS) — have the potential to be a more cost-effective alternative to conventional transportation options in underserved communities."[6] Additionally, AV adoption could result in 4.4 million direct jobs for people with disabilities through providing this community with additional means of personal mobility.[7]

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[3] See U.S. Department of Transportation, National Roadway Safety Strategy (January 2022). Available at: https://www.transportation.gov/sites/dot.gov/files/2022-02/USDOT-National-Roadway-Safety-Strategy.pdf

[4] See Securing America's Future Energy (SAFE), "America's Workforce and the Self-Driving Future" (hereinafter SAFE 2018") (June 2018). Available at: https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/SAFE_AV_Policy_Brief.pdf

[5] See U.S. Department of Transportation, Volpe National Transportation Systems Center and Centre of Policy Studies, "Macroeconomic Impacts of Automated Driving Systems in Long-Haul Trucking" (January 2021). Available at: https://ouravfuture.org/wp-content/uploads/2021/05/dot_54596_DS1-1.pdf

[6] See Securing America's Future Energy, "Increasing Mobility and Access with Autonomous Vehicles" (April 2023). Available at: https://safe2020.wpenginepowered.com/wp-content/uploads/2023/04/CATT_Brief_2_v04.pdf

[7] See National Disability Institute, "Economic Impacts of Removing Transportation Barriers to Employment for Individuals with Disabilities Through Autonomous Vehicle Adoption" (December 30, 2022). Available at:

III. Pro-Innovation Policies That Support AV Advancement Are Critical for Global Competitiveness and Workforce Opportunity

The importance of U.S. leadership with respect to AV technology is well-documented.[8] America's ability to maintain and cement global leadership is central in securing the aforementioned societal and economic benefits the technology will bring, as well as advancing workforce opportunity.

The U.S. motor vehicle industry is an economic engine: it directly employs over 3 million people and supports over 1 million additional jobs and significant revenues across supplier networks. AV adoption has the potential to strengthen these figures.[9] It is therefore critical that we ensure the technology's resulting supply chains emerge in the United States. A recent case study found that a policy framework favorable to deployment – coupled with effective partnerships between the public sector and industry, educational institutions, and communities – will boost development and inject economic activity in the traditional manufacturing and industrial economies across the country.[10]

It is important to note that the U.S. is already home to a dynamic and growing AV industry. For example, the AV industry supports over 6,000 jobs in the Pittsburgh region alone,[11] and studies estimate continued growth across the country in the coming years. An economic analysis conducted by Steer projects that near-term deployment of AV delivery services, for example, will create 24 million direct jobs among technicians and supervisors, operational staff, and software engineers, as well as 10 million indirect and induced jobs due to economic gains

https://www.nationaldisabilityinstitute.org/wp-content/uploads/2023/02/ndi-economicimpactsofremovingtransportationbarriers.pdf

[8]See Testimony of Farrah, Jeff, Executive Director of the Autonomous Vehicle Industry Association, Committee on Energy & Commerce Subcommittee on Innovation, Data, and Commerce hearing on "Economic Danger Zone: How America Competes to win the Future Versus China" (February 1, 2023). Available at: https://d1dth6e84htgma.cloudfront net/CORRECTED_Witness_Testimony_Farrah_IDC_2023_02_01_Hearing_dac1666f21.pdf?updated_at=2023-01-31T19:30:19.078Z

[9] See U.S. Chamber of Commerce Technology Engagement Center, "Innovation Highway: Unlocking the Social and Economic Benefits of Autonomous Vehicles" (July 2023). Available at: https://www.uschamber.com/assets/documents/CTEC_InnovationHighwayReport_July23.pdf

[10] See Center for Strategic & International Studies, Caporal, Jack; O'Neil, William; Arrieta-Kenna, Seán, "Bridging the Divide: Autonomous Vehicles and the Automobile Industry," (April 2021). Available at: https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210414_Caporal_Bridging_Divide_AVs.pdf?VersionId=FPD0WGpKizesSoGJZ9.gfUEAnKqUvV.W

[11] See TEConomy Partners, LLC for Regional Industrial Development Corporation and the Greater Pittsburgh Chamber of Commerce, "Forefront: Securing Pittsburgh's Break-out Position in Autonomous Mobile Systems" (August 2021). Available at: https://ridc.org/wp-content/uploads/2021/10/PGH-Autonomy-Report-Executive-Summary.pdf

between 2025-2035.[12] PTIO supports policies that are favorable to continued AV deployment in the U.S. to ensure growth of this industry and the domestic jobs it supports.

IV. Building the AV Workforce Pipeline Alongside Continued Deployment

As with previous technological advancements, PTIO acknowledges that AVs will bring occupational shifts and changes to the way certain work is performed. But this will not occur overnight. In fact, research suggests that most AV-related labor impacts will not be seen until after 2040, even when using aggressive assumptions about adoption rates.[13]

That said, PTIO believes the time to begin preparing is now. The opportunity exists today to concurrently pursue the safe deployment of AVs while taking steps to build capacity in our education and workforce development systems to position the American workforce to succeed alongside the technology. Indeed, existing evidence shows that ongoing AV advancement and real-world deployments are in service of efforts to prepare the workforce for an AV future, as well as to build the programs and knowledge base that will facilitate transitions to new jobs in an AV economy.

For example, AV companies like Nuro and Aurora have created partnerships with local community colleges that provide training pathways and certificates that prepare individuals for roles in the AV industry.[14] Policymakers and other stakeholders have the opportunity today to collaborate with these and other existing workforce development programs, industry experts, and educators to develop best practices in constructing effective AV career programming. Doing so will build our capacity to scale programs over time – positioning our workforce system and industry to meet workers' needs both today and in the future as the technology continues to develop and advance. Real world deployments – like the operations that informed the Nuro and Aurora programs mentioned above – can serve as the basis for advancing our understanding around new jobs and transitioning roles. They will also support knowledge attainment around newly-required skills and how those skills map against competencies associated with incumbent roles – as well as support development of the programs and strategies designed to empower workers by leveraging those skill matches and bridging the gaps.

PTIO is pleased to share our Workforce Policy Agenda with the Subcommittee, which represents our organization's first set of workforce guidance providing policy recommendations based on what is known about AVs and where deployment exists today. The agenda includes proposals

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[12] See Steer, "Economic Impacts of Autonomous Delivery Services in the US" (September 2020). Available at: https://ouravfuture.org/wp-content/uploads/2021/02/200910_-Nuro_Final_Report_Public.pdf

[13] See Securing America's Future Energy (SAFE), "America's Workforce and the Self-Driving Future" (June 2018). Available at: https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/SAFE_AV_Policy_Brief.pdf

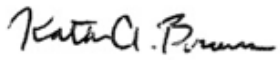
[14] See Nuro, "Nuro Launches Upskilling Initiative" (December 2, 2021). Available at: https://medium.com/nuro/nuro-launches-upskilling-initiative-ec216f635164 See Aurora, What do self-driving vehicles mean for jobs and the economy? (hereinafter "Aurora 2023") (May 18, 2023). Available at: https://blog.aurora.tech/progress/what-do-self-driving-vehicles-mean-for-jobs-and-the-economy

designed to connect workers with AV-induced economic gains and maximize benefits for Americans. These include: (1) labor market information reforms to further our understanding about the impact of AVs on the workforce; (2) policies that build capacity across our workforce system to support new AV career pathways while enabling providers to innovate and meet the needs of their local economies; and (3) proposals that invest in the worker and empower individuals to exercise choice in their career trajectory.

V. Conclusion

PTIO thanks the Subcommittee for holding today's hearing. We are committed to working with lawmakers and other interested stakeholders to pursue practical policies – such as those outlined in our agenda – that build capacity in our workforce system and advance our understanding of the interplay between AVs and the workforce in order to prepare Americans for the economic opportunities and changes that the technology will catalyze. The chance to advance these objectives exists alongside the opportunity to facilitate the safe deployment of AVs and unlock the technology's potential benefits for communities across the country. PTIO stands ready to support the Subcommittee as it works toward this goal.

Sincerely,



Kathryn Branson
Executive Director
Partnership for Transportation Innovation and Opportunity
kathryn@ouravfuture.org

July 26, 2023

The Honorable Gus Bilirakis
Chair
Innovation, Data, and Commerce Subcommittee
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

The Honorable Jan Schakowsky
Ranking Member
Innovation, Data, and Commerce Subcommittee
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Bilirakis and Ranking Member Schakowsky:

On behalf of the International Association of Fire Chiefs (IAFC), the International Association of Fire Fighters (IAFF) and the National Volunteer Fire Council (NVFC), we express our gratitude for you holding this legislative hearing titled: "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China." The IAFC, IAFF, and NVFC applaud the work being done to develop national standards for highly autonomous vehicles (AV). As influential leaders of the public safety community, we would like to share our thoughts on this emerging topic. The following areas must be considered in developing AV-related legislation.

The road to strengthen AV safety starts with AV manufacturers educating and communicating with first responders, especially when it comes to AV crash avoidance capabilities. We therefore recommend that Congress develop a framework to strengthen the relationship between AV manufacturers and first responders to ensure both agree on a strategy for traffic incident management. With respect to the committee's call to identify AV elements that may require standards, we recommend the inclusion of following fire service priorities: AV engines, AV electrical equipment, standards for access to AVs, and shut-off procedures for response to incidents involving AVs. The inclusion of these standards will help protect the safety of users of AVs, as well as responders on the scene. They will also help address issues related to lithium-ion batteries that are becoming all too common.

Statistics show that a high number of secondary crashes have occurred when a vehicle with an automated driving system struck a parked emergency vehicle at an incident scene, which often results in the severe injury or loss of life for our first responders. First responders must be assured that AVs will be able to identify a roadway incident scene and/or emergency vehicles parked in or adjacent to a roadway and react appropriately. AVs must recognize and react to emergency vehicles displaying warning lights or siren, any temporary traffic controls, and/or emergency personnel manually directing traffic, and either come to a full stop in a safe location or navigate around the scene in a safe manner. They also must recognize parked emergency vehicles at incident scenes and follow state and local "move over" laws. Regulations relating to AV safety need to address these requirements as we increase the number of AVs on our roadways.

When it comes to AVs and identification, more work needs to be done. Identification should include a requirement for uniform markings, badging, or visual indicators that identify the vehicle as having automated features, along with what type of alternative fuel or power is onboard. As representatives of the fire and emergency service, we constantly hear emergency responders say they want a way to identify quickly and easily what type of power is on board a vehicle. Fire and EMS personnel need to know whether an AV is powered by gas, electric, alternative fuel like hydrogen, Compressed Natural Gas (CNG), propane, etc. When approaching an AV in an emergency, it also would be helpful for first responders to be able to identify what level of automation is present (example - Level 2, 3, 4, or 5 AV).

Every day, fire departments across the county struggle with the lack of resources. Ensuring that local communities that test/operate AVs have the necessary tools to respond to AV-related incidents is key. We would like to see a federal requirement that AV manufacturers or organizations seeking to operate Level 4 and 5 AVs must pre-plan their deployment by first meeting with local fire, EMS, and law enforcement agencies in the operational area under consideration. This must occur long before those vehicles begin operation or testing. If we are not able to keep up with the rapid deployment of AVs, then we will not be able to respond when incidents arise.

We are happy to see that the proposed legislation would establish a Highly Automated Vehicle Advisory Council. However, we strongly urge that representatives of the fire service, EMS, and law enforcement, are included on the council. These are the public servants who respond to AV-related incidents. As a continually invested stakeholder in AV technology, public safety professionals should be consulted about the future of AVs. To ensure safe nationwide deployment of AVs, the public safety community must have clear representation on this council.

On behalf of the IAFC, IAFF and NVFC, we thank the subcommittee for the opportunity to submit this statement on the advancement of AV technology and the role that local public safety organizations must play in it. All these issues are vital to ensure that first responders can safely respond to AV incidents. We look forward to continuing to work with the subcommittee to ensure that AV development and deployment will involve the active consultation of first responders, so this promising technology can realize its full potential in improving the safety of America's roadways.

Sincerely,

Fire Chief Donna M. Black, EFO, CFO
President and Board Chair
International Association of Fire Chiefs

Edward A. Kelly
General President
International Association of Fire Fighters

Fire Chief Steven W. Hirsch
Chair
National Volunteer Fire Council

cc: The Honorable Cathy McMorris-Rodgers, Chair, House Committee on Energy and Commerce
The Honorable Frank Pallone, Ranking Member, House Committee on Energy and Commerce

: sa

Congress of the United States
Washington, DC 20515

July 17, 2023

The Honorable Pete Buttigieg
Secretary
U.S. Department of Transportation
1200 New Jersey Avenue, S.E.
Washington, DC 20590

The Honorable Gina M. Raimondo
Secretary
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, DC 20230

Dear Secretary Buttigieg and Secretary Raimondo:

We write to bring your attention to the competitive and national security implications of allowing autonomous vehicles (AVs) made by Chinese companies to test and operate in the United States.

Autonomous vehicles are essential to the future of the automotive industry and continuing the global leadership of this country. Last year, nearly 43,000 people died in motor vehicle traffic crashes.[1] This is a national crisis that we have unfortunately come to expect. AVs and their already regulated predecessors, advanced driver assistance systems (ADAS), are the key to reducing and even eliminating traffic fatalities.

But Americans will not benefit from the future AVs promise to bring if the United States continues its current trajectory of inaction. China is already filling the void to set global standards, establish supply chains, and deploy the technology on its own.

As you know, the United States is in an ongoing competitive race with China across many fronts, of which autonomous vehicle development and deployment is an essential sector. China recognizes that autonomous technology will be a driving force in this century and have immense implications on national security and economic leadership. In 2020, China's National Development and Reform Commission, the Ministry of Industry and Information Technology, and 11 other ministries and commissions jointly issued a strategy that prioritizes autonomous-driving technology.[2]

Since then, China's AV industry has grown beyond even Beijing's regulatory framework, with significant growth in robotaxi services, computing, and infrastructure. Much of that success has hinged on their advancements in artificial intelligence (AI), with companies like ByteDance Ltd. establishing the country's largest computing center for autonomous-driving infrastructure and the creation of DriveGPT, which like ChatGPT, relies on reinforced learning with human feedback.[3]

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[1] https://www.nhtsa.gov/press-releases/traffic-crash-death-estimates-2022
[2] https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/from-sci-fi-to-reality-autonomous-driving-in-china
[3] https://www.bloomberg.com/opinion/articles/2023-04-24/autonomous-vehicles-tesla-needs-to-catch-up-with-china-s-drivegpt

The People's Republic of China also has strong restrictions on United States autonomous vehicle companies operating or testing in China. We are concerned that we are ceding a serious strategic advantage by not barring Chinese companies from operating in the United States in return.

AV testing and deployment regulations are fragmented state-by-state and even city-by-city in the United States. While the National Highway Traffic Safety Administration (NHTSA) has a "Test Tracking Tool" as a part of their Automated Vehicle Transparency and Engagement for Safe Testing (AV TEST) Initiative, participating in the list is voluntary and does not include any of the Chinese AV companies known to be testing the United States.[4]

In California, seven Chinese companies have licenses to test their AV technology, including international industry leaders Baidu Apollo and Pony.ai. Pony.ai also has a permit to test in Arizona. In the span of a year, the seven companies collectively logged nearly half a million miles on roads in California.[5] This level of testing not only raises the competitive concerns highlighted above, but we believe also opens the country up to national security risks.

Technology used by AVs, LiDAR, RADAR, cameras, AI, and other advanced sensors and semiconductors, can all be used to collect data on the American people and infrastructure that could be shared back to China and ultimately to the Chinese Communist Party (CCP). The massive amount of data being collected by these cars could give the CCP an unprecedented vantage point into the United States. Beijing has already pioneered the use of big-data analytics to identify dissidents at home, and we are concerned that those tactics could be deployed here and abroad.

As we spend billions of dollars to strip Chinese communications equipment from our networks to protect our national security, we are concerned that we are turning a blind eye to the risks of allowing Chinese AVs and AV technology unencumbered access to our networks and roadways.

We urge you to seriously consider the national security and competitive risks of allowing Chinese autonomous vehicle companies and technology producers to operate and test in the United States, all while restricting American companies from testing on roads in China. We ask that you coordinate with NHTSA, as well as any other relevant agency, to investigate the prevalence of these companies in our country and identify pathways to restricting their access and ability to operate here. It is imperative that we prioritize American leadership in autonomous vehicle technology and do not cede competitive advantages to an adversarial nation that does not share our values and commitment to freedom.

Thank you for your time and attention to this matter.

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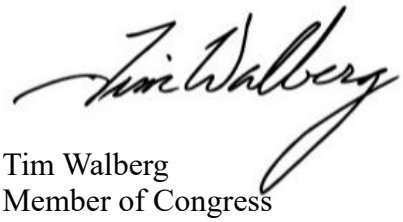
[4] https://www.nhtsa.gov/automated-vehicle-test-tracking-tool#:~:text=As%20automated%20driving%20systems%20developers,of%20the%20AV%20TEST%20Initiative.
[5] https://thechinaproject.com/2023/02/28/chinese-autonomous-vehicle-testing-in-california-is-coming-under-growing-scrutiny/#:~:text=Chasing%20Cruise%20and%20Waymo%2C%20Chinese,in%20California%20in%202022%20%2F%20TechCrunch

Sincerely,



Tim Walberg
Member of Congress

Debbie Dingell
Member of Congress

Robert E. Latta
Member of Congress

Marc Veasey
Member of Congress

CC: Ann Carlson, Acting Administrator, National Highway Traffic Safety Administration

TEAMSTERS TO CONGRESS: AUTONOMOUS VEHICLE SAFETY CAN'T WAIT

2023.07.26

Press Contact: Matt McQuaid Phone: (202) 624-6877 Email: mmcquaid@teamster.org

(WASHINGTON) – The following is a statement from Teamsters General President Sean M. O'Brien on the legislative hearing today in the House Energy and Commerce Committee concerning two bills that would regulate autonomous vehicles (AVs):

"Congress has an opportunity to put an end to the unregulated Wild West of AV testing and deployment. Unfortunately, the SELF DRIVE Act is a reckless approach to this issue, and only continues the disastrous trend of laws written by and for Big Tech. The Teamsters will use every resource at our disposal to stop AV legislation that does not prioritize workers and safety.

“In contrast, Representative Dingell’s proposal demonstrates meaningful leadership towards creating a federal safety framework that holds AV companies accountable for their products through binding, enforceable requirements. However, any Energy and Commerce Committee proposal is just one piece of a necessary and comprehensive response from Congress. A future AV package must also include efforts to create strong regulation on the operation of commercial motor vehicles and the impact of the deployment of AVs on workers.

“The Teamsters are committed to working with members of Congress on both sides of the aisle to get federal AV policy right, given the high stakes for our members. We look forward to continuing these conversations.”

ACTIVE TRANSPORTATION ALLIANCE

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July 26, 2023

Congresswoman Jan Schakowsky
2408 Rayburn Building
Washington, DC 20515

Dear Congresswoman Schakowsky,

Active Transportation Alliance supports requiring Autonomous Vehicles to be vision tested to protect venerable roadway users. We ask that you not support any bill that sets up a regulatory framework that does not include a vision test to ensure that the vehicle can detect and respond to bicyclists, pedestrians, and other vulnerable road users.

Active Transportation Alliance is a Chicagloand civic advocacy organization whose mission is to advocate for walking, bicycling, and public transit to create healthy, sustainable, and equitable communities. Active Transportation Alliance places at the center of its concerns those of vulnerable road users. Active Trans frequently hears from families of fatal crashes that involves vehicles, bikes, and pedestrians.

According to the local web publication Streetsblog Chicago as of July 17, 2023, there have been 16 pedestrian fatalities and 3 bicyclist fatalities on Chicago's streets this year. Active Transportation Alliance is frequently approached by the families and friends impacted by roadway fatalities seeking guidance on how to advocate for vulnerable users.

Twenty percent of all our roadway fatalities are bicyclists and pedestrians. If we are to reduce those fatalities we need to make sure that the new technologies are developed with vulnerable road user safety in mind. Manufacturers will create vehicles that match the safety standards Congress sets, **so we ask that you please ensure that any regulatory framework legislated by Congress includes safety standards that explicitly require testing for the safety of vulnerable road users.**

Sincerely,

ACTIVE TRANSPORTATION ALLIANCE

W. Robert Schultz, III, J.D, (he/him/his)
Campaign Organizer
Active Transportation Alliance
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Don't miss our once-a-year event on Sept. 3 when people on bikes have DuSable Lake Shore Drive all to themselves. Whether you're new to biking or a seasoned rider, Fifth Third Bike the Drive is an event to remember.

Amalgamated Transit Union

10000 New Hampshire Avenue, Silver Spring, MD 20903-1706
(301) 431-7100 Fax (301) 431-7117

Office of the International President

July 28, 2023

Dear Members of the Subcommittee on Innovation, Data, and Commerce:

ATU members have been driving Americans of all ages safely to their destinations since 1892. Autonomous vehicles (AV) buses are an existential threat to our members' unbreakable bond with the travelling public. We transport precious cargo: vulnerable school bus children and transit riders who are overwhelmingly people of color that do not own their own cars and heavily rely on the bus for their mobility needs. They deserve the peace of mind of knowing that if they step on that bus, they will come home in one piece.

AV buses are unproven and dangerous. These vehicles threaten the health, safety, and security of working families who rely on public transit, both riders and workers. They are also a threat to our economy. Most parents would agree that they wouldn't feel comfortable dropping their kid off at the bus stop if the yellow bus carrying their flesh and blood was being operated by a robot instead of a human being who would stop at nothing to ensure that their child comes home safely. That being the case, are transit riders any less precious?

