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Safety Considerations for Automated Passenger Vehicles

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SUMMARY

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Safety Considerations for Automated Passenger Vehicles

Automated vehicle technologies offer a range of driver support functions that some stakeholders assert may improve traffic safety. These technologies vary in their capabilities and current stages of development. Select automation technologies are currently available in many privately owned passenger vehicles, while vehicles with automation technologies allowing for reduced or no driver responsibility are generally limited to specific services in select cities in Arizona, California, Georgia, and Texas.

Motor vehicle crashes are a leading cause of death in the United States, and several stakeholders—including automotive companies, regulators, and safety advocates—have attempted to mitigate crash frequency through various measures, including the standardization of safety technologies. Advocates of automated vehicle technologies suggest that these technologies could lower the traffic fatality rates in the United States if they are more widely adopted. However, there is a lack of consensus on the evaluation criteria and safety benefits of automated vehicle technologies. Selected studies have evaluated the performance of these technologies compared to human drivers, but the scope and results of these evaluations vary. Stakeholders from the automotive and technology industries identify automated vehicles as a mechanism to bolster driver safety in the near term. Safety advocacy groups see potential safety benefits of automated vehicles and generally advocate for more testing and stringent evaluations before implementing the technologies. Meanwhile, the extent of consumer confidence and trust in automated vehicle technologies may affect consumer demand for them.

The National Highway Traffic Safety Administration (NHTSA), a part of the Department of Transportation (DOT), is the federal agency primarily responsible for overseeing the safe deployment of automated vehicle technologies in passenger vehicles. NHTSA has several responsibilities, including establishing Federal Motor Vehicle Safety Standards (FMVSS), conducting investigations, issuing recalls, and rulemaking. FMVSS are a means to ensure safety in performance and design, but the standards are primarily designed around human-driven vehicles. This may limit aspects of the development of automated vehicles. NHTSA uses its investigative and recall powers to evaluate the safety of vehicles and has investigated and recalled vehicles equipped with automated vehicle technologies. NHTSA has proposed several rules and finalized one rule related to automated vehicle technologies.

State governments have taken a variety of approaches to regulating automated vehicles with limited guidance from NHTSA. Congress has provided direction related to automated vehicles through surface transportation reauthorization and annual appropriations acts. Such efforts include grant programs that may support the deployment of automated vehicles and studies on the status of automated vehicle technologies and federal readiness. Between the 114th and 119th Congresses, Members introduced legislation to adjust FMVSS for automated vehicle technologies, establish an advisory council for the safe implementation of automated vehicle technologies, create additional grant programs that may support automated vehicle deployments, alter exemption requirements for automated vehicles, and establish programs to facilitate the deployment of automated vehicle technologies.

Congress may opt to evaluate the development of this technology and requirements for its safety and to engage in congressional oversight. Legislative options include directing NHTSA to adjust the performance and design evaluation of automated vehicles, altering the data reporting requirements for automated vehicles, standardizing certain automated vehicle technologies, instituting programs to educate drivers on the proper use of the technology, and expanding research programs for these technologies. Congress may also continue with the status quo or opt to scale back federal activity or requirements.

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Introduction

Vehicle safety has been a focus of congressional activity in surface transportation authorization legislation for many years. Beyond oversight of the Department of Transportation's (DOT's) National Highway Traffic Safety Administration (NHTSA), which oversees the safe deployment of passenger vehicles, Members have explored the role of technology in increasing transportation safety and providing additional driver services. Multiple companies are testing and deploying various levels of automated vehicle technologies on public roads in the United States, leading to policy questions regarding the appropriate role of these technologies in vehicles and whether existing statute and regulation sufficiently encompass a changing technological landscape. Some stakeholders argue that automated vehicle technologies could reduce traffic-related injuries and fatalities and have urged Congress to support further testing and deployment. Other stakeholders have expressed concern about the extent of vehicle automation and have urged Congress to do more to oversee the testing and deployment of such technologies.