ATU supports legislation prohibiting autonomous vehicles from being operated in transit or school bus transportation on public roads. Attached please find our report entitled *Don't Let the Robot Drive the Bus.*

As Congress considers legislation authorizing autonomous vehicles, transit and school buses -- regardless of how much they weigh or how many people they carry -- should be off the table. States that are green lighting AV buses and putting Americans at risk should be stopped in their tracks by the federal government. We need to protect people before profit. Congress should put the brakes on this corporate gold rush in which profiteers are rushing self-driving multi-ton missiles onto our streets and highways. Thank you for your consideration of our views.

Sincerely,

John A. Costa
International President

attachment

Don't Let the Robot Drive the Bus!

ATU

The Amalgamated Transit Union (ATU) is the largest union representing public transportation workers in North America, with nearly 200,000 members across 46 states. In addition to workers in the transit and school bus industries, ATU represents thousands of workers at major over-the-road bus companies throughout the country.

We are a union of bus drivers with a simple message to the U.S. Congress as it considers legislation giving the green light to autonomous vehicles:

Please keep human beings in the driver's seat of our transit and school buses!

Don't put American lives at risk by allowing unproven technology to drive us down streets and highways without a safety net.

ATU urges Congress to prohibit autonomous vehicles from being operated in transit or school bus transportation.

Not Ready for Prime Time

Dangerous Vehicles

Unlike heavy rail, buses run on local roads and highways shared with other vehicles. The interface with human beings and their unpredictable tendencies creates safety hazards which will never likely be overcome. As stated in a recent report from Carnegie Mellon University,[1] while vehicle automation has been applied to transit operating in "closed" rail systems for many years, "there is a significant jump in the level of complexity and risk when moving from closed to open road systems."

As cities across the United States have put in place so-called "Vision Zero" initiatives designed to entirely eliminate crosswalk collisions between vehicles and pedestrians, the deployment of autonomous vehicle (AV) buses needs to be carried out with the same expectations. There can be no level of acceptable risk prior to third party or regulatory approval of these vehicles, which will likely never be able to avoid collisions with pedestrians, bikers, and other vehicles driven by people.

Today, pedestrians and drivers are constantly distracted by hand-held gadgets. This trend is only likely to get worse in the future. Unless we build infrastructure for AV buses to perform in their own secluded environment (like we have done for planes and trains), the risk of disaster will always be present. The level of danger of course increases substantially in the case of vehicles carrying 50-100 passengers.

We have already seen a few examples of accidents where people have gotten hurt.

- In a well-publicized 2018 incident, an Uber automated vehicle pilot test resulted in the death of a pedestrian. It was reported at the time that test vehicles were involved in 37 crashes over the prior 18 months leading up to the fatal crash.
- In 2019, a self-driving shuttle in Las Vegas crashed into a truck. While there was an operator on board, they did not have direct access to the manual override controls.
- In 2020, a self-driving shuttle in Ohio came to an abrupt stop, requiring a passenger who was thrown from their seat to receive medical attention for their injuries.
- In 2020, a self-driving shuttle in Utah sent a 76-year old man to the hospital after it came to an abrupt stop.
- NHTSA has opened investigations into 27 crashes involving Tesla vehicles. There have been at least 11 deaths in Tesla vehicles that involved their autopilot feature in the U.S. alone.
- A 2020 report showed that Waymo's driverless cars were involved in 18 accidents and 29 near-miss collisions over a 20-month period.

In September of 2022, at least three driverless cars were responsible for holding up traffic and reportedly blocking a bus lane in San Francisco. An autonomous vehicle veered into a bus lane and stopped mere inches away from a Muni bus, forcing the driver to reroute and maneuver around it. In another San

1 *How to Make Sense of Bus Transit Automation. Considerations for policy makers on the future of human-automation teaming in the transit workforce.* Nikolas Martelaro, Sarah E. Fox, Jodi Forlizzi, Raj Rajkumar, Chris Hendrickson, and Stan Caldwell. Traffic 21, A transportation research institute of Carnegie Mellon University, Spring 2022.

Francisco incident, nearly 20 driverless cars blocked traffic for two hours, obstructing a fire truck responding to an emergency, leading to a delayed response that resulted in property damage and personal injuries.[2]

In addition to these incidents, the City of Toronto at the end of 2021suspended its trial of a self-driving bus after a similar one crashed into a tree in nearby suburbs, critically injuring the onboard attendant. Just months before, Toyota announced an immediate halt to its all-electric autonomous bus that had been ferrying athletes and staff around the Olympic Village in Japan after it collided with a visually impaired athlete attempting to cross the road at a crosswalk.

Toronto suspends self-driving bus pilot after disastrous Whitby crash

Laura Hanrahan | Dec 22 2021, 9:50 am

City of Toronto

There is no substitution for the human eye. Bus drivers who see pedestrians preparing to enter a crosswalk are able to make eye contact with that person, waving them on safely. That type of interaction will likely never be able to be replicated by an AV bus. If that person on the sidewalk decides to cross illegally when they do not have a walk sign, hopefully the bus operator can see them jaywalking. Programming an AV bus to cope with complicated human behaviors will be incredibly challenging. Young people and elderly people walk slower. People in wheelchairs operate at another pace. Human beings can change their minds about stopping or going in a heartbeat. Maybe they are late for an appointment or are anxious to get out of the rain. AV buses cannot currently recognize the actions of police directing traffic or bikers changing lanes, and they likely will not be able to do so in the future. Dealing with unpredictable human beings and failing to accurately compensate for our impetuous actions make the safe operation of AV buses extremely difficult, and perhaps impossible.

> *"It all sounds great until you encounter an actual robo-taxi in the wild. Which is rare: Six years after companies started offering rides in what they've called autonomous cars and almost 20 years after the first self-driving demos, there are vanishingly few such vehicles on the road. And they tend to be confined to a handful of places in the Sun Belt, because they still can't handle weather patterns trickier than Partly Cloudy. State-of-the-art robot cars also struggle with construction, animals, traffic cones, crossing guards, and what the industry calls "unprotected left turns," which most of us would call "left turns."*

It's a scam: Even after $100 billion, self-driving cars are going nowhere. Auto Blog, October 8, 2022. https://www.autoblog.com/2022/10/08/autonomous-cars-slow-progress-losses-doubt/

While humans are remarkable at predicting the behavior of others, AVs have neither the sensors needed to read faces and attentional focus, nor algorithms for processing that vital information should they be given it. That is vital for safety. While humans have "generalized intelligence" able to adapt rapidly to novel circumstances, there is no such thing on the horizon to replace our "neural networks" in

2 Multiple Driverless Cruise Cars Block Traffic in San Francisco. https://www.sfgate.com/local/article/driverless-cruise-cars-block-SF-traffic-17467985.php, September 26, 2022.

automated driving systems. Rather than quickly adapting, automated driving systems are dependent on decision making from within fixed datasets.

Moreover, road hazards are not the only issue. Significantly, the current technology often fails when the vehicle has to enter a bus bay where passengers wait to board. In addition, AV buses have not developed to the point where they can drive during inclement weather conditions such as fog, heavy snow, or even rain.

There are also huge network security considerations involved with autonomous buses. They are vulnerable to hacking. Are we prepared for hijackings of buses carrying 50-100 people by evil people operating from remote locations?

In summary, AV buses are simply not even remotely roadworthy today. The current state of pedestrian-detection technology for driverless vehicles in general is quite weak. People should not be used as crash dummies in the development of AV buses, whether they are on board a vehicle or in harm's way on the street.

Attention Span Issues

Moreover, transitioning fully functioning bus operators into safety drivers (responsible for stepping in if an autonomous bus isn't reacting to a situation) is incredibly risky, as recent studies have shown that human beings simply do not have the required attention spans for this task.[3] People have trouble staying focused when expected to monitor an autonomous system, and their vigilance decreases after just 21 minutes, a physiological phenomenon known as the "vigilance decrement." In other studies, it has been documented as occurring in as little as ten minutes. After this period, driver performance worsens. Bus operators typically work in eight hour shifts, well beyond the 21-minute attention span. This will undoubtedly result in major safety concerns for autonomous buses if they are permitted to operate on U.S. highways.

While some may say that much of aviation is now safely automated, attention span is much more significant for bus operators than it is for pilots. Airplanes are predictable and the sky is spacious and friendly. Airplane pilots have three main concerns in the air: mountains, adverse weather, and other airplanes. These things are easy for computer systems to monitor well in advance of danger, giving pilots plenty of wiggle room to appropriately take action. Conversely, bus drivers operate on crowded roadways with numerous types of potential hazards. They have only split seconds to make life-or-death decisions and take action and must always be fully alert and engaged with the task at hand.

Forcing Drivers off the Bus is a Massive Safety Risk

Crime Fighters

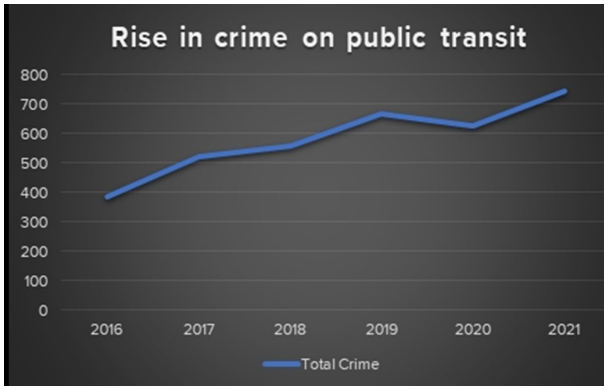
This is an extremely risky time to consider taking transit workers off of our buses. We are in the midst of an unprecedented spike in crime on transit all across the country.[4] There is an opioid epidemic and a housing crisis, so the issues that we've been seeing in the cities have migrated into our public transit systems. In Los Angeles, the crime rate on the county's metro system has skyrocketed since the pandemic, adding fuel to

3 *Detection of Attentional State in Long-Distance Driving Settings Using Functional Near-Infrared Spectroscopy.* Professor Mary Cummings, Duke University, 2015.

4 *Cities Want to Return to Prepandemic Life. One Obstacle: Transit Crime.* New York Times, April 25, 2022. https://www.nytimes.com/2022/04/25/us/public-transit-crime.html

long-burning debates on policing, homelessness and mental health. In Chicago, smoking, drinking, gambling, and fighting are commonplace on CTA buses.[5] In Denver, the conditions on the buses are frightening.[6]

Phoenix[7]:



According to Christopher B. Leinberger, an emeritus professor of business at George Washington University who studies urban spaces and transit, the most effective way to reduce violence on public transit systems is to get more people back to riding them. "Having lots of folks from all different incomes riding mass transit is the best way to suppress crime," he says. "Obviously the police have a major role to play, *but it really comes down to having people, lots of eyes, on different people*."[8] This of course includes transit workers, who play an enormous role in transit safety, going way above and beyond their traditional driving duties.

In March of 2022, a quick-thinking Broward County transit bus driver (and ATU member) drove her bus to the Fort Lauderdale police headquarters when a gunman opened fire on the bus, killing two passengers. When the driver heard gunshots, she forced her way into a turn lane and then pulled up to the police headquarters. Officers rushed out after hearing the commotion and the suspected shooter stepped off the bus and surrendered.[9]

In late 2022, four teenagers punched and kicked a 55-year-old man on a Pierce County Transit bus in what deputies described as an unprovoked assault. The bus driver pulled over while the attack unfolded and radioed dispatchers for help.[10]

In Daytona Beach, FL, a Votran bus driver stopped a sexual assault attempt on a bus, wrestling an armed man away from a passenger after he had pulled down his pants and underwear. The driver of the bus tackled the suspect who had been harassing and touching a woman on the bus. When officers arrived, they found the suspect armed with a sheathed knife with a 5-inch blade.[11]

In Oahu a father praised a city bus driver for stepping up and stopping the sexual assault of his 17-year-old daughter from going any further. All of a sudden, the suspect was on top of her, rubbing his groin area

5 https://www.cbsnews.com/chicago/news/cta-bus-drivers-say-cpd-officers-now-riding-some-routes-but-union-wants-to-see-if-the-tactic-lasts/

6 *Anger and Heartbreak on Bus No. 15. As American Cities struggle to recover from the pandemic, Denver's problems spill onto its buses.* https://www.washingtonpost.com/nation/2022/06/06/bus-denver-pendemic-violence/

7 https://www.12news.com/article/news/crime/assaults-drug-crimes-valley-buses-light-rail-risen-last-5-years/75-5de267bd-46f8-4ec9-a3c2-bed63ef74477

8 *Cities Want to Return to Prepandemic Life. One Obstacle: Transit Crime.* New York Times, April 25, 2022. https://www.nytimes.com/2022/04/25/us/public-transit-crime.html

9 *Florida bus driver hailed as hero after gunman opened fire*. Florida Times-Union (Jacksonville), March 19, 2022.

10 *Man was punched, kicked by 4 suspects in assault on Pierce Transit bus, deputies say.* The News Tribune (Tacoma, Washington), December 7, 2022.

11 *Police: Bus driver stops attempted sex assault.* News-Journal (Daytona Beach, Florida), July 24, 2018.

against her leg for about 10 seconds. Then the driver intervened. "I saw what you did. Get off the bus! I don't like that on my bus, he shouted."[12]

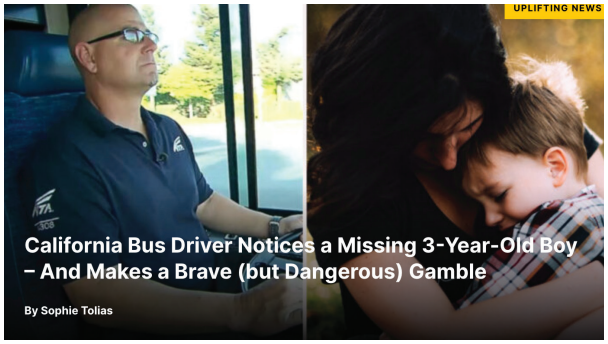
A bus driver was hailed as a hero after surveillance video surfaced of her courageously saving an 80-year-old woman from a vicious attack on a bus in Port Angeles, WA.[13] The suspect rose from his seat and suddenly delivered a sharp kick to the elderly woman sitting across from him. He started punching her, slamming her head into the floor. After hearing the victim's screams, the bus driver immediately pulled the bus over and attempted to intervene. The attacker then began choking the driver, who distracted the suspect long enough to open the back doors and allow four other passengers to escape and call 911. "She did a marvelous job. She was exceptional; always placing the safety of her passengers ahead of herself," said the Clallam police department.

In the Bay Area, a VTA bus driver on the job for less than six months was honored for his heroic actions behind the wheel. He is credited with rescuing a three-year old boy kidnapped from a local library by a stranger. The driver was at the right place at the right time and did the right thing. He spotted the child and the suspect on his bus and slyly slowed down his ride to give police enough time to meet him at a BART station, where the boy was rescued and reunited with his family. "They just come up to me, shake my hand. 'Were you that bus driver? Thank you, I have my own child that rides the VTA bus service and knowing that they'll be safe with an operator such as yourself,'" the driver said.[14]

12 khon2.com/local-news/sexual-assault-on-thebus-leaves-oahu-teen-shaken-father-thanks-bus-driver-for-stepping-in

13 *Brave Driver Saves 80-year old Woman From Brutal Bus Beating.* insideedition.com/16757-brave-driver-saves-80-year-old-woman-from-brutal-bus-beating. June 2, 2016.

14 *Bus driver honored for rescuing boy kidnapped from Milpitas Library.* June 19, 2015. https://abc7news.com/child-abduction-alfonso-david-edington-kidnap-missing/795585/



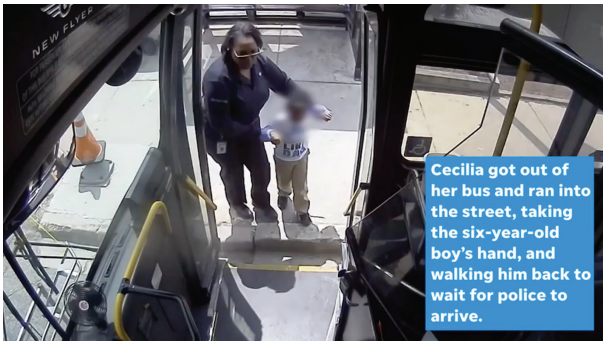
Would a computer have acted in the same way in these cases? What would have been the result if that bus was driven autonomously without a human being to save that child or the elderly woman in Washington State? Or the countless women subjected to sexual assault on public transit? Do we really want to eliminate transit's last line of defense and allow these heinous criminals to roam free on our buses?

Community Heroes

Bus operators, the eyes and ears of our communities, routinely perform heroic acts that impact all of us. They alert 911 about the existence of house fires. They talk suicidal people off of bridges. Taking potential heroes off the bus will result in tragedies that could have been averted.

On a stormy night in September of 2021 in Queens, New York, an ATU member drove out of flash flooding that suddenly surrounded her New York City transit bus. She was so focused on forcing the bus to safety, she didn't notice her passengers were standing on their seats as water rushed in. At first, the drive was fine. But when the bus reached Queens Boulevard, the bus suddenly was in a river of water. The driver managed to plot a path through floodwaters at a time when other cars were being abandoned. "She drove passengers through 3 to 4 feet of water. I watched that video. The water was in the bus. People are literally standing on their seats to make sure that they did not drown inside a bus," said New York Governor Kathy Hochul.[15] "She didn't pull over and say, 'I'm out of here, I'm going home.' She stood there. She drove; she went through the night and did what it took to get people there safely."

Two months earlier, an Alabama bus driver was nicknamed the "Angel Driver" after saving the life of a choking 2-year-old boy. The bus driver came across a car on the side of the road with a man frantically waving his arms while his son was clearly in distress with blue lips. When the bus driver asked the father if his son was choking, he replied, "Yes." The bus driver exited her vehicle and proceeded to give two squeezes to the sternum followed by a firm pat of the back after holding him upside down, removing the obstruction in the child's throat.[16]



A California bus driver who picked up a young missing autistic man was applauded as a hero in 2019. The driver saw a 20-year-old man wandering around a BART station and convinced him to get on the bus. The man had been missing for three days and was considered at risk because of his autism. The bus driver recognized

15 *Heroic bus driver says she was so focused on getting passengers out of floodwater, she didn't notice they were standing on seats.* CNN Wire, September 3, 2021.

16 *Local bus driver saves choking child, named 'Angel Driver.'* The St. Clair Times (Alabama) July 29, 2021.

him from news reports posted on Facebook and told the young man his family was looking for him.[17]

In East St. Louis, MO, a MetroBus driver was honored for his heroic actions in 2021. He was driving along his route when he spotted a toddler sitting alone in a field near a gated subdivision. Feeling uneasy, he pumped the brakes and ran over to the young boy. He asked the boy if he wanted to ride with him and the child smiled. The driver then wrapped his coat around the boy before alerting the agency's dispatch team, who called the St. Clair's County Sheriff's Office. While he waited for police to get there, the driver made sure the boy was comfortable by giving him bottled water and chips he packed for his lunch later. "It was heart breaking to see that child all alone. I have a daughter who is a little bit older than this child. The bus is a safe haven," said the driver. "I am not a hero. I was just doing what I thought was the right thing to do."[18]

Dayton RTA bus driver praised as hero for helping passengers to safety during tornadoes.

Beyond the headlines, many bus drivers amass millions of accident-free miles over their careers, winning the trust and respect of their riders. They engage with customers while providing a safe and comfortable ride. This requires special skills and an ability to communicate.

WVTM 13

"Bus driver hailed a hero after finding missing 11-year-old girl; Lakesha English has only been on the job 6 weeks"

— December 14, 2020

THE BUFFALO NEWS

"Buffalo bus driver saves woman from jumping off bridge"

— October 30, 2020

NBC·17 HD

"'Thank God I was able to help her': Bus driver saves passenger's life with Heimlich maneuver"

— March 7, 2020

wtop

"Metrobus driver administers CPR to slumped over taxi driver near Union Station"

— March 6, 2020

THE PRESS-ENTERPRISE

"Perris; Bus driver wins award for quick thinking"

— January 8, 2020

3WTKR HAMPTON ROADS | NORTHEAST NC

"HRT bus driver called 'guardian angel' for his heroic actions"

— September 9, 2021

GREEN BAY PRESS-GAZETTE

"Bus driver runs into burning building to help evacuate residents"

— October 11, 2019

17 *Bus driver applauded as hero at Tri Delta Transit meeting.* The East Bay Times (California), December 13, 2019.

18 *Bus driver rescues toddler sitting alone in field.* CNN Wire, May 1, 2021.

NBC 17 HD

"Heroic Milwaukee bus driver rescues baby wandering streets alone in the cold"

— August 9, 2019

THE CITIZENS' VOICE

"LCTA bus drivers receive more honors for heroic actions"

— July 18, 2019

School Bus Drivers: We Move Precious Cargo

Every day, school bus drivers across the country are entrusted with the care and safety of millions of children as they are transported to and from school and school-related activities on public school buses. Drivers are not only responsible for the safe and proper operation of the school bus, but also must often respond to medical and other emergencies that may arise during the trip to and from school, as well as disciplinary problems and all-too frequent outbreaks of violence aboard their buses. School bus drivers, as friend and care giver to the children entrusted to them, are often the first to respond in such instances and serve to warn school officials when a child is demonstrating violent or other potentially dangerous behavior early in the school day.

Typically, the only authority figure aboard the school bus, drivers have only a rear-view mirror in which to view the students entrusted to their care. Bullying has become a huge problem. Despite receiving minimal training as to what constitutes unacceptable behavior, school bus drivers do an amazing job, putting their full attention on the road and traffic around them, ensuring that our kids get to school and back in the safest way possible.

Will a robot ever be capable of forcing a bully to sit down? Our school buses need **more** workers on board, not fewer. The idea of automating school buses and putting children in harm's way without adults to protect them is simply insane!