Automated vehicle technologies range from those that assist drivers to those that aim to operate the vehicle without a human backup driver. The responsibilities of and potential need for a human driver vary depending on these capabilities. Driver assistance technologies that support the driver include features such as cruise control, lane departure warnings, lane centering assistance, and parking assistance. In vehicles with these technologies, the human driver generally has similar responsibilities as in a vehicle with no automated vehicle technologies. More advanced automated vehicle technologies can operate a vehicle without any human intervention. Many traffic and safety standards were developed around human-driven vehicle designs, and their applicability in the context of a range of human responsibility in automated vehicles may present challenges.

Driver assistance technologies are available in many vehicles. Other, more advanced automated vehicle technologies are in the development stage. Manufacturers lack consensus regarding the design standards and safety implications of these developing technologies. The range of potential approaches challenge uniform evaluation of such technologies and their relationship to automated vehicle safety.

This report focuses on the safety of automated vehicle technologies in passenger vehicles and a range of these vehicle technologies. It addresses all levels of automation but focuses on policy issues relevant to higher levels of automation. The report provides an overview of federal legislation related to automated passenger vehicles and discusses the role of NHTSA in the safe deployment of passenger vehicles. The report also discusses options for how Congress could respond to or shape automated vehicle development and deployment.

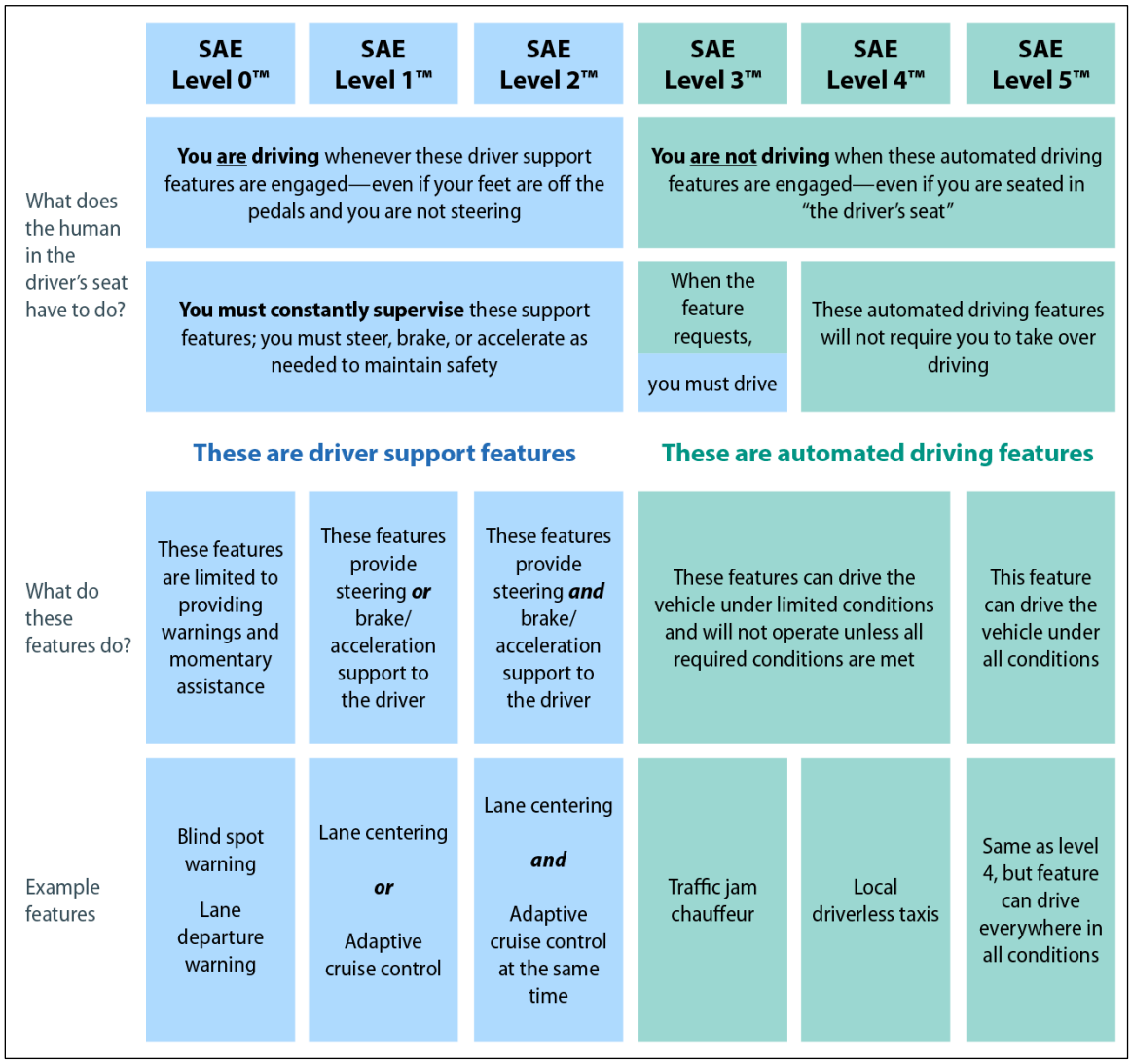
Defining Automation

Automated vehicle technologies are associated with different driver responsibilities and capabilities than human-operated vehicle technologies. Some forms of automated vehicle technology require full driver engagement, while more advanced forms operate the vehicle with no human engagement. Most stakeholders commonly reference SAE International's taxonomy on driving automation when discussing the capabilities of automated vehicle technologies,[1] as shown

[1] SAE International, "Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles," SAE J3016, April 30, 2021, https://www.sae.org/standards/content/j3016_202104/. SAE International was formerly known as the Society of Automotive Engineers.

in **Figure 1**. NHTSA recognizes SAE International's levels of automation and has used this terminology in proposed rules and guidance documents.[2]

Figure 1. Levels of Vehicle Automation



Source: Figured created by CRS from SAE International, "SAE Levels of Driving Automation™ Refined for Clarity and International Audience," May 3, 2021, https://www.sae.org/blog/sae-j3016-update.