THE BUFFALO NEWS

"BPS bus driver honored for courage under fire"

— February 16, 2023

FOX NEWS channel

"Ohio school bus driver called a 'hero' after saving student from passing car"

KY3

"Mo. school bus driver called 'hero' after reporting man at bus stop with gun who allegedly threatened to shoot at bus"

— November 2, 2022

CNN

"'An absolute hero:' School bus swerves to avoid gunshots, ends up in ditch"

— May 10, 2022

The Post and Courier

"'Hero' Columbia bus driver honored for saving students during hijacking by Army trainee"

— May 19, 2021

The Loudonville Times

"WATCH: 'Hero' N.Y. bus driver saves student from being hit by car"

— December 14, 2020

The Human Cost of Automating Bus Driver Jobs

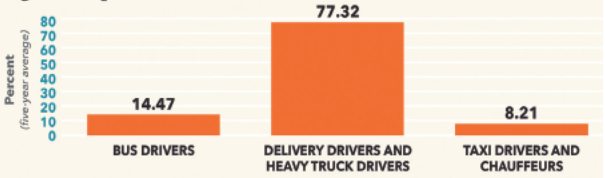
"This job [as a bus driver] provides meaningful satisfying work, with a salary and benefits package which allows me to take care of myself and my family. Without this job I would more than likely have to take on multiple jobs in order to provide the lifestyle I currently enjoy, which would mean less quality time with loved ones, more stress, frustration, and very likely less life satisfaction."

— Kevin, a bus driver for the Washington Metropolitan Area Transit Authority.

The median worker in a driving occupation earns about $31,000, enough to keep a family out of federally defined poverty. If people like Kevin were to try to replace their salary with minimum-wage jobs, they would need to work two full-time jobs.[19]

FIGURE A.

Percent of Workers in Driving Occupations by Occupation, 2010-2014



Source: Authors' analysis of American Community Survey data from IPUMS-USA, University of Minnesota, www.ipums.org.

More than 600,000 bus drivers would lose their jobs if AV buses became a reality. Communities of color would be disproportionately affected. Nearly as many women as men are bus drivers.

Driving for a living is the single most common job for high school educated men in this country, the same group whose wages have gone down by 11% over the past thirty years. The social cost of eliminating their jobs is so high that it's not sustainable. The greater good is protecting our citizens. Why do we want to put millions of people out of work, causing crises in their families and a huge stress on our already shaky economy?

"If autonomous vehicles begin to replace traditional vehicles, U.S. drivers could see job losses at a rate of 25,000 a month, or 300,000 a year, according to a report from Goldman Sachs Economics Research."

Self-driving cars could cost America's professional drivers up to 25,000 jobs a month, Goldman Sachs says. https://www.cnbc.com/2017/05/22/goldman-sachs-analysis-of-autonomous-vehicle-job-loss.html. May 22, 2017.

19 *Stick Shift: Autonomous Vehicles, Driving Jobs, and the Future of Work.* Washington, DC: Center for Global Policy Solutions, 2017. https://globalpolicysolutions.org/wp-content/uploads/2017/03/Stick-Shift-Autonomous-Vehicles.pdf

Conclusion

ATU members have been driving Americans of all ages safely to their destinations since 1892. AV buses are an existential threat to our members' unbreakable bond with the travelling public. We transport precious cargo: vulnerable school bus children and transit riders who are overwhelmingly people of color that do not own their own cars and heavily rely on the bus for their mobility needs. They deserve the peace of mind of knowing that if they step on that bus, they will come home in one piece.

AV buses are unproven and dangerous. These vehicles threaten the health, safety, and security of working families who rely on public transit, both riders and workers. They are also a threat to our economy. Most parents would agree that they wouldn't feel comfortable dropping their kid off at the bus stop if the yellow bus carrying their flesh and blood was being operated by a robot instead of a human being who would stop at nothing to ensure that their child comes home safely. That being the case, are transit riders any less precious?

✓ ***ATU Supports: Legislation prohibiting autonomous vehicles from being operated in transit or school bus transportation on public roads.***

As Congress considers legislation authorizing autonomous vehicles, transit and school buses -- regardless of how much they weigh or how many people they carry -- should be **off the table.** States that are green lighting AV buses and putting Americans at risk should be stopped in their tracks by the federal government. We need to protect people before profit. Congress should put the brakes on this corporate gold rush in which profiteers are rushing self-driving multi-ton missiles onto our streets and highways.

May 2023

For more information and updates regarding transit workers and riders please visit www.atu.org.

If you have any questions about this proposal, please contact Jeff Rosenberg in the ATU Government Affairs Department at jrosenberg@atu.org.

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Silver Spring, MD 20903

John A. Costa, International President
Yvette Trujillo, International Executive Vice President
Kenneth R. Kirk, International Secretary-Treasurer

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July 24, 2023

The Honorable Yvette D. Clarke
2058 Rayburn House Office Building
Washington, DC 20525

Dear Representative Clarke,

We write to ask that you withhold support for any autonomous vehicle legislation that does not include a vision test demonstrating that the vehicle can detect and respond to vulnerable road users of all races and ethnicities.

Currently, more than 20 percent of roadway fatalities in our country are bicyclists and pedestrians, and, in both the number and percentage of roadway fatalities, deaths of vulnerable road users continue to increase. We believe new technologies, including advanced driver assistance programs, connected vehicles, and eventually autonomous vehicles, have the potential to improve safety on our roads — but only if the technology is required to meet safety standards that take all road users into account.

People biking, walking, or using wheelchairs or other mobility devices are the most vulnerable users of our roadways, and often the most difficult for automated systems to detect. Therefore, the systems should undergo a separate vision test which includes showing the ability to recognize common bicycling and walking infrastructure including shared lane markings (sharrows); crosswalks, including those that use art, pavers, or other non-standard paving; bike lanes, whether striped or buffered (with paint or physical barriers); and advisory bike lanes.

Autonomous vehicles in San Francisco were found to engage in four of the five driver behaviors with the highest results in vulnerable user fatalities, including: running red lights, rolling through stop signs, failure to yield to pedestrians in crosswalks, and dangerous right turns (AVs did not speed.) Each of these four behaviors observed in AVs could be addressed by AVs meeting minimum standards to detect and respond to all roadway users, signage, and markings.

As organizations representing bicyclists, pedestrians and other vulnerable road users, we ask you to ensure that any legislation allowing increased exemptions for autonomous vehicles

includes safety standards that require a vision test ensuring these vehicles can detect and respond to all road users of all races and ethnicities.

Thank you for your consideration, please contact Leah Golby at leah@nybc.net and Caron Whitaker at Caron@bikeleague.org with any questions.

Thank you,

Leah Golby
Board President
New York Bicycling Coalition

Bill Nesper
Executive Director
League of American Bicyclists

THE DAWN PROJECT
Making Computers Safe for Humanity
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July 25, 2023

Chairwoman Cathy McMorris-Rodgers
2188 Rayburn House Office Building
Washington, DC 20515

Honorable Frank Pallone
2107 Rayburn House Office Building
Washington, DC 20515

Chairman Gus Bilirakis
2306 Rayburn House Office Building
Washington, DC 20515

Honorable Jan Schakowsky
2408 Rayburn House Office Building
Washington, DC 20515

Dear Chairwoman Rodgers, Ranking Member Pallone, Chairman Bilirakis and Ranking Member Schakowsky:

Thank you for holding an incredibly important hearing this week on creating a Self-Driving Vehicle Legislative Framework. I write to respectfully urge you to ensure that any legislation that is passed by Congress contains language that demands that any software that takes away human driver responsibility and decision-making is independently tested to be 100% safe before being put in vehicles on our roads.

My name is Dan O'Dowd, and I am the Founder of The Dawn Project, a safety advocacy group campaigning to ensure that the software we rely on in day-to-day life is absolutely secure. I have spent forty years developing secure, unhackable software to meet the very highest levels of cyber security, for NASA, Boeing, the US Air Force, the FBI, and other major organizations. In matters of national security, our software is trusted by the Government to never fail and be impenetrable to hackers. Our software keeps the F-35 and the B1-B in the skies and sent the Orion Crew Exploration Vehicle into space last November.

For the past two years, we have warned NHTSA, Congress and the public of the critical safety defects present in Tesla's dangerous and defective self-driving systems. Now is the time to act to protect the public from dangerous, experimental technology to ensure that driver control systems, such as advanced driver assistance systems and autonomous vehicles, are tested to be 100% safe before they are put into production and sold to the public. Under current law, there are no restrictions to placing any technology in vehicles, no matter how dangerous that technology may be. We implore Congress to close this dangerous gap in current law.

Tesla's unchecked deployment of its self-driving systems, 'Full Self-Driving' and 'Autopilot', is a clear and present danger to our road users. Per data from NHTSA's Standing General Order on Crash Reporting, at least 23 Americans have already died in crashes involving Tesla's self-driving software since June 2021. Open-source data from community trackers of deaths

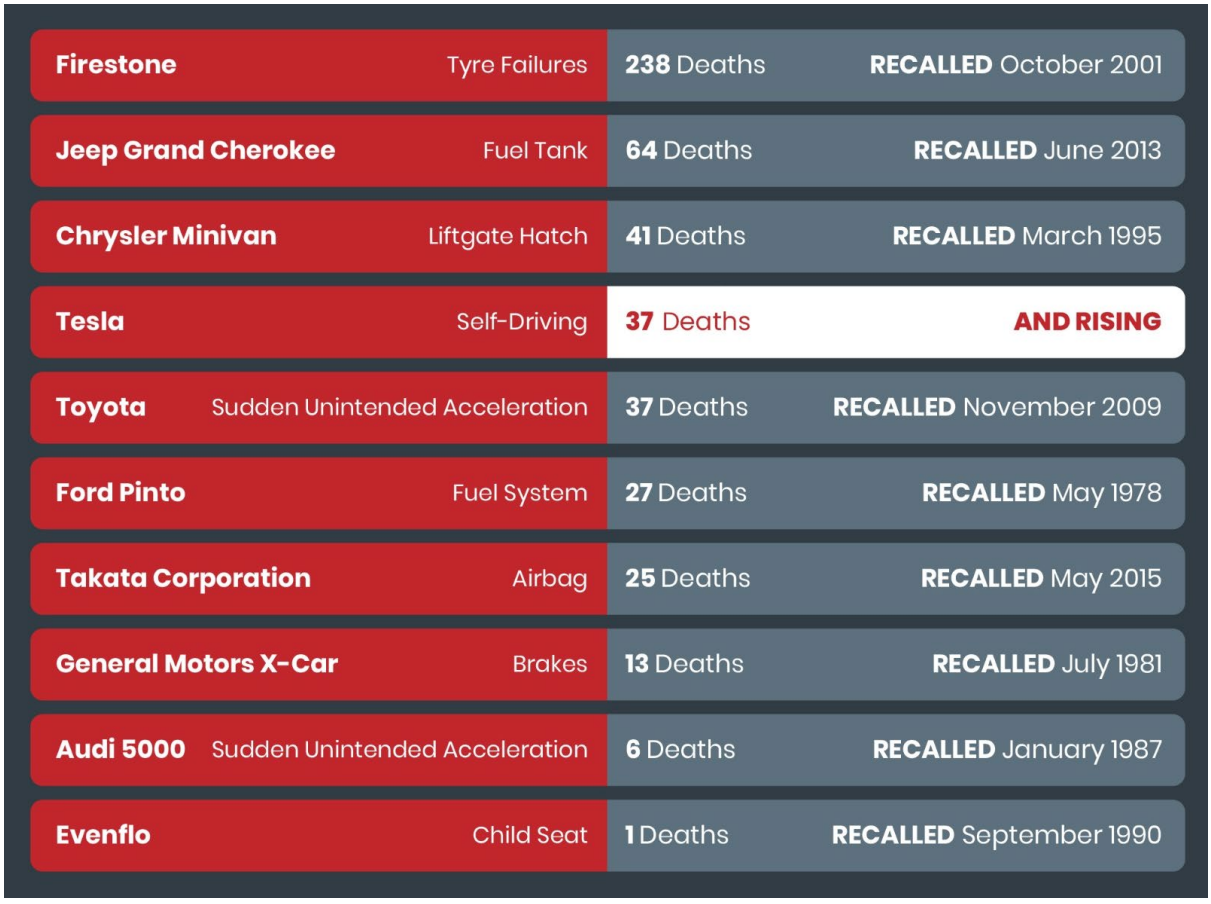
involving Tesla's self-driving systems place the total number of fatalities at 38 since 2016. In its present state, this defective technology has no place on our public roads.

The Dawn Project tests have revealed a litany of defects, including that a self-driving Tesla will fatally run down a child sized mannequin crossing the road, blow past a stop sign at 35mph, overtake stopped school buses displaying their warnings, ignore 'Do Not Enter' and 'Road Closed' signs and run over a stroller in its path.

Above and beyond these flaws, the FSD software is particularly vulnerable to hacking. Hackers at a recent cyber security convention were able to hack into a Tesla in minutes. Tesla's defective technology is a serious threat to the safety of our nation - If North Korea, Russia or China were to target Tesla's self-driving systems, hundreds of thousands of Americans could die within minutes.

NHTSA's statistics show the true extent of the threat that Tesla's self-driving software poses to other drivers, pedestrians and cyclists. Since June 2021, Tesla's self-driving systems have been active in 840 accidents. For context, Honda, the manufacturer with the second highest number of crashes, reported 108 during this period. Despite this, Tesla has been allowed to deploy this software on every road in the US, and has shipped its self-driving technology to over a million customers.

The biggest automotive recalls in history:



There have already been 37 deaths relating to Tesla's self-driving systems, overtaking many of the largest recalls in US history. Tesla's self-driving systems now have more deaths than the Ford Pinto Fuel System as well as Takota Airbag recalls. The first death associated with

Tesla's self-driving software occurred in 2016 and fatalities have since overtaken the number of deaths for many previous manufacturers who faced recalls in the past. The number of deaths will continue to grow until this software is recalled.

Early detection and addressing fatalities is intended to remediate the processes in organizations which weaken safety standards in their products, before the reckless processes are normalized and result in a mass casualty event.

In 2022, we presented our findings to NHTSA's senior leadership, urging them to thoroughly investigate Full Self-Driving and providing them with all the information needed to methodically recreate our tests. I met with Senator Richard Blumenthal, where we discussed the flagrant risks of Tesla's self-driving systems. I have also met in person with many members of the Energy and Commerce and Transportation and Infrastructure Committees. Despite multiple investigations into Tesla's self-driving technology and a recall of Tesla's Full Self-Driving software, NHTSA has taken no action to remove this threat from our roads, which is why I implore you to ensure that legislative measures are taken to address this deadly safety risk.

Additionally, we have brought the dangers of Tesla's self-driving technology to the attention of the American people through a high-profile campaign that has included nationwide TV advertising, five full-page ads in The New York Times, and a public safety announcement broadcast during the Super Bowl. The American people are virtually unanimous in wanting swift action on this life-and-death matter. We conducted a survey of registered voters that showed that 93% agree that a Full Self-Driving car that would run over a child in a crosswalk must be banned from our roads immediately.

In conclusion, I implore you to ensure that legislation regarding autonomous vehicles puts the safety of Americans first and foremost. Unlike other self-driving manufacturers such as Waymo and Cruise, who test their vehicles in carefully mapped and geofenced environments, Tesla has recklessly deployed their self-driving technology to "anyone in North America", per Elon Musk. We must not stand by while self-driving Teslas continue to claim lives on our roads and threaten our national security. We cannot jeopardize the safety of ordinary Americans any longer - Tesla's self-driving systems must be taken off our roads until they are conclusively proven to be safe.

Thank you for your consideration of this important issue. I stand ready to help.

Sincerely,

Dan O'Dowd
Founder, The Dawn Project

American Property Casualty Insurance Association
INSURING AMERICA apci.org

NATHANIEL F. WIENECKE
SENIOR VICE PRESIDENT

July 17, 2023

The Honorable Cathy McMorris Rodgers
Chair
House Energy and Commerce Committee
Washington, D.C. 20515

The Honorable Frank Pallone
Ranking Member
House Energy and Commerce Committee
Washington, D.C. 20515

The Honorable Gus Bilirakis
Chair
House Energy and Commerce Subcommittee
on Innovation, Data, and Commerce
Washington, D.C. 20515

The Honorable Jan Schakowsky
Ranking Member
House Energy and Commerce Subcommittee
on Innovation, Data, and Commerce
Washington, D.C. 20515

Dear Chair Rodgers, Ranking Member Pallone and Representatives Bilirakis and Schakowsky,

As you know, automated vehicles hold great promise to save lives by reducing the number of deaths and accidents on our nation's roads as well as providing increased mobility for disabled and aging populations. Nonetheless, vehicle accidents and damage to vehicles will continue to happen. On behalf of the American Property Casualty Insurance Association (APCIA) and our nearly 1200 member companies, I write to highlight that to protect people and property, vehicle liability insurance must remain an indispensable part of vehicle risk management. As it has been for over a century, insurance remains the most effective means to fairly and efficiently compensate crash victims.

As your committee renews its work on autonomous vehicle legislation, APCIA continues to urge policymakers to maintain a focus on roadway safety; support the continued primacy of state regulation of insurance and liability issues; and ensure that vehicle owners control and can grant access to vehicle-generated data.

Data Access and Innovation

- To support data access, vehicle owners must be able to control and grant access to vehicle-generated data on a real-time and secure basis.
- To support innovation in motor vehicle technology, insurers will need to have reasonable access to information to identify a vehicle equipped with advanced technology systems including common terminology addressing the type of technology on board a vehicle.
- Insurers need access to this information to develop products and underwriting methods to meet the needs presented by the changing nature of the risk and to obtain regulatory approval to bring those products to market as well as efficiently handling claims.
- Accident data, as well as, pictures and video from an automated driving system should be available to federal and state transportation regulators, law enforcement, the parties to an accident, insurers

and authorized representatives of parties to an accident. The data should be available on reasonable terms to allow for prompt accident investigation and resolution of claims for damage and injury arising from the accident.

Safety

- The increased automation of driving functions will mean that, over time, some motor vehicle laws and regulations may need to be changed. Nonetheless, all vehicles must continue to meet all federal and state safety requirements and be capable of complying with all state motor vehicle laws.
- Any exceptions to existing auto safety laws and motor vehicle safety standards should be exceedingly rare and limited to only the highest levels of automated driving and should clearly define the levels of automation to which the modification applies. Exceptions should not be made for collision protection standards or, indeed, any human safety features.
- Automated and connected vehicle systems must be hardened against cyber-attack.

Primacy of State Regulation on Insurance and Liability Issues

- Insurance will continue to be regulated on a state by state basis. This regulatory framework should be maintained.
- Liability apportionment should remain with the states.
- State legal systems should be allowed to adapt to ensure accident victims are appropriately compensated. The U.S. legal system has proven to be very adaptable to new technology.

APCIA looks forward to continuing our work with you and your colleagues on this important issue.

Sincerely,

Nathaniel F. Wienecke

INTERNATIONAL UNION OF POLICE ASSOCIATIONS

THE ONLY UNION FOR LAW ENFORCEMENT OFFICERS

SAM A. CABRAL
International President

MICHAEL V. CRIVELLO
International Secretary-Treasurer

July 24, 2023

The Honorable Cathy McMorris Rodgers, Chair
The Honorable Gus Bilirakis, Chair
The Honorable Frank Pallone, Ranking Member
The Honorable Jan Schakowsky, Ranking Member
House Committee on Energy and Commerce
Sub Committee on Innovation, Data, and Commerce
Washington, D.C. 20515

Dear Representatives Rodgers, Bilirakis, Pallone, and Schakowsky:

On behalf of the International Union of Police Associations (I.U.P.A.), I offer our thoughts on the upcoming discussions of automated vehicles and self-driving vehicle legislation.

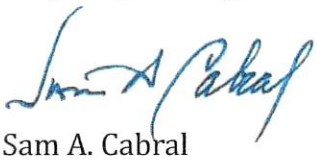
The International Union of Police Associations, AFL-CIO, represents rank and file, active-duty law enforcement professionals across this great nation, including in the territories of Puerto Rico and the Virgin Islands.

We surveyed our members and found that most had experienced no contact with self-driving vehicles. Generally, however, we have serious concerns about this technology. As these vehicles are being developed, criminals are working diligently to hack the systems for unlawful activities. Among other concerns, if a self-driving vehicle can deliver a pizza to a residence, it can also deliver a bomb to a school or public gathering.

We are also generally opposed to federal law trumping state and local statutes dealing with issues that will vary widely. We are concerned that broad preemption may invalidate laws requiring AVs to yield to emergency response vehicles and otherwise operate lawfully in the case of an emergency. Further, what is appropriate in rural areas and farming communities would not address the problems in New York City. We believe that local elected bodies should determine what is appropriate for their states and communities.

We look forward to working with you and your staff to address the problems these vehicles may pose to our communities.

Very Respectfully,



Sam A. Cabral
International President

Transportation Trades Department, AFL-CIO

July 25, 2023

The Honorable Cathy McMorris Rodgers
Chair
House Committee on Energy and Commerce

The Honorable Frank Pallone, Jr.
Ranking Member
House Committee on Energy and Commerce

The Honorable Gus Bilirakis
Chair
Subcommittee on Innovation, Data, and Commerce

The Honorable Jan Schakowsky
Ranking Member
Subcommittee on Innovation, Data and Commerce

Dear Chair McMorris Rodgers, Ranking Member Pallone, Chair Bilirakis, and Ranking Member Schakowsky:

On behalf of the Transportation Trades Department, AFL-CIO, (TTD), I request that our comments detailing transportation labor's priorities and principles for legislation that ensures the safe and responsible deployment of autonomous vehicles (AVs) be entered into the record for the subcommittee's July 26 hearing, entitled "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China." By way of background, TTD consists of 37 affiliated unions whose interests in automated vehicles span operations, maintenance, manufacturing, safety, and more.