Notes: *Adaptive cruise control* automatically adjusts the vehicle's speed to keep a preset distance between it and the vehicle in front of it. *Automatic emergency braking* provides momentary braking assistance, whereas adaptive cruise control provides sustained braking and acceleration support. *Traffic jam chauffeur* is a technology that operates the vehicle in specific conditions, locations, and speeds without the assistance or supervision of the driver. No Level 5 vehicles are commercially available.

Level 0 through Level 4 automated vehicle technologies are in different stages of implementation and development. Level 5 automation, or "full automation," is in development and has not been deployed. Level 0 technologies are widely implemented in passenger vehicles with features such

[2] For example, see National Highway Traffic Safety Administration (NHTSA), "Automated Vehicles for Safety," 2021, https://www.nhtsa.gov/vehicle-safety/automated-vehicles-safety.

as automated emergency braking (AEB),[3] blind spot warning,[4] and lane departure warning.[5] Level 1 technologies are available in many vehicles and include driver assistance systems, such as lane centering[6] and adaptive cruise control.[7]

Automotive and technology companies have implemented Level 2 and Level 3 automation in privately owned passenger vehicles. Level 2 and 3 vehicles require driver supervision or intervention, which necessitates that the vehicle have a traditional design with conventional manual controls, such as a steering wheel, driver's seat, and gas and brake pedals.[8] Level 2, also known as "partial automation," was introduced in commercially available passenger vehicles in the mid-2010s.[9] Partial automation uses a combination of Level 1 technologies and requires the driver to support the operation. For example, a combination of lane centering and adaptive cruise control might be considered a Level 2 technology.

Level 3 automation, or "conditional automation," is available in select passenger vehicles and was first introduced in 2021.[10] Conditional automation can operate in specific geographies or traffic conditions without requiring driver intervention. Level 3 requires the driver to resume control when the technology is outside of its limited operating parameters.

Level 4 automation, or "high automation," is used in limited deployments, such as taxis or ride-hailing services in certain cities in Arizona, California, Georgia, and Texas.[11] Highly automated vehicles may be designed to not require a human to operate the vehicle at any point, which could make vehicle design elements, such as a steering wheel, pedals, or a driver's seat unnecessary.

[3] Automatic emergency braking (AEB) systems apply the vehicle's brakes automatically in time to avoid or mitigate an impending forward crash with another vehicle; NHTSA, "Driver Assistance Technologies," May 22, 2025, https://www.nhtsa.gov/vehicle-safety/driver-assistance-technologies.