AVs are often touted for their potential to increase safety, improve transportation access, produce environmental benefits, and create new American jobs in the manufacturing and technology sectors. Yet, for all the benefits promised by the AV industry, we too often overlook the serious impacts AVs will have on workers, safety, equity, and other important factors if this technology is not properly regulated by the federal government.

The snapshot of AV deployments today should concern policymakers. The AV industry has been permitted to engage in dangerous experimentation on our roads that has largely evaded the level of federal scrutiny needed to ensure safety isn't compromised. Federal and state policy leaders have been welcoming to AV developers and, too often, embraced a hands-off approach to regulating them and their equipment. Any legislation you advance must change the current irresponsible approach to AV deployments and finally put in place strong, enforceable safety guardrails.

While this committee's jurisdiction may not extend to crafting policies that address all of these impacts, TTD believes that you nonetheless have a responsibility to the American people to work within your committee and with your colleagues across other relevant committees to ensure any AV legislation takes full stock of its potential negative impacts and to craft policy solutions that ensure the transportation workforce has the skills they need to manage technological change in this industry and has a central voice in the shape of that technological change.

Ultimately, your committee will play a central role in determining whether AV technologies will be viewed by millions of Americans as positive progress or a degradation of safety. The outcome we achieve will be dependent on the decisions made by Congress and regulators in our executive branch. The following represents transportation labor's key priorities that Congress must consider as the foundation of any legislative framework for the testing, deployment, and regulation of AVs:

Transportation Trades Department, AFL-CIO
815 Black Lives Matter Plaza, NW / 4th Floor / Washington, DC 20006
Tel: 202.628.9262 / www.ttd.org
Greg Regan, President / Shari Semelsberger, Secretary-Treasurer

Transportation workers must be prioritized, and their voices enshrined in legislation

Technological change in the transportation sector is not new to transportation workers. They have lived through generations of new breakthroughs and have demonstrated their skill and adaptability as innovations accelerated and placed new demands on them while redefining our system of mobility. Meanwhile, their jobs and skills requirements have constantly evolved and Americans have benefited from their resiliency, precision, safety training, and know-how.

But the firsthand knowledge, skills, and experience of those workers will only be harnessed to ensure the safe testing and adoption of autonomous technologies if we craft policies that guarantee they have a seat at the table at every step of the way, from research to deployment. TTD recently offered a number of policy solutions to meet these goals in a joint letter with ITS America to the U.S. Departments of Transportation and Labor.

Policies like ensuring better data collection, building innovative partnerships between stakeholders and the federal government, and building new capacity for workforce training programs to ensure the current and future workforce have the skills they need to manage new technologies are not only common sense; they also have the broad support of labor, industry, employers, academia, and other important stakeholders. We encourage the subcommittee to review these recommendations and to work with TTD and our partners in innovation to guarantee they are foundational to any AV legislation.

Safety must be paramount in any AV legislation

News stories in recent years clearly demonstrate the need for a strong federal framework for AV testing and deployment that prioritizes safety and accountability. Consider the following, which represents a mere snapshot of incidents involving AVs:

- In 2019, a self-driving shuttle in Las Vegas crashed into a truck. While there was an operator on board, they did not have direct access to the manual override controls.
- In 2020, a self-driving shuttle in Ohio came to an abrupt stop, requiring a passenger who was thrown from their seat to receive medical attention for their injuries. This pilot project was a component of the 2015 Smart Cities challenge.
- In 2020, a self-driving shuttle in Utah sent a 76-year old man to the hospital after it came to an abrupt stop.
- NHTSA has opened investigations into 27 crashes involving Tesla vehicles. There have been at least 11 deaths in Tesla vehicles that involved their autopilot feature in the US alone.
- Recent stories out of California, a hotspot for AV testing, have highlighted incidents as innocuous as traffic jams caused by malfunctioning vehicles, to more serious incidents, like the one in which a Tesla using its autopilot feature crashed into a firetruck, killing the driver inside the vehicle.

TTD aligns itself with the Joint AV Tenets introduced by Advocates for Highway and Auto Safety, and believes they must be core to ensuring a true safety framework for the deployment of AVs. All workers deserve to know that an autonomous car or bot driving next to them is safe enough to be on the same road or in the worksite. Any legislation developed by Congress or regulations promulgated by the U.S. Department of Transportation (DOT) must strengthen the development of future Federal Motor Vehicle Safety Standards (FMVSS) for AVs and mandate tests of key components (i.e., a vision test) on any system whose performance is inseparable from the safe deployment of that vehicle. Congress and the federal government must focus on strong safety regulation and enforcement rather than hands-off policies sought out by the AV industry, such as waivers and exemptions that clear the way for widespread piloting and deployment of AVs.

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Scope and context must be appropriately defined

Despite shortsighted calls from industry to apply the same set of policies to all classes of vehicles, Congress must recognize that different classes of vehicles operate in different contexts and come with their own unique set of challenges. A passenger vehicle operating on city streets is simply not the same as a Class 8 truck or a city bus.

In a 2022 paper published by Traffic21, a transportation research institute at Carnegie Mellon University, one of the world's leading robotics research institutions, the authors found that transit vehicles, including public transit buses and vans, are "highly likely" to require the presence of a qualified human operator, regardless of how far automated technologies come. The report notes that, "even with safety-enhancing technologies in place, there remains a need for operators on board to scan for latent hazards or threats to safety that aren't immediately visible to the system or the driver, but that may be predictable to an experienced operator."

Some of the challenges highlighted in the report are as simple as the fact that drivers, cyclists, and police use hand signals to communicate with other drivers or direct traffic. Eye contact between drivers is often used to determine if it is safe to proceed through an uncontrolled intersection, but for both, the report states, "there is no parallel mechanism to communicate between autonomous vehicles and the rest of the world." The report goes on to highlight a number of critical, non-driving tasks performed by bus operators, and draws attention to overlooked challenges, including those brought about by iterative advancements in automated technologies.

The human element in the context of public transportation simply cannot be overlooked, and the same is true for other classes of commercial vehicles. In a recent FMCSA waiver request by Waymo and Aurora, the AV companies self-identified that without a human operator, mandatory evidence-driven safety measures simply cannot be carried out. In the request, Waymo and Aurora admitted that "Compliance with [regulations requiring the placement of warning devices to alert drivers that a commercial motor vehicle is stopped in a traffic lane or on the shoulder] is not feasible for autonomous CMVs without a human on board." Instead, they proposed using cab-mounted warning lights, which are less safe for a variety of reasons including that cab-mounted lights may be obscured by the rear portions of the vehicle including trailers and cargo.

TTD raised a host of concerns with this waiver request, but for the purposes of today's hearing, we hope it serves to reiterate that this is just one of many unanswered questions about if, or even how, highly automated vehicles can safely operate in the context of commercial motor vehicles.

Global economic competitiveness cannot be met through hands-off policies

Like with today's hearing, we often see the claim that we are falling behind China and other countries in the development and deployment of automated driving system technologies. But for workers, the lingering question is what would "leading" in this sector even mean for their future employment opportunities? History tells us that without clear federal leadership American manufacturing workers will be the last to benefit from the economic benefits of these technologies. To ensure broadly shared prosperity and that jobs created in AV manufacturing are good jobs here in the United States, lawmakers must take clear steps. They must ensure that U.S. government assistance for the development of AV technologies, and federal procurements of AVs or procurements by transit agencies or state and local governments through federal assistance, come with strong Buy American policies and a U.S. Employment Plan or similar procurement standards that ensure the development and use of AVs also benefit communities and lead to good middle-class domestic manufacturing jobs.

Congress must work across the aisle and with key stakeholders to meet our policy needs

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Greg Regan, President / Shari Semelsberger, Secretary-Treasurer

Finally, we want to be clear that TTD firmly believes that a federal framework is necessary to meet the workforce, safety, and technological challenges presented by automated vehicles. The current piecemeal landscape of legislation being led by state legislatures is a recipe for disaster, but is ultimately a reflection of the federal government standing on the sidelines. However, we strongly believe that the best way to achieve this goal and to meet the concerns of transportation labor is not to make partisan choices by lining up behind a Democratic- or Republican-led AV bill in today's hearing. Rather, we strongly urge all members of this committee to work together on a bipartisan basis, in close consultation with all stakeholders – not just the voices of industry – to craft a product that protects Americans, provides union workers with good jobs, and treats this technology with the seriousness we believe it ultimately deserves.

Transportation Trades Department, AFL-CIO
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Greg Regan, President / Shari Semelsberger, Secretary-Treasurer

AFL-CIO

LEGISLATIVE ALERT

June 24, 2023

Dear Members of the Subcommittee on Innovation, Data, and Commerce:

On behalf of the 60 affiliates of the AFL-CIO, representing 12.5 million working people, the AFL-CIO submits this letter for the record to urge the Subcommittee on Innovation, Data, and Commerce to prioritize worker voice, safety and vigorous federal oversight and regulatory enforcement, as it considers legislation governing the deployment of autonomous vehicles (AVs). The development of this technology must be data-driven and the significant concerns of workers, their unions, and the public cannot take a backseat to corporate profit, cost cutting, and the ever-present race to the bottom. At the same time, this Subcommittee must be sure to support good paying, union jobs as it develops legislation to govern these emerging technologies. The AFL-CIO also wants to express its strong support for the views expressed by the Transportation Trades Department, AFL-CIO, the Amalgamated Transit Union, and the Transport Workers Union.

Self-driving vehicle technology is already challenging the future of transportation as the developers of this technology, many of them billionaire tech and auto corporations, push for premature adoption before the federal government has established rigid, enforceable standards and regulations. We also know that unless Congress and the Administration force AV developers to prove their safety worthiness before they're permitted to traverse our roads and highways, we could see dangerous applications of AV technology in our public transportation systems.

Automated safety systems like forward collision warning, blind spot detection, lane-keeping, pedestrian detection, and automatic emergency braking can serve an important role in improving outcomes, passenger safety, and experience. While the Subcommittee should certainly prioritize these tools, it is critical that any such automation include the capability for human-automation teaming. The continued development of this technology intertwined with the complexity of environmental conditions and pedestrian activity requires a human operated failsafe in emergency situations.

New legislation governing autonomous vehicles must also incorporate sophisticated data-sharing infrastructure, reporting to relevant federal agencies, and Congressional oversight. Regulations in this emerging area must be based on real-world information and experiences, and oversight of corporate efforts to capitalize in this space must be comprehensive. Software and in-vehicle sensors can provide useful data for operators and manufacturers to analyze and report on crashes, near misses, and other incidents.

Importantly, the implications of autonomous vehicle technology on public transportation and commercial use must be considered simultaneously in any legislative framework. Apart from private vehicles, highly automated commercial vehicles are in testing on public roadways, often without human operators. The safety concerns for workers and the public traverse any private-commercial divide and the legislative framework must as well.

As President Biden has emphasized, our economic policy must prioritize the creation of good paying, union jobs. Here, the Subcommittee can ensure broadly shared prosperity, and that manufacturing jobs created in the autonomous vehicle industry are good jobs with high labor standards that will benefit communities across the country.

We applaud the Subcommittee's efforts to develop thoughtful and comprehensive legislation in this space and urge the Members to keep worker voice and safety at the forefront of any considered legislation.

Sincerely,

William Samuel
Director, Government Affairs

The Honorable Representative Jan Schakowsky
2408 Rayburn House Office Building
Washington, DC 20525

Dear Representative Schakowsky,

We write to ask that you withhold support for any autonomous vehicle legislation that does not include a vision test demonstrating that the vehicle can detect and respond to vulnerable road users of all races and ethnicities.

Currently, more than 20 percent of roadway fatalities in our country are bicyclists and pedestrians, and, in both the number and percentage of roadway fatalities, deaths of vulnerable road users continue to increase. We believe new technologies, including advanced driver assistance programs, connected vehicles, and eventually autonomous vehicles, have the potential to improve safety on our roads — but only if the technology is required to meet safety standards that take all road users into account.

People biking, walking, or using wheelchairs or other mobility devices are the most vulnerable users of our roadways, and often the most difficult for automated systems to detect. Therefore, the systems should undergo a separate vision test which includes showing the ability to recognize common bicycling and walking infrastructure including shared lane markings (sharrows); crosswalks, including those that use art, pavers, or other non-standard paving; bike lanes, whether striped or buffered (with paint or physical barriers); and advisory bike lanes.

Autonomous vehicles in San Francisco were found to engage in four of the five driver behaviors with the highest results in vulnerable user fatalities, including: running red lights, rolling through stop signs, failure to yield to pedestrians in crosswalks, and dangerous right turns (AVs did not speed.) Each of these four behaviors observed in AVs could be addressed by AVs meeting minimum standards to detect and respond to all roadway users, signage, and markings.

As organizations representing bicyclists, pedestrians and other vulnerable road users, we ask you to ensure that any legislation allowing increased exemptions for autonomous vehicles includes safety standards that require a vision test ensuring these vehicles can detect and respond to all road users of all races and ethnicities.

Thank you for your consideration. Please contact Dave Simmons at dave@rideillinois.org and Caron Whitaker at Caron@bikeleague.org with any questions.

With gratitude,

Dave Simmons
Executive Director
Ride Illinois

Bill Nesper
Executive Director
League of American Bicyclists

Transport Workers Union of America, AFL-CIO

"AMERICA'S FIGHTING DEMOCRATIC UNION"

1220 19th Street NW, Suite 600 • Washington, DC 20036 • 202.719.3900 • www.twu.org

New technologies like AVs should be viewed as part of a larger pro-worker innovation policy

TWU members have been at the forefront of new transportation technology for generations.[1] Our experience as frontline workers implementing, operating, and maintaining new equipment, processes, and modes leads us to believe that innovation can and should have a positive outcome for working families. Such outcomes are not guaranteed, but can be achieved when policymakers take steps to:

- Require transparent planning & reporting (both to effected workers and to safety regulators)
- Maintain existing safety & security standards, i.e., require new technologies to demonstrate that they meet or exceed our standards rather than lower standards to meet a current technology's capabilities
- Mandate workforce involvement in planning and implementing new technology, including as an integral part of any government advisory bodies.

AVs are not unique in this regard, they are simply another innovation in a long line of transportation technologies stretching back to the wheel. These principles, if fully expressed as part of any AV legislative framework, will ensure that American workers benefit from this potential technological transition.

We are deeply concerned that the major AV developers have an unambiguous plan to rush driverless vehicles onto our roads and into our public transit systems without safety standards or adequate failsafes - including a human operator - to ensure the safety of these vehicles. These companies are asking the state and federal policymakers to sidestep the tough safety questions and sanction these deployments with very limited oversight or regulation. This "trust me" approach pretends that this technology is somehow independent of the realities of every other innovation over the past two centuries. It would defy decades of federal transportation safety policy and places the public and workers at significant and unnecessary risk. It is also the exact opposite approach that we have learned through countless accidents across multiple modes: federal oversight is essential to ensure the safety of transportation systems. The proactive approach taken by the Department of Transportation ensures the transportation technologies we sanction across the multi-modal network are safe by demanding these innovations demonstrate their safety capabilities BEFORE widespread deployment. We know that even the most advanced technologies fail on a regular basis and that the best protection is strong regulation, redundancy, and well trained workers.

[1] The TWU has commented extensively on this issue over the past several years, including testimony last year before the House Transportation and Infrastructure Committee. We would also draw your attention to the Worker-first AV Legislative Framework and the AV Tenants led by the Advocates for Highway and Auto Safety, both of which the TWU has strongly endorsed.

Many of the policies the TWU believes must be included in an AV legislation would need to be implemented by the Federal Motor Carrier Safety Administration (FMCSA) and the Federal Transit Administration (FTA). These areas require partnership between the Transportation and Infrastructure Committee and the Energy and Commerce Committee. Any legislation which does not include fulsome titles from both jurisdictions will not properly regulate the industry and will undermine workers' futures.

Different approaches presented by the draft proposals

The TWU is pleased to see that this hearing will evaluate two different approaches to setting a framework for AV regulation and deployment. It is our hope that this timely hearing will launch a careful, bipartisan process to address the complex policy choices before you[2]. This committee has an opportunity to embrace and advance responsible, pro-safety and pro-worker legislation or take us down a dangerous path that continues the current approach of permitting poorly regulated, often dangerous AVs to traverse our roads and highways without clear and enforceable standards. We strongly believe that any approach that does not properly regulate these vehicles prior to their widespread deployment is unacceptable and, as we have stated repeatedly, one that we will strongly oppose.

TWU has been a vocal proponent of responsible AV policy and has offered a number of proposals that would protect passengers and workers from the premature and rogue deployment of AVs. We have publicly addressed a number of critical issues that lie at the center of the legislative choices before this committee. We believe that the proposal offered by Representative Dingell responsibly and directly addresses most of these issues within the Energy and Commerce Committee's jurisdiction. This legislation is the product of more than two years of difficult discussions with stakeholders across the industry; it is a well-thought out and well-designed approach tailored to the realities we are seeing on our roads in 2023. While we appreciate that the draft offered by Representative Latta aggressively takes on the competition issues presented by China and others, the core of this draft remains little changed since 2016 - an era before any driverless vehicle was a reality, before the widespread adoption of ridesharing, and before many of the companies in the industry were even established. There is no question that the Dingell draft presents a more holistic and realistic approach on these issues.

Public transportation must be held to the standards of commercial vehicles

One of the most significant differences between proposals under discussion is their treatment of public transportation. The Dingell proposal makes it clear that public transportation vehicles are not eligible for exemptions from federal requirements when an equipment manufacturer seeks to test or implement autonomous vehicles or buses in a transit system. This is the same

[2] Statement, July 19, 2023, by TWU International President John Samuelsen: https://www.twu.org/safety-and-union-jobs-must-be-prioritized-in-autonomous-vehicle-legislation/

standard both bills apply to commercial motor vehicles (CMVs) generally, but quirks in the code make it necessary to explicitly extend this line to public transportation (as defined in 49 USC 5302). The Latta proposal would open a regulatory gap between CMVs and those operated by transit agencies - potentially driving billions of dollars in research, investment, and deployment efforts into transit systems as other avenues for CMV projects would be limited. Given the evolving research[3] around the limitations of AV technology in public transit specifically, such a loophole runs directly counter to the reality of the threat to safety posed by these systems in their current state. It is a dangerous policy to permit the widespread use of exemptions for purposes of unleashing this technology, without a human operator onboard, in the complex public transit industry.[4]

Further, we would note that the proper venue in the House for discussions of AV deployment in public transportation is the Transportation and Infrastructure Committee. The TWU believes the Dingell proposal is necessary to allow the subject matter experts on public transportation policy the ability to write the rules for the industry. The Dingell language (specifically the updated 49 USC 30113(b)(2)(F) under section 7 of the proposal) is the best, clearest demarcation line between the committees and an absolutely essential component of any final bill.

Human-accessible controls are a necessary safety component for all vehicles

As drafted, the Latta proposal wrongly exempts AVs from all Federal Motor Vehicle Safety Standards that are applicable to the human driver. The draft does not even require the manufacturer to demonstrate an equivalent level of safety before removing these controls. By definition, a level 4 AV will require human supervision and intervention when automations fail and when these vehicles are faced with situations beyond their programming. Permitting AVs in our transportation system without the capability needed for a human to take control of the vehicle is dangerous and should be rejected entirely.

For workers whose workplace is the vehicle under their responsibility, this policy choice is potentially catastrophic. We know from decades of experience that transportation automation routinely fails. In aviation, pilots regularly take control of the aircraft, despite autopilot capability, in response to failure or malfunction. The Boeing 737-MAX crashes in 2019[5] and the

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[3] How to Make Sense of Bus Transit Automation: https://www.cmu.edu/traffic21/research-and-policy-papers/traffic21-policy-brief-22.1---apr-14-002.pdf

[4] Opinion article by John Samuelsen, Tech Crunch, February 2022: https://techcrunch.com/2022/02/02/humans-should-drive-our-transit-future-not-robotic-vehicles/

[5] The Boeing 737-MAX crashes were caused by faulty angle of attack sensors which, falsely, believed the aircraft was tilted upwards when flying along a horizontal plane. This system responded to this incorrect information by pointing the aircraft's nose downward (believing this would level out the aircraft). In response, the pilots, witnessing the aircraft beginning a nose dive, attempted to pull the flight controls upwards to counteract the computer's commands. The angle of attack sensors then read this upward movement as exacerbating its false reading and put more thrust into its downward tilt. This process continued until the aircraft crashed at full speed with the computer still believing the aircraft was pointed upwards. At the time of these crashes, pilots in the U.S. had been trained to simply turn off the automation and take control of the aircraft manually if the computer

Washington, DC Metro red line crash in 2009[6] were all the result of failed automation technology overruling human commands. Hundreds died because of technology failure and unresponsive human intervention systems. These failures are continuing in AV systems on the road today. In 2017, an autonomous shuttle testing on the streets of Las Vegas, NV was involved in a slow motion accident because the driver's controls (an Xbox controller) were locked in an inaccessible glovebox.[7] To blanketly exempt all AVs from human driver safety requirements without assuring equivalent safety outcomes guarantees that these vehicles will crash[8] and that people will be hurt or killed as we see on our roads today.

AV companies should not be allowed to profit from test vehicles on public roads

The two proposals also differ around the rules for testing and evaluation of AVs. This is important because AV companies that run driverless rideshare operations are being incentivized to engage in unsafe behavior on public roads. Under the Latta language, companies who operate test vehicles alongside regular traffic would be able to charge riders and package delivery companies for use of these vehicles. To be clear: these are NOT vehicles which NHTSA has exempted from specific standards or which have demonstrated alternative compliance methods. These provisions are focused on experimental vehicles in the early stages of development - the most dangerous stage of the innovation cycle.