[4] Blind spot warning systems alert drivers with an audio or visual warning if there are vehicles in the driver's blind spots; NHTSA, "Driver Assistance Technologies."

[5] Lane departure warning systems monitor lane markings and alert the driver when they detect that the vehicle is drifting out of its lane; NHTSA, "Driver Assistance Technologies."

[6] Lane centering assistance provides continual steering to keep the vehicle centered in its lane; NHTSA, "Driver Assistance Technologies."

[7] Adaptive cruise control automatically adjusts the vehicle's speed to keep a preset distance between it and the vehicle in front of it; NHTSA, "Driver Assistance Technologies."

[8] John L. Campbell et al., *Human Factors Design Guidance for Level 2 and Level 3 Automated Driving Concepts*, NHTSA, August 2018, pp. 8-9, https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/13494_812555_l2l3automationhfguidance.pdf.

[9] Fred Lambert, "Understanding Tesla's Self-Driving Features: The Autopilot," *electrek*, June 16, 2015, https://electrek.co/2015/06/16/understanding-teslas-self-driving-features-the-autopilot/.

[10] Honda, "Honda to Begin Sales of Legend with New Honda SENSING Elite," press release, March 4, 2021, https://global.honda/en/newsroom/news/2021/4210304eng-legend.html.

[11] Waymo, "Scaling Waymo One Safely Across Four Cities This Year" (blog), March 13, 2024, https://waymo.com/blog/2024/03/scaling-waymo-one-safely-across-four-cities-this-year; Stephanie Brinley, "Self-Driving Cars Gain Momentum in the US," *S&P Global Mobility*, September 9, 2024, https://www.spglobal.com/mobility/en/research-analysis/self-driving-cars-gain-momentum-in-us.html; and Pete Bigelow, "With Cruise on Off-Ramp, Here's the Status of Remaining Robotaxi Players," *Automotive News*, December 11, 2024, https://www.autonews.com/technology/an-robotaxi-waymo-after-cruise/.

Passenger Vehicle Safety

Vehicle crashes are a leading cause of death in the United States; an estimated 39,345 people died in traffic crashes in 2024.[12] Historical data on roadway fatalities are presented in **Figure 2**.[13] Automotive companies, regulators, researchers, safety advocates, and other stakeholders have attempted to mitigate crash frequency and traffic fatalities with vehicle technologies and standards, among other strategies.

NHTSA oversees the safe deployment of passenger vehicles and addresses traffic safety issues through various measures, including issuing safety standards and engaging with automotive companies on best practices. The implementation and standardization of safety technologies such as seat belts, airbags, and electronic stability control contributed to the decrease in roadway fatalities from the 1960s to the 2010s.[14] Some industry stakeholders believe that automated vehicle technologies may further improve traffic safety, while many safety advocates believe that further evaluation of automated vehicle technologies' performance is necessary.[15]

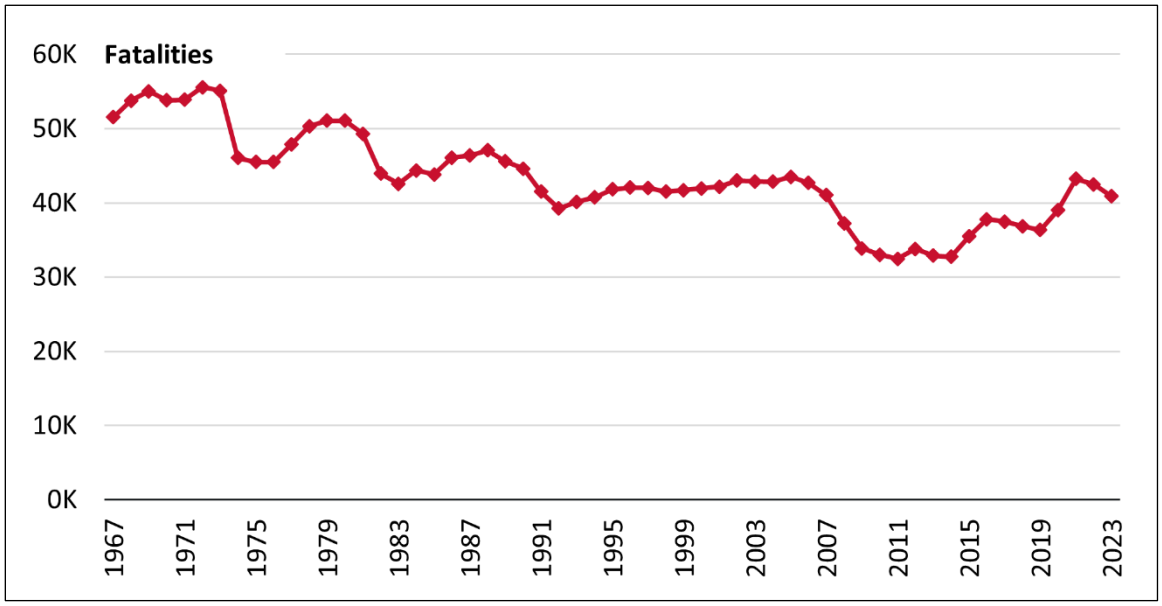
[12] CDC, "About Transportation Safety," November 19, 2024, https://www.cdc.gov/transportation-safety/about/index.html; and NHTSA, *Early Estimate of Motor Vehicle Traffic Fatalities in 2024*, DOT HS 813 710, April 2025, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813710.

[13] CDC, "About Transportation Safety."

[14] NHTSA, "Seat Belts," accessed February 4, 2025, https://www.nhtsa.gov/vehicle-safety/seat-belts; NHTSA, "Vehicle Air Bags and Injury Prevention," accessed February 4, 2025, https://www.nhtsa.gov/vehicle-safety/air-bags; and Caitlin N. Webb, *Estimating Lives Saved by Electronic Stability Control, 2011-2015*, DOT HS 812 391, March 2017, https://crashstats.nhtsa.dot.gov/Api/Public/Publication/812391.

[15] For example, see testimony of Jeff Farrah, CEO, Autonomous Vehicle Industry Association, in U.S. Congress, Senate Committee on Commerce, Science, and Transportation, Subcommittee on Surface Transportation, Maritime, Freight and Ports, *Examining the Roadway Safety Crisis and Highlighting Community Solutions*, 118th Cong., 2nd sess., May 21, 2024, pp. 2-11, https://www.commerce.senate.gov/services/files/2EE4A8CF-59BE-4267-8B4F-EC78A68B1F5D; and Testimony of Catherine Chase, President of Advocates for Highway and Auto Safety, in U.S. Congress, House Transportation and Infrastructure Committee, Highways and Transit Subcommittee, *The Future of Automated Commercial Motor Vehicles: Impacts on Society, the Supply Chain, and U.S. Economic Leadership*, 117th Cong., 2nd sess., September 13, 2023, https://democrats-transportation.house.gov/download/cathy-chase-testimony.

Figure 2. U.S. Traffic Fatalities, 1967-2023



Source: Figure created by CRS using data from Federal Highway Administration (FHWA), "Motor Vehicle Traffic Fatalities, 1900 – 2023 National Summary," April 2025.

Note: The most recent year for which data are available is 2023.

Evaluating the Safety of Automated Vehicles

Automotive manufacturers and regulators may face challenges in evaluating the safety of automated vehicle technologies. Level 0 and Level 1 technologies have been widely available in passenger vehicles for years and are standardized in their certification. Level 2 through Level 4 automated vehicle technologies have been in development since the mid-2010s and do not have a standardized mechanism for evaluating the safety of these technologies. These evaluation limitations have led to varied research on the safety of Level 2 through Level 4 vehicle technologies. Additionally, the public perception of these technologies has remained inconsistent, with some citing perceived safety concerns.