While some AV developers may support this language which would allow technology companies to start earning revenue for their investors earlier in the process, the fact is that these vehicles will have little to no safety data available for NHTSA to determine the threat level to other road users. True road tests are necessary for safety regulators to determine whether a new technology will eventually be viable. Unless these tests are barred from revenue service, bad actors will be able to rush unsafe components, software, and vehicles into service seeking a quick infusion of cash for their early investors. This is a very common strategy for many forms of technology (often termed the "minimum viable product" - the core item for sale which can prove a company has a potentially marketable product), but it has never been an acceptable practice in transportation, where the bare minimums are generally considered unsafe. Any

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responded in this way - an action that would have averted these disasters entirely. https://transportation.house.gov/imo/media/doc/2020.09.15%20FINAL%20737%20MAX%20Report%20for%20Public%20Release.pdf

[6] The 2009 WMATA red line crash at Rhode Island Avenue metro station occurred when the positive train control system did not sense a stopped train waiting at the station platform. The train leaving Union Station behind it was told to accelerate along an empty track. The operator of the accelerating train saw the stopped train and pulled the brake. After briefly slowing down in response to the human command, the automatic system then reiterated its command to accelerate as it still did not sense the stopped train ahead. The automation overruled the human operator and crashed at full speed into the back of the stopped train while the human operator continued to hold the unresponsive brake lever. https://www.ntsb.gov/investigations/AccidentReports/Reports/RAR1002.pdf

[7] https://www.ntsb.gov/investigations/accidentreports/reports/hab1906.pdf

[8] NPR, June 15, 2022 https://www.npr.org/2022/06/15/1105252793/nearly-400-car-crashes-in-11-months-involved-automated-tech-companies-tell-regul

sincere attempt to regulate the AV industry must hold the line on this standard practice and keep testing vehicles out of revenue service.

AVs must provide safety regulators with robust, publicly available safety data

One of the most glaring contrasts between the Latta and Dingell drafts is in data collection and reporting. Unlike traditional cars, AVs are and will be capable of tracking and reporting performance and safety metrics in significant and detailed ways. For the vehicles on the roads today, this data is already being collected and sent back to the developers, often as proprietary information. Some AV companies have argued that this approach is essential to their business model - Waymo even sued the state of California to keep its data away from the public[9] - but denying safety regulators and publicly interested groups access to this data is producing negative safety outcomes. Unless safety regulators can independently and accurately assess unbiased datasets, they will not be able to make important decisions on which pieces of technology are truly ready for deployment and which are just marketing material.

The Dingell approach would codify existing NHTSA policy on AV data collection and establish a public, searchable database of AV testing projects. This is absolutely necessary if we are serious about analyzing and responding, in real time, to safety defects - especially in the wake of accidents. The proposal would also require the installation of event data recorders (similar to an aircraft's black box) which would give investigators the necessary information to determine the proximate causes of accidents. Perhaps most importantly, the Dingell proposal would require exemption holders to share certain data with NHTSA as a condition of their exemptions. Our understanding of the "need" for an increased number of exemptions for these vehicles is to gather sufficient real-world data to establish best safety practices; if this is the case, the automakers should have no concerns with sharing that exact thing with safety regulators. AV developers constantly brag about the safety of the vehicles they want to deploy; the more data available to analyze those claims, the better off every road user will be.

The Latta draft contains no reporting or data collection requirements.

Any exemption program for AVs must be designed to produce updated safety standards

Both proposals include allowances for significant numbers of AVs to be exempted from safety standards for more than a decade. While the TWU is concerned about the overall number of untested vehicles each draft would allow onto our roads, the differing approaches present very different futures for the safety of our systems.

The TWU is concerned that the process envisioned in the Latta draft could break incentives for automakers to push NHTSA to conclude rulemaking processes for AVs and allow unelected

[9] Waymo sues California to hide its AV crash data: https://www.theverge.com/2022/1/28/22906513/waymo-lawsuit-california-dmv-crash-data-foia

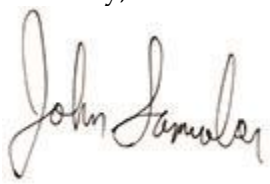
bureaucrats to govern by exemption rather than establish updated standards to equitably govern the industry. This approach permits exemptions for up to 100,000 AVs per manufacturer per year as long as these vehicles "make easier the deployment, development, or field evaluation" of AVs. Manufacturers would be eligible for these exemptions forever. This structure nearly ensures that NHTSA will not be able to complete a comprehensive set of motor vehicle safety standards for the foreseeable future as some manufacturers may prefer to sell vehicles under an exemption rather than meet a new standard.

In contrast, the 80,000 AVs per year per manufacturer allowable under the Dingell proposal would be subject to conditions of deployment (including data collection reference above) - conditions which would be enforceable by NHTSA should a recipient break these terms. Manufacturers would lose their exemptions for specific components or systems as NHTSA completed relevant rulemakings to update the standards. NHTSA's authority to issue any of these exemptions would sunset after 12 years with the final four years seeing a slow down of production to allow manufacturers a glide path back into the normal certification process. This approach will help ensure that stakeholders and policymakers are aligned in pushing for completion of serious rulemakings in a timely manner.

The TWU strongly believes that action is required now if safety regulators are going to have any chance to ensure oversight of this technology before widespread deployment. This belief is shared by both the Latta and Dingell proposals and we hope the Committee will take the best of these efforts to move forward on a bill which: raises AV technology to the highest standards; scrutinizes and carefully regulates the use of exemptions from federal safety requirements; provides real-time data to the public and regulatory experts so that responsible, data-driven safety assessments can be made; keeps unsafe, untested technology off the road; and, does not undermine our public transportation systems' workforce.

We have been consistent for a number of years about what we believe must be included in any AV legislation. We will not support any legislation that fails to live up to those standards. We look forward to working with all parties in this committee as well as the Transportation and Infrastructure Committee for a pro-safety and pro-worker AV bill.

Sincerely,



John Samuelsen
International President

CC: The Honorable Cathy McMorris Rodgers
The Honorable Frank Pallone

July 17, 2023

The Honorable Cathy McMorris Rodgers
Chair
House Committee on Energy and Commerce

The Honorable Frank Pallone, Jr.
Ranking Member
House Committee on Energy and Commerce

The Honorable Gus Bilirakis
Chair
Subcommittee on Innovation, Data, and Commerce

The Honorable Jan Schakowsky
Ranking Member
Subcommittee on Innovation, Data, and Commerce

Dear Chair McMorris Rodgers, Ranking Member Pallone, Chair Bilirakis, and Ranking Member Schakowsky:

On behalf of the nation's state and local government elected and appointed officials, we urge Congress to once again reject legislation on autonomous vehicles (AVs) with provisions for any additional federal preemption of state and local authorities. State and local officials widely support a competitive American economy that embraces technology improvements including AVs, but we must integrate them in a manner that ensures safe operations which is the role of states and local governments. We should move beyond AV legislation that was widely rejected in the 115th,116th, and 117th sessions of Congress and instead work together to advance AV legislation that rejects federal overreach and advances ingenuity in the design and manufacturing of AVs in America.

The regulation of motor vehicle safety, in the traditional manner (as defined in Title 49 Sections 30102 and 30111 which includes the design, construction and performance of a motor vehicle) is, and must remain, a federal obligation. However, state and local governments are the primary authorities over operational safety, including regulating both the operation of motor vehicles after such vehicles have been constructed and the operators of those motor vehicles. In addition, state and local governments hold the authority to establish the rules of the road and traffic laws for how motor vehicles can be safely operated on public roadways. For example, the federal government can require that a vehicle be able to properly identify and observe a stop sign, but the sole authority to establish laws requiring observation of such stop sign, and the enforcement

thereof, continue to reside with state and local authorities who are best suited to respond to local needs.

State and local governments stand ready to work with Congress to ensure the safe integration of AVs into our existing transportation networks, while guaranteeing continued safety on our nation's roadways and streets for all users.

National Conference of State Legislatures
National League of Cities
National Association of Counties
American Association of Motor Vehicle Administrators
American Association of State Highway and Transportation Officials
Governors Highway Safety Association
United States Conference of Mayors

TRANSPORT WORKERS UNION OF AMERICA
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July 25, 2023

The Honorable Gus Bilirakis
Chair
Subcommittee on Innovation, Data, & Commerce
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

The Honorable Jan Schakowsky
Ranking Member
Subcommittee on Innovation, Data, & Commerce
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Chair Bilirakis and Ranking Member Schakowsky,

On behalf of more than 2,000 San Francisco transit workers represented by TWU Local 250-A, I am writing to share our experience with the ongoing live testing of driverless cars in our city. Our members include bus and trolley operators, mechanics, and others who are navigating the streets of San Francisco, California alongside these vehicles. Cruise, a company owned by General Motors, and Waymo, a company owned by Alphabet Inc., are each operating hundreds of autonomous vehicles (AVs) on our streets and we believe the problems this has created will be replicated nationwide unless the federal government can establish a pro-safety, pro-worker regulatory regime for this technology.

Beginning in June 2021, the California Public Utilities Commission granted private companies licenses to operate driverless cars within the city limits of San Francisco. These licenses were expanded earlier this year to allow both Cruise and Waymo to operate for-profit driverless taxi services 24 hours a day across the entirety of San Francisco. The state has awarded these licenses over the objections of the San Francisco Municipal Transportation Agency and the San Francisco County Transportation Authority which found that Waymo's operations in the city were producing an injury rate of 130% the national average. The situation has not improved since this bleak statistic was published. We have seen accidents, injuries, traffic jams, emergency services delayed, law enforcement confusion, blocking access to crime scenes, recalls, and the death of one pet as these companies treat our streets and our people as their personal testing range.

For bus, light rail, and trolley operators, these vehicles are causing significant delays and distractions. In addition to crashing into our vehicles – which immediately halt buses and force riders to find alternative transportation – and blocking rail lines, our members report regular

traffic jams on narrow city streets from AVs stopping abruptly, "pulling over" without leaving space for buses to go around, vehicles becoming unresponsive, and other odd behavior that is caused by automation quirks. Put simply, these vehicles have been a consistent nuisance since being introduced on our roads. While human-operated vehicles can cause similar delays, bus operators can usually get the driver's attention and correct the problem. Without anyone present to move the vehicle, our members are forced to simply wait for the AV to correct its mistake.

Delays on public transit not only create inefficiencies, but put our members' safety at risk, as well. Assaults on transit workers across the country are at an all-time high. One of the main causes of worker assault in public transportation is rider anger at delays or diversions. Hurried riders forced to wait longer than expected for a bus or to arrive at their destination raise the level of tension onboard a bus – creating a pressure cooker atmosphere that all-to-often results in an assault on one of our members or on a passenger. We do not believe that whatever value private interests may be receiving from testing AVs on our roads is worth the risk of assault to bus drivers and transit riders.

The members of TWU Local 250-A are struggling to operate safely on the streets of San Francisco alongside unproven driverless vehicles using our city as a test track. We hope that Congress can establish a federal framework for AV research, development, and deployment which ensures safety standards are never undermined in the name of profit.

Sincerely,

Anthony Ballester
President
Transport Workers Union
Local 250A

TRANSPORT WORKERS UNION
LOCAL 1400

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July 24, 2023

The Honorable Gus Bilirakis
Chair
Subcommittee on Innovation, Data, & Commerce
Committee on Energy & Commerce
U.S. House of Representatives
Washington, DC 20515

The Honorable Jan Schakowsky
Ranking Member
Subcommittee on Innovation, Data, & Commerce
Committee on Energy & Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Chair Bilirakis and Ranking Member Schakowsky,

On behalf of the members of Transport Workers Union Local 1400, I am writing to express our members' concerns with proposed legislation regarding autonomous vehicles (AVs). Local 1400represents fire fighters, emergency medical technicians, and other first responders working for the Port Authority of New York and Jersey. These workers are on call 24 hours a day to respond to emergencies inside tunnels, on bridges, and on approach roadways carrying more than500,000 vehicles every day. Whether and how AVs are introduced into our transportation system will have a major effect on the safety of my members, as well as the traveling public.

As first responders, our members are deeply concerned about the threat unregulated, untested vehicles pose to public safety. On an average day, fire fighters and medical crews respond to several incidents within our jurisdiction. This work requires specialized equipment and training to maneuver through heavy traffic with minimal clearance around vehicles while operating hundreds of feet above or below the Hudson River. Our members are trained to respond to emergencies as quickly as possible and nearly always arrive within one minute of a call because, in these very tight operating environments with very few options for escape, any delay puts the lives of hundreds of people at risk. Crashed or inoperable vehicles make this task especially difficult as they further limit the space first responders have to operate while traffic attempts to continue to flow around the incident. It is precisely because of environments like this that autonomous vehicles must be required to demonstrate their capability to meet our existing standards BEFORE they are introduced for widespread use.

In cities that currently allow AV testing on public roads, we have seen small, driverless cars hindering fire engines, ambulances, and law enforcement vehicles from reaching their destinations in a timely manner. In narrow city streets, a car which suddenly stops and becomes unresponsive, an algorithmic failure that causes massive traffic delays, or other failures of automation pose potentially deadly problems if they delay emergency

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vehicles for even a short period of time. Were any of these events to happen inside the Holland Tunnel (4 lanes of traffic inside a narrow tube constructed in the early 1920s), the results could be catastrophic.

Human operators and human-accessible vehicle controls are essential safety components in our transportation system. When a first responder makes eye contact with a driver (or fails to make eye contact), that worker knows how the driver is going to respond in traffic. In the event a driver is incapacitated, and a vehicle is stopped but functional, a first responder is able to quickly use recognizable controls to move the vehicle to a safe place. To my members, these are not symptoms of human-operated machinery, they are essential safety features. For first responders, the importance of these features cannot be understated. Unless and until AVs have demonstrated that they meet or exceed the level of safety provided today through human interaction and human-controls, our government should not allow AVs to be widely deployed.

We appreciate the Committee's focus on these important issues and strongly hope that any legislation under consideration will prioritize the needs of workers as AV technologies enter our workspace.

Sincerely,
Patrick J. Reynolds
President, TWU Local 1400

July 26, 2023

Re: Hearing on "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China"

Dear Members of the Subcommittee on Innovation, Data, and Commerce:

On behalf of the more than one million active and retired members of the UAW, thank you for this opportunity to share our perspective in response to the hearing on "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China."

UAW strongly urges the Subcommittee to reject legislation that would lead to more Autonomous Vehicles (AV) on the road or to the widespread use of self-driving technology without sufficient safeguards for public safety and union jobs. Congress should adopt an intentional and measured approach to fully understand the risk to public safety and to the union auto manufacturing workforce. Removing the current guardrails to simply make it easier for companies to test and produce AVs does not serve the public interest. This industry transition presents an opportunity to invest more in domestic manufacturing and to extend high standards for the workforce that have been long established by UAW members in this country. Any expansion of the testing or production of AVs should be conditioned on compliance with rigorous safety standards and a requirement that these vehicles be produced by a workforce under a collective bargaining agreement with industry prevailing wages and benefits for the duration of any testing period or demonstration program. If there is an AV transition, Congress must not allow it to be a race to the bottom.

Our comments will address three major areas of concern regarding AVs. First, it is critical that the U.S. lead in the manufacturing of advanced technology vehicles and avoid the mistakes of the past by relying on imports for AVs or key components. Second, AVs must be developed, manufactured, and deployed in a way that workers whose jobs are disrupted not only be held harmless, but can share in the gains by creating new quality union jobs. Finally, AV policy should be deployed as a public good that improves safety and mobility, not simply as a business model to replace workers and reduce labor costs, which is why policy must be shaped by substantial worker and community input. To address these issues, regulatory, procurement, safety, national security, and trade policy must be coordinated to ensure that technology benefits workers and creates quality union jobs.

Autonomous Vehicles, Strategic Components, and Infrastructure Must be Union-Made in U.S.

The auto industry drives manufacturing in our country and has played a significant role in creating and sustaining a strong middle class. American autoworkers are more diverse and more unionized than the

overall workforce.[1] Over 1 million people work in motor vehicle parts and manufacturing.[2] UAW members work at 26 light-duty vehicle final assembly plants in 8 states building vehicles for a wide variety of applications – from sports cars to work pickups. Additionally, the UAW represents auto parts workers throughout the country making engines, transmissions, stampings, axles, drivelines, seats, interiors, and other components. Beyond light-duty vehicles, UAW members build heavy-duty commercial, agricultural, aerospace, and defense vehicles, all of which may be impacted by AV technology. UAW members are proud to be building the vehicles of the future, including hybrids, plug-in hybrids (PHEVs), battery electric vehicles (BEVs), AVs, and increasingly efficient gasoline vehicles. Many UAW workplaces have or are slated to build advanced technology vehicles, including the Chevy Bolt-based Cruise AV in Orion, MI, and the future GM Cruise Origin AV shuttle in Detroit, MI.[3]

Much like electrification, the auto industry is investing billions to develop and deploy AV technology. This investment could reshape the industry's manufacturing footprint, raising important questions for auto workers. Will AVs and key components be made in the U.S., or will it result in a new wave of outsourcing? Will new AV jobs meet industry standards? Or will companies use new technologies as an excuse to erode industry job quality?

While the mass deployment of AVs remains far in the future, the development of AV technology presents an opportunity to re-invest in American manufacturing, with union workers making the vehicles of the future. But, to make sure this disruption does not leave American workers behind, policies that support or facilitate this new technology must be paired with a commitment to locate these jobs in the United States at comparable or better wages and benefits to the jobs they replace. Current examples, such as the semiconductor shortage or the race to catch-up with China on battery production, show the importance of building new technologies domestically from the start and avoiding a global race to the bottom based on outsourcing.

Promoting domestic production of AVs and key components will be especially important to help offset job disruptions from AV technology in manufacturing or transportation. The auto industry is already going through significant changes due to electrification. It is not yet known what impact AVs will have on demand for vehicle manufacturing – particularly if AVs radically change personal vehicle ownership patterns, utilization rates, and vehicle lifespans. As vehicles become more connected and complex, it is imperative that these vehicles and strategic components are manufactured in the U.S. and meet rigorous safety standards. These key components include semiconductors, sensors (lidar, radar, camera), lithium-ion battery cells, electric and data architecture, and electric motors. Exemptions to vehicle safety requirements should be highly targeted and ensure that manufacturers are not reducing vehicle content at the expense of public safety. Finally, AV data storage, analysis, and other remote tasks [i.e., remote driving, customer service] must be done domestically by well-trained union workers in order to create quality jobs and provide the highest levels of privacy and safety.

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[1] *See* Paul Prescod, Jacobin, We Need A Pro-Worker Transition to Electric Vehicles (Dec. 20, 2022) ("Black workers have long been overrepresented in auto employment and today make up 16.6 percent of autoworkers (as compared to 12.5 percent of workers in the economy as a whole)… Seventeen percent of autoworkers are under a collective bargaining agreement, while only 11.8 percent of the overall workforce is").

[2] *See* Bureau of Labor Statistics. *Automotive Industry: Employment, Earnings, and Hours*. Retrieved from: https://www.bls.gov/iag/tgs/iagauto.htm

[3] General Motors. "Factory ZERO, Our First Fully Dedicated EV Assembly Plant": https://www.gm.com/stories/factory-zero-first-dedicated-ev-plant

AV Jobs Must Be Good Jobs

Federal policy must ensure AV jobs are as good as or better than the jobs they are replacing, whether in manufacturing, transportation, or the public sector. Without a comprehensive worker- and community-centered approach to automated technology, we risk a mass deployment of AVs that hollows out jobs in sectors that have long provided quality union jobs. The U.S. government must fully assess these disruptions up front and develop mitigation strategies to increase in good union jobs.

Our AV policy must avoid the mistakes of the past by adopting a strategy that reverses decades of offshoring and declining unionization. The UAW is leading the transition to a cleaner and high-tech auto industry. UAW members are building light, medium, and heavy-duty electric vehicles (EVs), batteries, and the next generation of efficient and zero-emission vehicles. We are also doing our part to ensure advanced auto technologies result in quality union jobs by organizing the country's first union battery cell manufacturing plant, securing neutrality agreements with firms along the EV supply chain, and negotiating investment commitments of advanced technology vehicles and components in our collective bargaining agreements.

However, as we have seen with electrification, advanced technology does not automatically lead to quality jobs. In the transition to EVs, while the auto industry is investing over a trillion dollars globally on electrification,[4] major auto companies seek to use the transition to cleaner vehicles in order to roll back hard-fought gains, including by shuttering and offshoring manufacturing facilities, cutting wages, and fighting attempts to include new facilities under existing collective bargaining agreements. As the White House notes in its report on domestic supply chains, "the automotive battery plants that are in existence or are advertising for production workers ***pay much less than existing powertrain plants***, in the range of $17-21 per hour [emphasis added]."[5] And the UAW has found that health and safety practices in the battery industry fall far short of the standards in unionized auto manufacturing.[6]

Just as with EVs, we cannot let the industry use new AV technology, joint ventures, or new business models as an excuse to cut out workers, avoid collective bargaining, or reduce job quality across the industry. Whether in AV manufacturing or operations, the emerging AV industry must not be modelled on the "gig-economy". Unfortunately, there are troubling signs that AV companies are relying on contract labor rather than creating safe, high-quality jobs.[7] As noted in Dr. Koopman's written testimony, highly-skilled safety drivers and maintenance and operations technicians will be essential.[8] All jobs related to AV

[4] *See* Paul Lienert, Reuters, Exclusive: Automakers to Double Spending on EVs, Batteries to $1.2 Trillion by 2030 (Oct. 25, 2022).

[5] *See* The White House. *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth* (June 2021) at 120.

[6] *See* UAW. July 2023. "High Risk & Low Pay: Hazardous Conditions and Low Wages Show Standards Must Be Raised at Battery Cell Plants Getting Billions in Taxpayer Dollars": https://uaw.org/wp-content/uploads/2023/07/Ultium-White-Paper.pdf

[7] *See* The Verge. February 5, 2020. "Waymo workers complain about cuts to benefits and needles in self-driving cars": https://www.theverge.com/2020/2/5/21123049/waymo-self-driving-cars-workers-vendor-contracts-benefits-needles; and The Verge. October 5, 2020. "Waymo and Cruise safety drivers face a bleak choice: pandemic or pollution?": https://www.theverge.com/2020/10/5/21473719/waymo-cruise-self-driving-car-backup-safety-driver-pandemic-wildfires-california

[8] Koopman, Philip. July 2023. "Summary: Testimony of Dr. Philip Koopman": https://democrats-energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/IDC_Philip%20Koopman%2C%20Ph.D.%20Testimony_Self%20Driving%20Cars-AV%20Hearing_2023.07.26.pdf, p. 8

operations, whether it is remote drivers, customer service centers, maintenance & diagnostics, cleaning, or safety testing, must be direct hires that provide good wages, benefits, job security, and freedom to join a union. Developing an AV industry run by well-trained union workers is essential to protecting jobs and public safety.

Government, transit agencies, manufacturers, and operators that deploy AV technology should be required to do job impact assessments. Any federal money supporting deployment of AV technology should require job impact assessments, plans to mitigate job losses, and commitments that deployment will not result in out-sourcing, sub-contracting, or erosion of job quality. AV operators seeking approval to deploy or expand deployments should be required to detail training, pay and benefits, and commitments to union neutrality. And all incident reports should include details on the impacts on worker and public safety, as well as whether those impacts could have been avoided with greater human oversight.

Communities and Workers Must Have Input

Industry, analysts, and government officials have recognized that AVs have the potential to be disruptive and transformational. While disruptive technologies are often discussed in glowing terms – it is important to keep in mind that past disruptive technologies or business models have fallen well short of their promises. For example, ride sharing promised reduced congestion and greater opportunities for workers, when in fact, in many instances it did the exact opposite, increasing congestion and leading to more precarious jobs with no safety net. Without robust regulation and oversight, we risk a low-road deployment of AVs where companies take short cuts when it comes to jobs and public safety and the least responsible actors set the standards, disadvantaging actors adopting safe and responsible AV practices.[9] Establishing federal baselines is also crucial so that communities in are not pitted against each other to adopt the most lenient regulations to attract AV investments and should allow localities to adopt additional regulations and conditions on AV deployment.

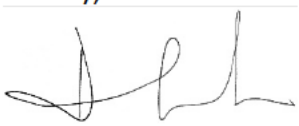
Considering the amount of public investment and required regulations needed to create the AV market, we have a collective obligation to get it right. That is why manufacturing and transit unions must have significant presence on all advisory boards, task forces, stakeholder committees, and all other consultative groups formed by public agencies. It is critical that this technology is developed and deployed, there is continuous stakeholder input that keeps the industry accountable to workers and communities.

Conclusion

The UAW fully supports the transition to a cleaner, safer, and more advanced auto industry. Proven automated technologies can improve transportation safety and mobility. However, robust regulations are essential to ensure AV technology works for workers and communities. There must be the full intention to maintain union-led standards long established in the auto industry, so we get it right. We cannot allow the AV industry to repeat the mistakes of the past, creating an industry based on outsourcing and the gig-economy.

[9] *See* Consumer Reports. July 18, 2021. "Tesla's 'Full Self-Driving' Beta Software Used on Public Roads Lacks Safeguards": https://www.consumerreports.org/car-safety/tesla-full-self-driving-beta-software-lacks-safeguards-a6698414036/

In unity,



Dawn A Le
Director, UAW Political and Government Affairs

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Assessing Readiness of Self-Driving Vehicles

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ABSTRACT

State agencies are increasingly faced with self-driving permit and licensing requests as self-driving operations expand. However, these expansions have led to congestion and problematic interactions with first responders, as well as increasing public distrust. To respond to these self-driving permit requests with evidence-based recommendations, government agencies need straightforward tools to help them objectively and holistically assess such requests. To this end, using self-driving disengagement data from California, as well as federal non-fatal and CA transportation network companies' crash reports, this effort demonstrates how the combination of human- and autonomy-initiated disengagements, coupled with non-fatal crash rates, can provide insight into assessing self-driving vehicle readiness for commercial operations. Additional results show that Cruise's and Waymo's robo-taxis in San Francisco are 4-8x more likely to be involved in non-fatal crashes, equivalent to the CA crash rates of Uber and Lyft. One major drawback to this approach is a lack of reporting by the majority of companies conducting self-driving operations on public roads in CA. This lack of reporting and companies' avoidance of publicly address emerging problems, while simultaneously claiming their technologies are superior to human drivers, suggests there are systemic problematic safety cultures in the self-driving community. If self-driving companies do not adopt more transparent and responsive safety practices, their non-fatal crash rates could continue to exceed that of human drivers. They also risk further eroding public sentiment, which could lead to further public rejection of what otherwise could have been a promising technology.

Keywords: Self-driving, readiness, crash rates, disengagements, robo-taxi, AV testing

INTRODUCTION

In the city of San Francisco, it is possible for the public to hail Cruise and Waymo robo-taxis to take them anywhere they want to go in the general area of downtown San Francisco. Waymo is similarly offering limited services in Arizona. Neither company has experienced any fatalities and only very few severe injuries [1]. Many herald these impressive accomplishments as the dawn of a new age of robotic transportation. However, closer inspection shows an industry in upheaval, with increasingly negative public opinion and serious questions about what it means to be a "safe enough" self-driving vehicle.

Both Waymo and Cruise self-driving vehicles have been involved in an increasing number of minor crashes in San Francisco, and even more problematic, travel lane impedances and unplanned stops are also on the rise, leading to difficulties for first responders. As both companies have tried to expand operations in San Francisco, public sentiment has turned increasingly against these operations due to the congestion and problems caused by vehicles freezing when they cannot negotiate a particular situation, a move known in the industry as a 'minimum risk maneuver [2].'

These incidents have grown in frequency and severity to the point that the city of San Francisco is attempting to manage a slower expansion of both companies' operations, citing threats to public safety [3]. In response, Waymo and Cruise launched a media campaign to sway public opinion by pointing out high fatality rates in cars in the US and asserting that their technologies provide safer transportation alternatives [4].

These issues are in sharp focus in California since that is currently where the bulk of self-driving testing occurs, but with increasing self-driving operations in Arizona, Texas, Nevada and other states, these issues will likely repeatedly resurface. In July 2021, NHTSA required companies to report crashes that occurred on public roads with autonomy engaged, or up to 30s prior to a crash [1], in an attempt to gather evidence about the status of self-driving technology. As a result, they worked with a handful of self-driving companies to issue voluntary recalls for problematic software, but NHTSA has generally let the states manage their self-driving operations through permits and licensing.

As a result, state agencies like Departments of Motor Vehicles will be increasingly faced with self-driving permit and licensing requests as self-driving operations expand, as well as the problems that can and have led to increasing public discontent. Currently, regulators at the state and federal levels make decisions about whether self-driving technologies are safe enough based on the notion of a safety case. When companies apply for a self-driving permit, they put forth a safety case argument, which is a written justification with supporting evidence that asserts they have achieved reasonably safe operations.

In the nascent world of transportation technologies that embed artificial intelligence, these safety cases can be ambiguous and more qualitative than quantitative. What government agencies need are straightforward tools to help them know whether a permit for self-driving testing and/or operations should be approved, and how to identify emerging trends that could negatively impact public safety.

The California Department of Motor Vehicles (CA DMV), on the front line of this new transportation frontier, developed one approach to safety case evaluation by instituting the requirement that self-driving companies with testing programs must report disengagements. Such events occur when a human safety-driver takes control due to an unplanned event or action, or the on-board autonomy stops working. Research has shown that disengagements are strongly associated with crashes [5, 6], so they could potentially flag emerging risks.

To extend this previous work and make the use of such metrics actionable in practice, this paper analyzes the most recent self-driving disengagement data from California, as well as federal crash reports including comparing human non-fatal crash rates to those of self-driving vehicles. This effort proposes that the combination of human-initiated and autonomy-initiated disengagements, when coupled with crash rates, can provide insight into when companies are ready to move from one permitting stage to the next. In addition, such metrics can flag possible emergent problems with testing and quality control, and also serve as leading indicators of companies with safety culture problems.

METHODS

To conduct this analysis, several different databases were used (Fig. 1). The disparate datasets were required to piece together a comprehensive dataset that could provide objective evidence as to the safety of current self-driving operations. This study focused on California data because it is the only state in the US that collects comprehensive data on autonomous vehicles (AVs), far more than the federal government. However, additional data was needed from federal datasets to complete the analysis, described below.

Figure 2 illustrates the basic stages of permitting for self-driving vehicles. Companies first test with a driver, then without, and then can move to driverless operations. Companies have the option of conducting 'drivered' self-driving trips, where a driver is present in the vehicle but in a supervisory role, allowing companies to charge for rides, while also building miles, data and experience. When conducting commercial operations, self-driving vehicle companies are effectively transportation network companies (TNCs).

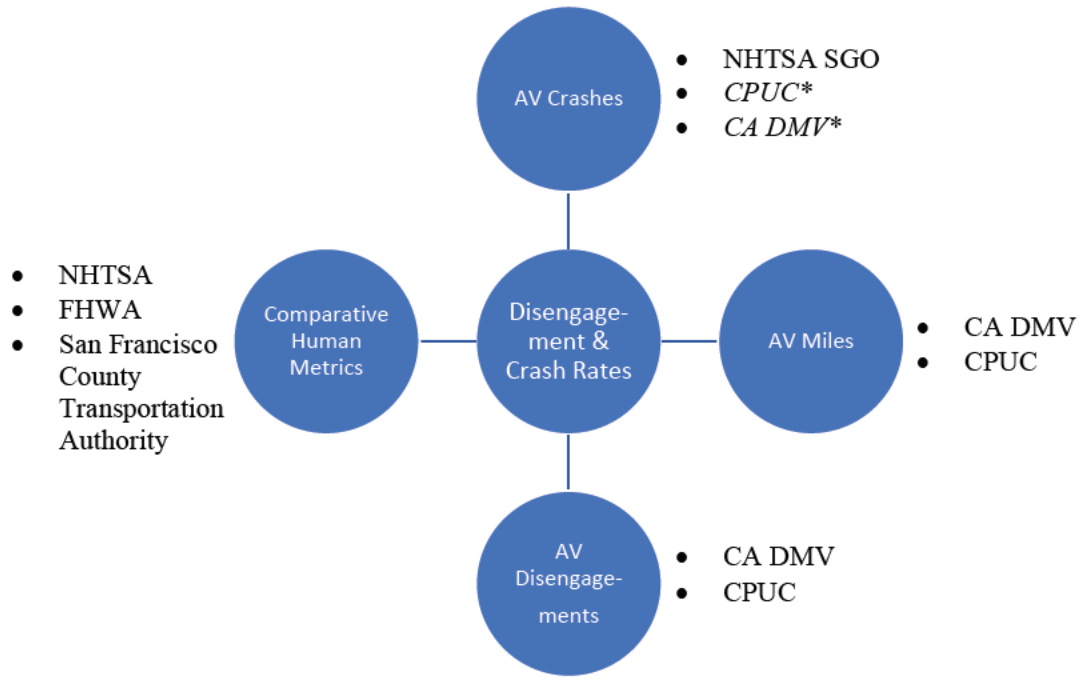


Figure 1 Sources of data for self-driving vehicle readiness assessment, * denotes redundant data

The CA DMV issues permits for autonomous vehicle testing and basic operations, so they maintain a list of companies that currently have testing and operational AV permits in CA [7]. Permits are issued for testing with safety drivers, testing with no drivers, and then for

driverless operations. As part of the permitting process, while in the testing phases, companies must provide annual reports of miles driven (both with and without autonomy), and the numbers and reasons for both human-initiated disengagements (HIDs) and autonomy-initiated disengagements (AIDs). CA DMV also requires that all testing permit holders report crashes that result in property damage, bodily injury, or death within 10 days of the incident. When companies graduate from testing, they no longer have to report this information.

Once a company obtains a driverless permit for operations in CA, the California Public Utilities Commission (CPUC) then issues commercial operating permits. So, to conduct self-driving business in CA, a permit for driverless operations from CA DMV must be obtained in addition to a permit from CPUC. While testing AVs in CA is not mandatory to obtain an operational permit in CA, a company would likely have an easier time of obtaining such a permit if there was evidence of safe testing. The CPUC also requires reporting [8], which includes miles and collisions, in addition to information about numbers of passengers carried, rejected trips, etc.

So, while miles driven for AVs in various phases of testing and operation (both drivered and driverless) can be taken from publicly-available CA DMV and CPUC reports, the number of collisions is not as straightforward. CA collision reports can include crashes that occurred under human manual control of the AV, and whether autonomy was a legitimate factor is not always clear. A better crash dataset is the NHTSA Standing General Order (SGO) dataset, which requires reporting of self-driving vehicles crashes that result in property damage or injury [1].

This dataset can also be sorted by the state, so just those crashes that occurred in CA can be isolated. Ideally the NHTSA SGO and CA DMV/CPUC datasets would be in agreement, but they are not, with more crashes in the CA database than in the SGO database. So, while it is possible to get crash data from the CA datasets, this analysis relied on the SGO data for crash reporting.

The last category of data gathered for this study was comparative human driver data. Crashes per 100 million vehicle miles travelled (VMT) is a long-standing metric used by the industry, and can be obtained for decades of years through both NHTSA crash reporting (through the Fatality and Injury Reporting System [9]), and the Federal Highway Administration's (FHWA) annual highway statistics [10]. This work used the 2021 data from both agencies, which are the most recent complete set of annual statistics. Because the self-driving companies are acting in a TNC capacity, it was also useful to examine comparative statistics about CA TNC collisions rates, supplied by the San Francisco County Transportation Authority [11].

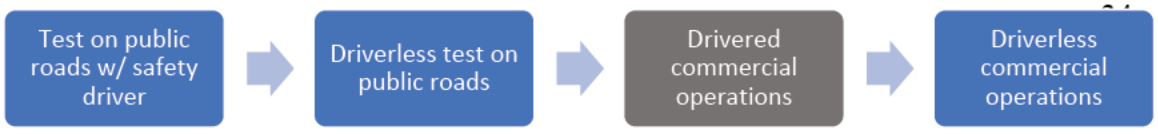


Figure 2 Typical progression of self-driving vehicle testing. Drivered commercial operations are optional.

RESULTS

Table 1 lists those companies with current CA permits that reported miles driven between December 2021 and November 2022 (the most recent publicly-available data) for three different types of self-driving: 1) Testing with a safety driver, 2) Driverless Testing, and 3) Driverless Operations. Mercedes Benz is a recent addition to the Driverless Operations group, not because of self-driving but because of its pending SAE Level 3 [12] product "Drive Pilot" that allows

drivers to be hands and eyes free during some portions of highway driving. The data discussed in this paper relates to only SAE Levels 4 and 5 testing efforts in Table 1. ArgoAI was not included since they have stopped self-driving development. The full list of companies with permits (but no reported miles) can be found on the CA DMV Autonomous Testing website [7]. It also should be noted that companies testing with a safety driver could be testing partial functionalities of self-driving systems.

CA DMV defines a disengagement as the deactivation of autonomy due to a detected failure of the autonomous technology or when a safety-driver or passenger/member of the public requires deactivation of the autonomy. In the 2022 CA DMV dataset, many companies reported zero human-initiated disengagements (HIDs), as well as zero autonomy-initiated disengagements (AIDs). A lack of AIDs reporting could be due to immature technology (e.g., a company is testing in shadow mode only), perfectly-performing technology, or unclear definitions (e.g., it is debated whether a vehicle that achieves a minimal risk condition is actually disengaging). HIDs could similarly be underreported when remote operators disengage the system but may not be reported as such since they are not physically in the vehicles. Thus, zero HIDs and AIDs reporting do not necessarily mean these companies had no disengagements.

There were three companies in the 2022 CA DMV dataset who reported no HIDs or AIDs: Apollo, Aurora, and Deep Route, marked in bold in Table 1. All three companies reported HIDs in the CA DMV 2021 data, but none in 2022. However, one company (Aurora) had very low miles in 2022 (26) and Deep Route only drove 761 miles, significantly less than the previous year (30,872). On the other end of the spectrum, Apollo drove almost four times as many miles from 2021 (638) to 2022 (2477) but reported no disengagements of any kind. This is particularly noteworthy since Apollo holds a permit to operate without safety drivers.

There were 14 companies that only reported HIDs in 2022 (marked with an asterisk in Table 1), and only 9 that reported both HIDs and AIDs (Fig. 3). The following sections will analyze these disengagements, as well as crash numbers, focusing primarily on those companies with deployment permits or permits to test without a driver. Companies with these permits, in theory, possess the most advanced technology so they set the bar by which other companies can be measured.

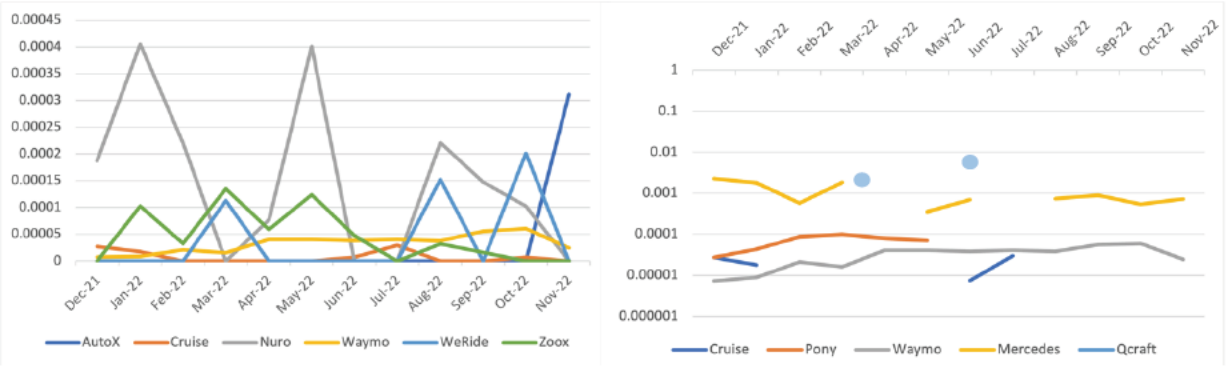
Human-Initiated Disengagements

Figure 3a depicts the average HIDs per all monthly miles driven in 2022 for companies with advanced permits conducting SAE Level 4/5 testing, which include commercial operations and testing without a safety driver. Even though these companies hold advanced testing permits, they still often test with a safety driver, especially for new software releases or when they are moving into new areas. For Fig. 3a companies, all companies generated miles all twelve months, and the line breaks in Figs. 3a and 3b mean that no disengagements were reported for that period. Completely missing from Fig. 3a is Apollo, who reported no HIDs for an entire year.

Lower numbers mean human safety drivers intervene less per mile, which for the companies in Fig. 3a, should be relatively low since they all have advanced permits and in theory, have relatively mature systems that are only being calibrated for software/hardware upgrades or new operational areas. It is important to remember that this metric is not an absolute performance or safety metric, as it can represent both an actual need to take over but could also be a measure of safety drivers' trust in their systems, since a takeover may not be needed. It also may be representative of a company's safety culture.

Table 1 Autonomous Vehicle Companies Testing & Operating in California

Testing w/ Safety Driver	Testing w/o Safety Driver	Deployment
• AIMotive Inc.* • **Apollo Autonomous Driving USA LLC** • Apple Inc. • **Aurora Operations, Inc.** • AutoX Technologies Inc.* • Bosch • Cruise LLC* • **Deeproute.AI** • DiDi Research America, LLC* • Gatik AI Inc. • Ghost Autonomy • Imagry Inc. • Mercedes Benz • Motional* • Nissan* • Nuro, Inc.* • NVIDIA Corp.* • Pony.AI* • Qcraft.AI • Qualcomm Technologies, Inc.* • Valeo North America, Inc. • Waymo LLC • WeRide Corp. DBA* • Woven Planet North America, Inc.* • Zoox Inc.*	• **Apollo Autonomous Driving USA LLC** • AutoX Technologies INC* • Cruise LLC* • Nuro, Inc.* • Waymo LLC • WeRide Corp.* • Zoox, INC*	• Cruise LLC* • Mercedes Benz • Nuro, Inc.* • Waymo LLC



(a) Advanced permit holders **(b) Commercial vs. top 3 safety-driver-only companies**

Figure 3 Example HIDS comparisons for CA DMV 2022 data

In Fig. 3a, Nuro has the most spikes in disengagements, which improve in the latter half of 2022. Waymo's HIDs/mile steadily rose throughout the year, but then fell in Nov. 2022, but still were higher than at the start of the year. Cruise and AutoX reported very few human disengagements, which may be concerning since it might indicate very little testing and

calibration is occurring. It is not realistic to think self-driving systems do not need any calibration for new areas or any software or hardware updates with test drives that could lead to human takeovers.

In addition to flagging unusual spikes and problems with not enough HIDs, another possible use of these data would be determining which companies might be ready to move to advanced permits. Ideally companies engaged in only testing would reach near-zero rates of human disengagements consistently before commercial deployment. Figure 3b compares those companies with the three lowest average annual HIDs/mile who are conducting only testing with a safety driver from the first column in Table 1 (Mercedes Benz, QCraft, and Pony) to the most advanced companies in the last deployment column (Waymo and Cruise). All companies generated miles all twelve months except for Pony.ai, who only drove the first six months of the reporting period.

Figure 3b, plotted on a log scale because of the large differences, demonstrates that Mercedes and QCraft are experiencing orders of magnitude more HIDs per mile. Pony.ai appears to have disengagement rates comparable to that of Waymo and Cruise, but this case demonstrates why HID rates are not enough to judge the performance of such systems. Pony.ai lost its permit to conduct driverless testing in CA in 2021 due to a crash and then lost its ability to conduct testing with a driver due to permit violations in 2022 [13], which is why the line prematurely ends.

In the Pony.ai case, if just the HIDs values were compared, the company would have appeared to be performing well and possibly well enough to conduct driverless operations. Thus, more data is needed for a comprehensive assessment. Understanding HIDs can only provide limited insight, the next section will examine the rate of autonomy-initiated disengagements, aka AIDs.

Autonomy-Initiated Disengagements

AIDs are a critical and necessary facet of self-driving operations. They demonstrate that a self-driving vehicle, on its own, can recognize a problem and either hand back control to the driver if there is one, or safely stop. For vehicles with safety drivers, this mitigation means handing control back to the driver. For vehicles without drivers in testing and operations, this could also mean turning control over to a remote operator, which is only safe at low speeds.

Only nine companies reported AIDs in the 2022 CA DMV dataset: Bosch, Apple, Gatik AI, Ghost, Intel, Mercedes-Benz, Qcraft, Valeo and Waymo. This lack of reporting makes assessing performance difficult, especially for regulatory agencies who need to determine whether public safety is at risk when these vehicles are deployed on public roads. For those nine compliant companies that reported AIDs, Fig. 4 illustrates the AIDs per mile rates over the 12-month period, with the rates plotted on a log scale due the large differences. The breaks mean zero disengagements were reported.

Not surprisingly, as the company with the longest history in self-driving development, Waymo, had the lowest rates of AIDs per mile. Mercedes Benz had a large spike in AIDs early in 2022 but then dropped to zero by the year's end. Indeed, for companies with active deployments like Waymo, regulators should expect low rates, but should be wary of companies who report zero disengagements for long periods of time. It is highly unlikely a company would not experience an AID for months on end, and reporting no disengagements suggests system upgrades and testing are not occurring with any regular frequency. Of course, the problem could

be that companies are experiencing disengagements but not reporting them due to problems with unclear definitions.

For those companies only conducting testing with safety drivers, these numbers indicate a clear performance measure that can be used to help determine permit status. Regulators should expect to see decreasing AIDs rates over time, with occasional spikes to indicate system upgrades. However, these spikes should decrease in magnitude over time for companies claiming to be ready to deploy. Figure 4 shows that of the companies with only safety-driver permits, Ghost and Bosch AIDs rates are very high. Bosch, a relatively new entrant to this fiend, had very low miles overall (769) and Ghost had several months of no testing, so these rates are not surprising. Apple did not appear to make significant progress over the year. Intel's performance was very sporadic and they also went several months without testing. Figure 4 indicates that QCraft and Gatik might soon be ready for driverless testing but both had low miles in 2022 (2589 and 1016 respectively), so more data is likely needed before a confident permitting

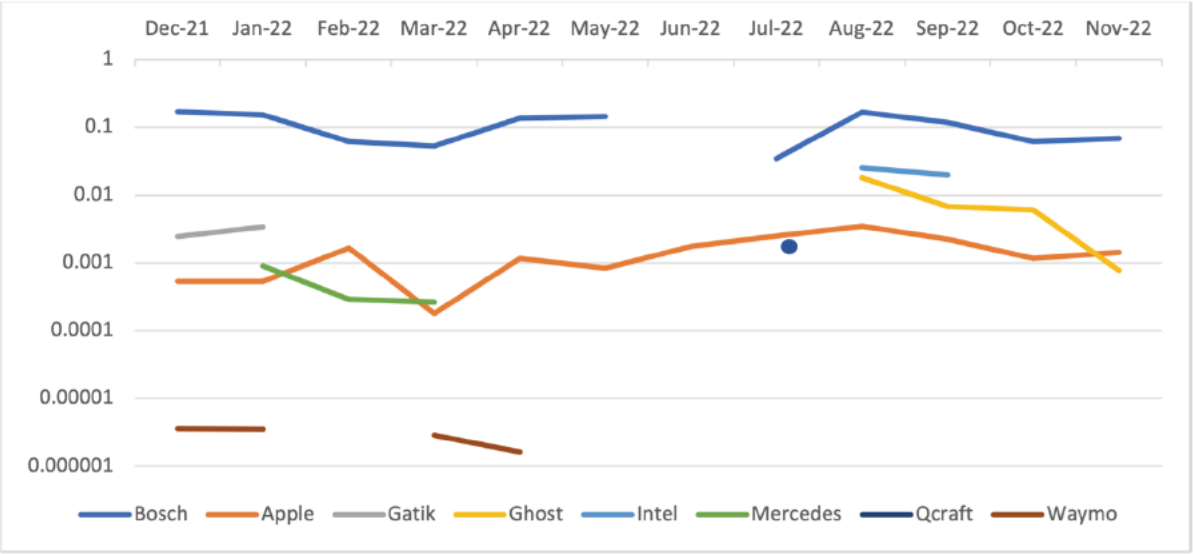


Figure 4 AIDs comparisons for CA DMV 2022 data

decision could be made.

The lack of AIDs reporting for the remaining companies is concerning, because such rates provide a more transparent metric to assess performance. Claims that assert vehicles with no manual controls cannot experience disengagements or that minimum risk maneuvers do not count as disengagements do not serve the public trust and potentially hide performance problems that regulators need to address.

For example, the high number of problems caused by Cruise and Waymo vehicles stopping in various phases of driving because of autonomy failures (which are legitimate but unreported disengagements) has led to San Francisco city officials' attempts to slow expansion of Cruise and Waymo programs [3]. However, without better disengagement reporting, the city does not have a clear record of the severity of the problem. This gap in reporting motivates the need for one more critical metric for regulators and government officials, which is crash reporting, detailed in the next section.

Crash Reports

Crash rates for self-driving companies can be computed by dividing the crashes that occur in CA in the DEC 21-NOV 22 time frame by those miles reported to the CA DMV (for vehicles engaged in testing) and/or to the CPUC in that same time frame for deployed vehicles.

Crash Rates for Companies with Deployment Permits

Figure 5 illustrates the CA SGO crashes for Cruise and Waymo for the 2022 data. Cruise began commercial driverless operations in June 2022, while Waymo conducted testing and drivered commercial operations throughout the year. To assess the 2022 performance of the deployed self-driving companies (not including Mercedes Benz Level 3 operations, which have yet to start), the numbers of crashes that occurred while in autonomous mode, both in testing and deployment, can be divided by those miles driven in those modes.

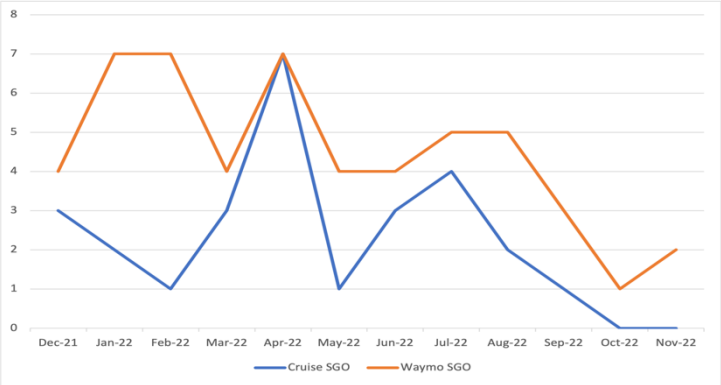


Figure 5 2022 NHTSA SGO crashes for Cruise & Waymo

The SGO does not gather miles driven so to calculate crashes per mile, the miles that companies must report to CA DMV and CPUC while in testing or operations can be used. In order to compare these crashes per mile to human drivers, similar crash rates are needed, which can be found using non-fatal crash rates. The average non-fatal crash data provided by NHTSA are police-reported crashes, which are commensurate with the SGO crashes that require reporting only in the cases of property damage or injury [1]. There is no fault or blame associated with these crashes, which is also true for the SGO.

Non-fatal crashes are mostly minor with fewer serious injuries, which is a better comparison for self-driving vehicles since there have been very few serious injuries for Waymo and Cruise and no fatalities. For 2021, the year with the most complete crash statistics, there were 5,458,644 non-fatal crashes, with a total of 2,322 billion VMT on all roads except interstates [9], which were excluded to more closely match the CA self-driving operational domain. This was as fine as the data could be parsed, and CA non-fatal crashes could not be isolated. This results in an overall average of 235 non-fatal crashes per 100 million VMT on roads other than interstates.

When a company's crash rate and the 235 non-fatal crashes per 100 million VMT are used to compute odds ratios (Table 2), an interesting picture emerges. While the self-driving crash numbers are small and aggregating miles across multiple agency documents could lead to under or overestimates, the trends carry important information. Cruise experiences 8 non-fatal crashes for every human non-fatal crash. Waymo, Cruise's main competitor, experienced a lower crash rate at 4x that of average drivers, but in 2022, they had not yet moved to driverless operations in CA.

While these non-fatal crash numbers are higher than average drivers not on interstates, another useful point of comparison is with TNC companies, since the operations are similar. To that end, the companies' self-driving collision numbers can be compared to Uber and Lyft

crashes reported in a recently-published document by the San Francisco County Transportation Authority examining CA ride-hailing performance [11]. The data from this report suggests that Uber and Lyft drivers are 4-10 times more likely to get in a crash than drivers not in a TNC, using 235 non-fatal crashes per 100 million VMT as the comparison point. So arguably, while Cruise and Waymo self-driving vehicles appear to be on par with non-fatal crashes occurring in similar human driving scenarios, these results beg an important regulatory question as to why such high crash rates are acceptable regardless of whether they are the result of human or robot actions?

Table 2 Dec. 21-Nov. 22 CA self-driving vehicle and 2021 human non-fatal non-interstate crash odds ratios. * indicates not statistically significant at alpha = .05.

Company	Dec21- Nov22 SGO Crashes	VMT	Crash Odds Ratio	Odds Ratio 95% Confidence Interval
Commercial Permits (All operational miles combined)				
Cruise	27	1478159	8:1	5-11
Waymo	53	5549530	4:1	3-5
Safety-Driver Testing Permits Only				
Apple	1	250191	2:1	.2-12*
Mercedes Benz	2	52975	16:1	4-64
NVIDIA	1	7169	59:1	8-421
Pony.ai	3	280412	5:1	2-14
Zoox	20	552133	15:1	10-24

Crash Rates for Companies with Testing Permits

The majority of companies testing with a safety driver have not experienced any reportable crashes via the SGO, which is to their credit. However, some have occurred, both in testing with and without drivers. Similar to the operational companies, the crash rates for the companies only conducting testing can be compared. Table 2 shows those calculations only for companies with crashes reported in the SGO from Dec. 21 – Nov. 22. Many of the confidence intervals are very large for companies like NVIDIA and Mercedes Benz, due both to low miles and low crash numbers. While Apple's crash rate comparison is not statistically significant, meaning it cannot be ruled out that Apple's crash rate is on par with humans, it illustrates why crash rates must be interpreted in light of the disengagement metrics. Their HID rate was .01 disengagements per mile, far more frequent that other companies, and as seen in Fig. 4, their AID rate is consistently high and possibly increasing. So, while the crash rate for Apple in Table 2 seems to be close to humans, it is because the safety drivers are frequently taking over.

The Zoox and Mercedes Benz numbers deserve more scrutiny because Zoox is testing without a driver and Mercedes Benz is set to deploy SAE Level 3 technology that may embed elements of the 2022 software that led to these crashes. Zoox reported no autonomy-initiated disengagements in 2022, which is not realistic so without such numbers, it is very difficult to assess the actual level of performance and safety for these systems. These crash rates

demonstrate that companies who report low human- or autonomy-initiated disengagements do not necessarily have impressive safety records.

DISCUSSION

In a series of surveys by the Pew Charitable Trust over the past ten years, public sentiment is increasingly against self-driving technology [14-16]. The recent local citizen uprising in San Francisco that led to the immobilization of self-driving cars when people placed orange cones on the cars' hoods is an obvious manifestation of this distrust [17]. Unfortunately, a hands-off approach to self-driving vehicle regulation meant to promote innovation may have had the opposite unintended effect. Because federal and state governments have not put safeguards in place to ensure public safety, the public, especially in San Francisco, increasingly rejects this technology.

This debate over whether self-driving vehicles are safe enough for widespread deployment in San Francisco, and more broadly around the country, has suffered from a lack of transparent and complete data. For example, Apollo Inc. reportedly is testing cars with no drivers in Sunnyvale and has reported no disengagements of any kind. This is likely impossible and suggests serious problems with their safety culture. To address such shortcomings, both state and federal regulatory agencies need evidence-based guidelines to help them assess whether a technology is ready for advanced stages of testing, like removing the safety driver, and also when it is advisable to allow companies to deploy and expand pilot self-driving operations. They also need the statutory authority to hold companies accountable when they are not in compliance with these reporting requirements.

To aid agencies in assessing self-driving vehicles, these results indicate that the combination of human- and autonomy-initiated disengagements, coupled with crash reports, can be used as a starting point for evidence-based decision-making. As a first step, data should be divided into those companies with deployment permits and those with testing permits, because there will be necessarily different expectations in performance. Table 3 lays out how the three metrics can notionally be used for these two layers of data analysis. This table serves as a starting point for discussions, with the expectation that as more data is generated, better guidelines can be established.

Companies in various testing stages will exhibit widely-varying capabilities, as seen in Figs. 3 and 4, so regulators should be looking for reasonable declines over time as opposed to specific thresholds until companies are ready to move to a more advanced permit. Arguably the *Assessment of Test Vehicles* phase could be broken into two categories, testing with and without safety drivers, but more data needs to be gathered to make more clear distinctions about metric differences between testing phases. Currently, the low crash numbers do not support such a split.

The metrics for the deployed vehicles are more specific and restrictive, since moving from testing to operations means broader exposure and higher risk for the public. For this group, ideally the disengagement rates would be very low for companies that have achieved commercial operations, but not zero since that would indicate a lack of quality control. Similarly, crash rates would be low, as well as the severity of any injuries. Investigation of crash risks that exceed the average human non-fatal crash rate, for example, is a risk mitigation technique meant to protect the public. One purported benefit of self-driving vehicles is their supposed ability to *lower* crash rates as compared to humans. If their rates continue to exceed that of humans, as they do in Table 2, and do not improve over time, then state and federal governments need to question the fundamental value of such systems.

In order for the HIDs, AIDs, and crash rate metrics to be informative, agencies should do the following:

- Mandate the reporting of these numbers with the penalty of permit withdrawal for offenders. This includes counting any premature termination of the autonomy, whether by a human or the system itself. Autonomy-initiated disengagements should also include when a vehicle (including those without traditional controls) executes a minimum risk condition.
- Develop automated systems that aggregate the reported data and post it on an easy-to-read dashboard that can be consulted by both agency officials and the public.
- Require self-driving companies to report major software upgrades so these events can be aligned with potential increases in disengagements.
- Require that companies who apply for permits specifically address their annual HIDs, AIDs, and crash rate metrics in each permit application.

Table 3 Recommendations for self-driving company assessment

	Human-initiated disengagements	Autonomy-initiated disengagements	Crashes	Meta-Analysis
Assessment of Deployed Vehicles	• Overall average should be relatively low[1] (~$2x10^{-5}$) • Spikes more than an order of magnitude should be investigated • Long periods of no disengagements could indicate a lack of quality control & testing.	• Overall average should be relatively low[2] (~$1x10^{-6}$) • A lack of reporting should not be tolerated and could be indicative of a poor safety culture.	• Rates can be assessed using NHTSA SGO or other crash reporting mandates. • As datasets grow, both non-fatal and fatal databases will provide additional insight. • Any rate greater than 1x human rate should be investigated.	• Ideally all three values would be low but there should always be some disengagements of both types to indicate mature testing practices and software/hardware updates.
Assessment of Test Vehicles	• Averages should generally decline over time, with a reduction in large spikes. • Long periods of no disengagements during active testing could indicate a lack of quality control or underreporting. • Rates of ~$1x10^{-4}$ would be expected for transition to driverless testing[3].	• Averages should generally decline over time, with a reduction in large spikes. • More evidence is needed for typical transition rates but a lack of reporting should prevent a driverless testing permit award.	• Rates should decline over time. • Rates above 10x human non-fatal crash average should not be awarded driverless testing permit.[4]	• Low crash rates should be cross-checked against both types of disengagements, as higher disengagement numbers could be the cause.

While these three metrics, taken in the aggregate, can help guide government agencies in making decisions about the viability of a self-driving operations, they are not the only metrics that should be considered. Self-driving vehicles are struck from behind at twice the rate of human drivers [1], if not more [18]. The companies are quick to blame human drivers, but these

higher-than-normal rates, coupled with many other similar incidents with Teslas while on Autopilot [19] suggest there is a significant phantom braking problem for all AVs that is flying under the proverbial radar.

Human drivers are often surprised by such dramatic decelerations for no obvious reason and may not be able to respond as quickly to an automated braking system that can engage far more quickly than humans. To better understand the scope of this problem, AV companies should be required to report all braking events that exceed -.5g, which is considered a hard braking event. With significantly more data, regulators will be able to understand the scope of the problem and develop mitigation plans.

In addition to hard braking events, companies should have to report the details surrounding vehicle retrieval events to state agencies. These events occur when a vehicle freezes for more than a few minutes, requiring external human intervention either in person or through a remote operator. The statements of San Francisco city officials indicate these events are likely leading to chaos and are potentially a threat to safety. However, without more specific data like frequency, duration, whether first responder vehicles were impeded, etc., it is not possible to judge the actual impact of such events. Self-driving companies have loudly asserted that their vehicles are safer than human drivers, so they should be more than willing to provide such data to demonstrate that the vehicles are not a threat to public safety.

LIMITATIONS

Since the CA DMV only releases the self-driving data once a year in the spring, the notional recommendations and conclusions in this paper are based on historical data and should be assessed through this lens. Given the year or more gap in time from these results, the performance of companies may have improved or declined. In addition, the non-fatal crash rate comparisons would be better if these data were available specifically in California.

For the 2022 data, there was a significant lack of reporting by the majority of companies with CA DMV permits. This lack of reporting makes it very difficult to make stronger conclusions and recommendations because companies do not want their operations to be scrutinized. It is also not clear whether the miles reported to CA DMV are independent from those reported to CPUC. For example, when a company allows employees to ride in self-driving cars, it is not clear whether those miles are reported to just one agency or both. In this study, it was assumed that all reports were independent, which gives the companies the greatest advantage but also could lead to underestimates of crash rates.

There was also misalignment between those crashes reported under the SGO program and those reported to CA state agencies. The reporting requirements should be better aligned so that crashes are properly attributed to either the human or computer driver. In addition, while the NHTSA and TNC crash rates are based on significant numbers of crashes and miles, the crash numbers as seen in Fig. 5 and Table 2 are low, which means the rates could change significantly as more data is received. That is why the recommendations in Table 3 are notional and expected to change over time.

CONCLUSIONS

Cruise and Waymo have shown in San Francisco that they can conduct robo-taxi operations at 4-8x the non-fatal crash rate of average US drivers, which is equivalent to that of TNC companies in CA. If self-driving companies are permitted to expand operations despite these numbers, state transportation agencies will be increasingly faced with self-driving permit

and licensing requests, as well as problems like vehicle retrieval events that can dramatically increase public distrust, like what has occurred in San Francisco.

The methodologies outlined in this effort demonstrate one way to assess companies' readiness to gain advanced testing or operational permits by examining both human- and autonomy-initiated disengagements alongside crash rates. Individually these metrics are limited, but when taken together they provide more cohesive insight into the capabilities of a company. While the number reported here are preliminary, they will only become more useful over time and with more data. However, a major drawback to this approach is a lack of reporting of these numbers, despite mandates to do so.

In CA, the only state to mandate disengagement reporting, the majority of companies did not report disengagement data, arguably because of unclear definitions. In addition, not one company addressed any of their crashes in their public-facing safety cases and/or voluntary safety self-assessments. A lack of public explanation as to how companies have mitigated known crash risks suggest systemic problematic safety cultures for all self-driving companies.

In order to address this performative safety issue, the federal government needs to mandate that every company have a 'Chief Test Engineer' that personally signs off on every new permit application as well as every software upgrade that affects vehicle control systems. Such a person exists for commercial aviation companies, who can point to historically low crash rates. By requiring the self-driving vehicle community to have more mature safety practices and clear lines of accountability, not only will crash rates drop but likely public sentiment would also significantly improve. If self-driving companies do not adopt more transparent and responsible safety practices, they could ultimately hobble what otherwise could have been a promising application of AI.

Lastly, while it is a noteworthy engineering accomplishment that Cruise and Waymo have achieved crash rates on par with that of the TNC industry, such high crash rates should not be tolerated regardless of who or what is operating these vehicles. NHTSA and other transportation researchers need to focus on the TNC crash problem to determine mitigations. For example, is required driver interaction with phones leading to distraction that causes such crashes? Furthermore, state agencies need to insist on reductions in crash rates for commercial TNC permits. Given that crashes are on the rise on US roadways, it should be unacceptable for TNCs to operate at such high crash rates.

ACKNOWLEDGEMENTS

Prof. Cummings provides advice to the California Department of Motor Vehicles via a contract with the University of California PATH Program. This paper was not funded by that contract or any other agency and solely expresses the opinion of the author. Thanks to the many reviewers who provided critical feedback.

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July 25, 2023

The Honorable Gus Bilirakis
Chair
House Subcommittee on Innovation, Data, and Commerce
U.S. House of Representatives
Washington, D.C. 20515

The Honorable Jan Schakowsky
Ranking Member
House Subcommittee on Innovation, Data, and Commerce
U.S. House of Representatives
Washington, D.C. 20515

Dear Chair Bilirakis and Ranking Member Schakowsky:

Ahead of the House Subcommittee on Innovation, Data, and Commerce's hearing titled "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China," I write to emphasize the importance of autonomous vehicles (AVs) for the future of mobility and to reiterate TechNet's strong support for passing bipartisan AV legislation in the 118th Congress to cement America's global competitive advantage in this evolving technology. Now, more than ever, TechNet believes that this cutting-edge technology can play an important part in America's efforts to provide more accessible means of transportation, improve safety on our roads and highways, and create countless new jobs related to AV construction, testing, and deployment. We greatly appreciate the attention of the Subcommittee to this matter.

TechNet is the national, bipartisan network of technology CEOs and senior executives that promotes the growth of the innovation economy by advocating a targeted policy agenda at the federal and 50-state level. TechNet's diverse membership includes dynamic American businesses ranging from startups to the most iconic companies on the planet and represents more than 4.5 million employees and countless customers in the fields of information technology, e-commerce, the sharing and gig economies, advanced energy, cybersecurity, venture capital, and finance.

AVs of all sizes and weight classes have the potential to enable tremendous societal benefits through increased safety and improved access to transportation, while reducing the inefficiency and error associated with human operators. For example, the U.S. reported a staggering 42,795 people died in motor vehicle traffic crashes in 2022. TechNet believes AVs are part of the solution for safer American roadways and that the federal government has a proper role to play in developing uniform standards that ensure the safe testing, deployment, and operation of autonomous

vehicles, as well as creating technology-neutral, market-based regulations that apply equally to all companies.

AV technology, which includes artificial intelligence, is rapidly evolving globally, especially in China, and we should not lose the opportunity to cement the United States as the premier leader in deploying this technology. Additionally, in the absence of a national framework, continued innovations in autonomous vehicle technology have led state legislatures and regulators to respond with many unnecessary burdens that are creating a 50-state patchwork of conflicting policies, which threaten the safe, uniform deployment of this technology on a national basis. Given how important the safe deployment of AV technology is to the American public, and to the innovation economy as a whole, we support AV legislation that is limited in scope on three core components necessary for safe deployment: preemption, exemptions, and expedited rule-making.

We appreciate the tireless leadership of Representatives Bob Latta (R-OH) and Debbie Dingell (D-MI) in developing legislation to pave the way for the safe and swift deployment of AVs throughout the country. Following today's hearing on these measures, we urge you to work together to advance a comprehensive, bipartisan measure on AVs this Congress. Time is of the essence in getting this done quickly and done right.

We appreciate your consideration of our views and look forward to working with you to advance American technology in the deployment of autonomous vehicles. Please do not hesitate to reach out if we, or our member companies, can be a resource to you and your staff.

Sincerely,

Peter Chandler

Peter Chandler
Vice President, Federal Policy and Government Relations

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July 26, 2023

Energy & Commerce Committee
Innovation, Data, and Commerce Subcommittee
118th Congress, Washington, D.C.

Dear Hon. Members of the Subcommittee on Innovation, Data, and Commerce:

I am a Professor of Law at the University of Miami School of Law. I focus my current research and writing on the law and regulation of automated vehicles. Reference is made to the hearing on "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China, on Wednesday July 26, 2023—10:30am, 2322 Rayburn House Office Building.

For ease of reference, I make comments on the "Self-Drive Act" (draft of July 19, 2023 (11:04 a.m.)) because it has line numbers included. The comments apply to any bill governing highly automated vehicles. Explanations for the suggested language appear following the proposed additions.

SUMMARY: A federal legislative framework for self-driving vehicles should promote equitable and fair distribution of risk from testing self-driving vehicle technology across all neighborhoods in a political subdivision of a State. Promoting equity is an important federal policy goal as indicated in the Justice40 Initiative. Testing of new technology should not occur without local input nor be concentrated in low-income areas and historically disadvantaged neighborhoods.

Federal legislation also should specify a uniform national standard for liability attribution from accidents involving highly automated vehicles because we have a national highway system. Specification of a uniform liability standard will conserve resources in federal courts because many plaintiffs pursue auto accident cases under diversity jurisdiction.

I suggest language below to address these concerns with a minimal number of additions. I would expect the National Highway Traffic Safety Administration (NHTSA) to address matters of detail for which this new statute would grant authority.

LANGUAGE: Insert on page 5 at line 4:

"(4A) EQUITABLE LOCAL TESTING PLANS. Notwithstanding paragraphs (1) and (2), a State or political subdivision of a State may condition testing of highly automated vehicles (including, without limitation, highly automated vehicle technology) on public roads or highways in any metropolitan statistical area upon approval by the applicable political subdivision(s) in the metropolitan statistical area of an equitable local testing plan appropriate for local conditions which, if implemented, would prevent disproportionate testing of highly automated vehicles (or highly automated vehicle technology) in low-income areas and other areas of concern such as historically disadvantaged neighborhoods. A State or political subdivision of a State may enforce compliance with such an equitable local testing plan by appropriate means, including administrative or judicially imposed fines and injunctions, and retraction of any testing licenses or permits previously granted. Parameters of an equitable local testing plan may not unreasonably limit (or operate to practically prevent) testing in any political subdivision of a State or in any metropolitan statistical area."

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On page 5, amend line 9 to read: "(e) COMMON LAW **AND PRODUCTS** LIABILITY.— "

On page 5 amend lines 13 and 16 by inserting after "common law" and "common law claims": "**or under State law relating to products liability**"

On page 5 at line 17 add: "**(3) DUTY OF CARE. Each highly automated vehicle manufacturer owes a duty of care with respect to the operation of its products and technology to other road users equivalent to the duty of care owed by a human driver under negligence standards of applicable State law. No owner/operator of a highly automated vehicle shall have contributory negligence or comparative fault for failure to act within the first 10 seconds after an automated driving system makes a request for a human driver to assume control over the vehicle. Contributory negligence or comparative fault, if any, after such 10 second period shall be determined based on the facts and circumstances of each case under applicable State law.**"

RATIONALE FOR SUGGESTED ADDITIONS: Permission for a local government to require an equitable local testing plan is appropriate to promote justice and fairness, consistent with the Justice40 Initiative. Note that the suggested addition does not mandate that all testing be conducted pursuant to a plan. It merely allows local governments to decide if such a plan is an appropriate tool to promote justice in their communities. Such an option should not be pre-empted by federal law for several reasons.

It is protective of public support for highly automated vehicle technology following an accident. The existence of such testing plans will counter any arguments made that the automated vehicle industry was targeting low-income persons or those in historically disadvantaged neighborhoods. Such a suggestion of targeting could result in needless social strife.

Avoiding even the appearance of targeting is particularly important because companies have a financial incentive to test in areas in which the expected accident costs are lower based on the lower expected earning power of an injured party in those areas. Historically, our national highway system was developed, in part, by discriminating against persons of color, particularly our African American citizens. We should not repeat the same grave injustice while developing a new transportation system. See Widen, William H., *Highly Automated Vehicles & Discrimination Against Low-Income Persons* (January 24, 2022). University of Miami Legal Studies Research Paper No. 4016783, North Carolina Journal of Law and Technology, Vol. 24, No. 1, 2022, Available at SSRN: https://ssrn.com/abstract=4016783.

Any federal statute should expressly preserve the ability to pursue a claim under State product liability statutes because state statutes can shape the contours of product liability law.[1] Any federal statute governing automated vehicles should include express clarification that any state laws relating to product liability are not pre-empted by federal law as a technical fix (and hopefully not a controversial one).

Specification of basic liability attribution rules for accidents involving highly automated vehicles will provide uniformity and certainty for our national highway

[1] For example, strict products liability entered the law of some States via statute and not common law decision. States provide for comparative fault in products liability cases by statute. The ability to bring a breach of warranty claim without privity of contract is governed by the Uniform Commercial Code (which is State law) and State statutes contain limitations periods applicable to product liability claims. A federal statute should not cast doubt over the continuing applicability of State statutes such as these via an overbroad scope of pre-emption with a carve-out limited to common law.

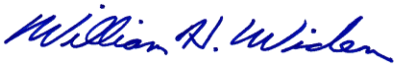
system rather than a patchwork across the states regardless of the attribution rule chosen. The suggestion for creation of a national duty of care owed by highly automated vehicle manufacturers for the operation of their computer driver technologies is the correct policy outcome for liability attribution because it uses tort law in its traditionally accepted way—by providing financial incentives for the least cost avoider to promote safety. The defendant in *Nilsson v. General Motors LLC*, Case No. 4:18-cv-000471-JSW (N.D. Cal. Mar. 30, 2018), admitted in the answer to the complaint that its vehicle owed a duty of care to other road users. This admission in a court filing suggests such an approach is both reasonable and balanced, as well as properly aligning tort law incentives to promote safety. See e.g., Koopman, Philip and Widen, William H., *A Reasonable Driver Standard for Automated Vehicle Safety* (June 10, 2023). Available at SSRN: https://ssrn.com/abstract=4475181; Widen, William H. and Koopman, Philip, *Winning the Imitation Game: Setting Safety Expectations for Automated Vehicles* (April 25, 2023). University of Miami Legal Studies Research Paper No. 4429695, Available at SSRN: https://ssrn.com/abstract=4429695.

Creation of a statutory duty of care to supplement statute law and clarify common law promotes judicial economy because it will allow a judge and a jury in most vehicle accident cases to fairly attribute liability based on their existing domain expertise with ordinary human driving situations. Many of these cases will appear in federal courts based on diversity jurisdiction. This specification of a duty of care uses the strengths of our existing judicial system rather than turning ordinary accident cases into complex product liability cases based on alleged defective design involving expensive expert testimony and analysis which is very difficult for ordinary persons to understand. Tracing accident causes to a system failure in a neural network used in a highly automated vehicle is particularly difficult given the opaque nature of a neural network (unlike a traditional algorithm).

Specification of a minimum reaction time within which contributory negligence or comparative fault may not be assessed is fair because of the well-known phenomenon of automation complacency. It is not reasonable to expect that a human driver can assume control over a highly automated vehicle the moment a takeover request is made. Available evidence suggests that in a driving environment, a 10 second period is a conservative lower limit. Widen, William H. and Koopman, Philip, *The Awkward Middle for Automated Vehicles: Liability Attribution Rules When Humans and Computers Share Driving Responsibilities* (May 10, 2023). University of Miami Legal Studies Research Paper No. 4444854, Available at SSRN: https://ssrn.com/abstract=4444854. Recognition of such a grace period to account for human reaction time is not a novel idea. In the report on the US Air accident in which a 737 made a water landing in the Hudson River, investigators included a 35 second delay in the post-crash analysis using simulations. National Transportation Safety Board. 2010. *Loss of Thrust in Both Engines After Encountering a Flock of Birds and Subsequent Ditching on the Hudson River, US Airways Flight 1549, Airbus A320-214, N106US, Weehawken, New Jersey, January 15, 2009*. Aircraft Accident Report NTSB/AAR-10 /03. Washington, DC.

More comprehensive language addressing liability appears in: Koopman, Philip and Widen, William H., *Liability Rules for Automated Vehicles: Definitions & Details* (May 10, 2023). University of Miami Legal Studies Research Paper No. 4444848, Available at SSRN: https://ssrn.com/abstract=4444848. I would be pleased to speak further.

Very truly yours,



William H. Widen

STATEMENT OF THE

AMERICAN ALLIANCE FOR VEHICLE OWNERS' RIGHTS

BEFORE THE
HOUSE ENERGY AND COMMERCE COMMITTEE'S
INNOVATION, DATA, AND COMMERCE SUBCOMMITEE'S
HEARING ON

"SELF-DRIVING VEHICLE LEGISLATIVE FRAMEWORK: ENHANCING SAFETY, IMPROVING LIVES AND MOBILITY, AND BEATING CHINA"

JULY 26, 2023

The undersigned organizations and companies of the American Alliance for Vehicle Owners' Rights ("AAVOR") respectfully submit this statement to the House Energy and Commerce Committee's Subcommittee on Innovation, Data and Commerce and ask that it be made part of the official hearing record for the July 26, 2023 hearing entitled "Self-Driving Vehicle Legislative Framework: Enhancing Safety, Improving Lives and Mobility, and Beating China."

Background on AAVOR

AAVOR is a diverse group of stakeholders united by the common goal of guaranteeing the right of all vehicle owners and users to have access to, and control of, the data generated by their vehicles. AAVOR's members represent interests from across the mobility ecosystem, including consumer advocates, fleet owners and operators, shared mobility service providers, preventative automotive maintenance and repair providers, insurers, automotive recyclers, and telematics providers.

Connection Between Vehicle Data Access and Autonomous Vehicles

The policy issue of the control – or "ownership" – of, and access to, the data generated by a motor vehicle – whether a car or a truck – by the owner of that motor vehicle is not solely an autonomous vehicle (AV) issue. It applies to the motor vehicles on the road today as well as

those that will be deployed in the coming decades. From AAVOR's point of view, getting a vehicle data access bill done and reaffirming the rights of vehicle owners to control vehicle generated data is a goal the members of the House Energy and Commerce Committee – and the entire Congress – should embrace. Whether vehicle data access for vehicle owners and those who have the owners' permission to access that data is addressed through AV legislation or another legislative vehicle is less important than achieving the goal of enactment of such an important new law.

"Right to Repair" Compared to Vehicle Data Access

Legislators must not confuse the issue of "right to repair", including a recent agreement struck between automakers and independent repair shops regarding access to repair and maintenance data, with comprehensive federal regulation of vehicle data access. Repair and maintenance data currently represents less than 25% of the data generated by today's vehicles. For AVs of the future that will be gathering data regarding the environment around the vehicle as well as the vehicle systems, a focus solely on repair and maintenance data is woefully inadequate. AAVOR urges legislators to craft federal legislation that addresses all vehicle data access, not just a small slice of the data being generated by today's and tomorrow's vehicles.

The "Road Ahead" for Vehicle Data Access

Vehicle generated data is the new frontier for the development of the future of mobility. Today's connected vehicles (cars, trucks and buses) offer consumers innovative new services, and bring significant downstream business development potential for all stakeholders in the on-road transportation sector, including, but not limited to, navigation (real-time localization/traffic information), infotainment (access to online movies/music), maintenance (fleet management/remote diagnostics/vehicle recovery), insurance (pay-as-you-drive/claim investigation), traffic efficiency (reduced congestion), sustainability (reduced fuel consumption), and safety.

However, this requires the right legal framework, which enables all stakeholders to access data generated by vehicles, starting with individual consumers and fleet owners, and extending through Original Equipment Manufacturers (OEMs), parts suppliers, vehicle

repairers, and the other many players across the entire transportation sector. This vehicle-generated data is related to nearly every aspect of the vehicle's operation and has been historically accessed through a physical "on-board diagnostics" (*e.g.,* OBD-II in passenger cars) port. A growing number of vehicles are transitioning to wireless access, bypassing the in-cabin, wired-access port and restricting access to vehicle-generated data by vehicle owners and third parties.

Vehicle-generated data – whether accessed through a wired port or wirelessly -- already provides many benefits to both consumers who own individual cars and companies that own dozens or thousands of vehicles. But these benefits will only be realized if vehicle owners: (1) retain the ability to securely access and control the data their vehicles (and equipment attached to their vehicles) generate, collect and store; (2) without artificial barriers that reduce consumer choice or competition; (3) in real-time through secure, technology-neutral, standards-based, in-vehicle access; and, (4) without obtaining consent from an entity that does not own or lease the vehicle.

AAVOR is convinced that Congress must take a lead role in guaranteeing vehicle owners and lessees access to and control of all data generated, collected and stored by vehicles. AAVOR supports enactment of federal policies that safeguard the rights of vehicle owners to:

- securely access and control their vehicle data (including authorizing access by third parties);
- directly, through in-vehicle access, in real-time;
- through a technology-neutral, standards-based, secured interface;
- that provides interoperable and bi-directional communication with the vehicle.

The rights of vehicle owners to control and access the data generated by their vehicles is too important to be left unaddressed by federal legislation. AAVOR supports federal efforts to establish a framework for securing the continued rights of vehicle owners – and entities that secure the express permission of vehicle owners -- to control and access vehicle-generated data on a real-time, secure and competitive basis.

AAVOR appreciates the opportunity to submit this statement to the Committee today and looks forward to working with its leadership and members to secure enactment of federal vehicle data access legislation in the near future. If you have questions about AAVOR's views on the issues covered in these comments or other policy matters related to vehicle data access, competition, consumer protection or privacy, please do not hesitate to contact Greg Scott at 202-297-5123 or at gscott@aavor.org.

American Car Rental Association

American Property Casualty Insurance Association

Automotive Oil Change Association

Automotive Recyclers Association

Consumer Action

NAFA Fleet Management Association

Owner-Operator Independent Drivers Association

Geotab, Inc.

Lytx, Inc.

Safelite Group, Inc.

ACTIVE TRANSPORTATION ALLIANCE

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July 26, 2023

Congresswoman Jan Schakowsky
2408 Rayburn Building
Washington, DC 20515

Dear Congresswoman Schakowsky,

Active Transportation Alliance supports requiring Autonomous Vehicles to be vision tested to protect venerable roadway users. We ask that you not support any bill that sets up a regulatory framework that does not include a vision test to ensure that the vehicle can detect and respond to bicyclists, pedestrians, and other vulnerable road users.

Active Transportation Alliance is a Chicagloand civic advocacy organization whose mission is to advocate for walking, bicycling, and public transit to create healthy, sustainable, and equitable communities. Active Transportation Alliance places at the center of its concerns those of vulnerable road users. Active Trans frequently hears from families of fatal crashes that involves vehicles, bikes, and pedestrians.

According to the local web publication Streetsblog Chicago as of July 17, 2023, there have been 16 pedestrian fatalities and 3 bicyclist fatalities on Chicago's streets this year. Active Transportation Alliance is frequently approached by the families and friends impacted by roadway fatalities seeking guidance on how to advocate for vulnerable users.

Twenty percent of all our roadway fatalities are bicyclists and pedestrians. If we are to reduce those fatalities we need to make sure that the new technologies are developed with vulnerable road user safety in mind. Manufacturers will create vehicles that match the safety standards Congress sets, **so we ask that you please ensure that any regulatory framework legislated by Congress includes safety standards that explicitly require testing for the safety of vulnerable road users.**

Sincerely,

ACTIVE TRANSPORTATION ALLIANCE

W. Robert Schultz, III, J.D, (he/him/his)
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Don't miss our once-a-year event on Sept. 3 when people on bikes have DuSable Lake Shore Drive all to themselves. Whether you're new to biking or a seasoned rider, Fifth Third Bike the Drive is an event to remember.

STATEMENT OF THE

AMERICAN ALLIANCE FOR VEHICLE OWNERS' RIGHTS

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Legislators must not confuse the issue of "right to repair", including a recent agreement struck between automakers and independent repair shops regarding access to repair and maintenance data, with comprehensive federal regulation of vehicle data access. Repair and maintenance data currently represents less than 25% of the data generated by today's vehicles. For AVs of the future that will be gathering data regarding the environment around the vehicle as well as the vehicle systems, a focus solely on repair and maintenance data is woefully inadequate. AAVOR urges legislators to craft federal legislation that addresses all vehicle data access, not just a small slice of the data being generated by today's and tomorrow's vehicles.

The "Road Ahead" for Vehicle Data Access

Vehicle generated data is the new frontier for the development of the future of mobility. Today's connected vehicles (cars, trucks and buses) offer consumers innovative new services, and bring significant downstream business development potential for all stakeholders in the on-road transportation sector, including, but not limited to, navigation (real-time localization/traffic information), infotainment (access to online movies/music), maintenance (fleet management/remote diagnostics/vehicle recovery), insurance (pay-as-you-drive/claim investigation), traffic efficiency (reduced congestion), sustainability (reduced fuel consumption), and safety.

However, this requires the right legal framework, which enables all stakeholders to access data generated by vehicles, starting with individual consumers and fleet owners, and extending through Original Equipment Manufacturers (OEMs), parts suppliers, vehicle

repairers, and the other many players across the entire transportation sector. This vehicle-generated data is related to nearly every aspect of the vehicle's operation and has been historically accessed through a physical "on-board diagnostics" (*e.g.,* OBD-II in passenger cars) port. A growing number of vehicles are transitioning to wireless access, bypassing the in-cabin, wired-access port and restricting access to vehicle-generated data by vehicle owners and third parties.

Vehicle-generated data – whether accessed through a wired port or wirelessly -- already provides many benefits to both consumers who own individual cars and companies that own dozens or thousands of vehicles. But these benefits will only be realized if vehicle owners: (1) retain the ability to securely access and control the data their vehicles (and equipment attached to their vehicles) generate, collect and store; (2) without artificial barriers that reduce consumer choice or competition; (3) in real-time through secure, technology-neutral, standards-based, in-vehicle access; and, (4) without obtaining consent from an entity that does not own or lease the vehicle.

AAVOR is convinced that Congress must take a lead role in guaranteeing vehicle owners and lessees access to and control of all data generated, collected and stored by vehicles. AAVOR supports enactment of federal policies that safeguard the rights of vehicle owners to:

- securely access and control their vehicle data (including authorizing access by third parties);
- directly, through in-vehicle access, in real-time;
- through a technology-neutral, standards-based, secured interface;
- that provides interoperable and bi-directional communication with the vehicle.

The rights of vehicle owners to control and access the data generated by their vehicles is too important to be left unaddressed by federal legislation. AAVOR supports federal efforts to establish a framework for securing the continued rights of vehicle owners – and entities that secure the express permission of vehicle owners -- to control and access vehicle-generated data on a real-time, secure and competitive basis.

AAVOR appreciates the opportunity to submit this statement to the Committee today and looks forward to working with its leadership and members to secure enactment of federal vehicle data access legislation in the near future. If you have questions about AAVOR's views on the issues covered in these comments or other policy matters related to vehicle data access, competition, consumer protection or privacy, please do not hesitate to contact Greg Scott at 202-297-5123 or at gscott@aavor.org.

American Car Rental Association

American Property Casualty Insurance Association

Automotive Oil Change Association

Automotive Recyclers Association

Consumer Action

NAFA Fleet Management Association

Owner-Operator Independent Drivers Association

Geotab, Inc.

Lytx, Inc.

Safelite Group, Inc.