Evaluation Limitations

In many cases, universities and research institutes have partnered with automated vehicle developers to evaluate and verify the safety of automated vehicle technologies. These stakeholders have not reached consensus on a preferred method to assess the safety of such technologies.[16] This lack of consensus on safety evaluation methods, among other factors, has led

[16] Huei Peng and Roger L. McCarthy, *Mcity ABC Test: A Concept to Assess the Safety Performance of Highly Automated Vehicles*, Mcity, January 2019, https://mcity.umich.edu/wp-content/uploads/2019/01/mcity-whitepaper-ABC-test.pdf; Megan Tsai, "To Make Autonomous Vehicles Safer, Researchers Team Up to Achieve Next-Level Safety Testing," University of Minnesota Center for Transportation Studies, July 17, 2024, https://www.cts.umn.edu/news-pubs/news/2024/july/autonomous; and Shuo Feng et al., "Safety Assessment of Highly Automated Driving Systems in Test Tracks: A New Framework," *Accident Analysis & Prevention*, vol. 144 (July 10, 2020), Article 105664, https://doi.org/10.1016/j.aap.2020.105664.

to various benchmarks and findings on the safety of automated vehicles from industry, research institutes, and universities.[17]

Level 2 and Level 3

Safety evaluations for partially (Level 2) and conditionally (Level 3) automated vehicles yield mixed results when compared with human-driven vehicles. Analyses of partially and conditionally automated vehicles found that crash rates and driving errors were lower for these technologies compared with a human-driven vehicle over the same miles driven.[18] Stakeholders may point to these analyses and other studies to suggest that partially and conditionally automated vehicles may be safer than passenger vehicles without this technology. Alternatively, some research suggests that further work is needed to determine whether partially and conditionally automated technologies are safer than human-driven vehicles.[19] Variables such as condition of roads and complexity of the driving environment may be different in the cases of the miles travelled by partially and conditionally automated vehicles versus the miles travelled by human-driven vehicles for a study. For example, studies evaluating the performance of partially automated vehicles and automated vehicle sensors in differing driving environments identified limitations with the technology when it encountered snow, work zones, degraded road markings, and temporary road markings.[20] Other safety limitations of partially and conditionally automated vehicles found in studies are drivers with impaired vigilance, a failure to properly supervise the technology, and an overreliance on the technology to drive them.[21] Recommendations to remedy

[17] Marjory S. Blumenthal et al., *Safe Enough: Approaches to Assessing Acceptable Safety for Automated Vehicles*, RAND, October 29, 2020, pp. 11-56, https://www.rand.org/pubs/research_reports/RRA569-1.html; Soheil Sohrabi et al., "Quantifying the Automated Vehicle Safety Performance: A Scoping Review of the Literature, Evaluation of Methods, and Directions for Future Research," *Accident Analysis & Prevention*, vol. 152, art. 106003 (February 8, 2021), https://doi.org/10.1016/j.aap.2021.106003; Soheil Sohrabi et al., "Assessing the Collective Safety of Automated Vehicle Groups: A Duration Modeling Approach of Accumulated Distances Between Crashes," *Accident Analysis & Prevention*, vol. 198, art. 107454 (January 29, 2024), https://doi.org/10.1016/j.aap.2023.107454; and Henry X. Liu and Shuo Feng, "Curse of Rarity for Autonomous Vehicles," *Nature Communications*, vol. 15, art. 4808 (June 5, 2024), https://www.nature.com/articles/s41467-024-49194-0.

[18] Tesla, "Tesla Vehicle Safety Report," accessed February 18, 2025, https://www.tesla.com/VehicleSafetyReport#q4-2024; Sohrabi et al., "Assessing the Collective Safety of Automated Vehicle Groups"; and Sherrilene Classen et al., "A Randomized Controlled Trial on Automated Vehicle Technologies for Drivers With Parkinson's Disease," *Occupational Therapy Journal of Research*, vol. 45, no. 2 (September 23, 2024), pp. 219-231, https://doi.org/10.1177/15394492241271115.

[19] Insurance Institute for Highway Safety (IIHS), "IIHS-HLDI Research Finds Little Evidence That Partial Automation Prevents Crashes," July 11, 2024, https://www.iihs.org/news/detail/iihs-hldi-research-finds-little-evidence-that-partial-automation-prevents-crashes; and Jessica B. Cicchino, "Convenience or Safety System? Crash Rates of Vehicles Equipped with Partial Driving Automation," *Traffic Injury Prevention*, February 21, 2025, https://doi.org/10.1080/15389588.2024.2448511 (published ahead of print).

[20] Rajesh Rajamani et al., *Influence of Autonomous and Partially Autonomous Vehicles on Minnesota Roads*, University of Minnesota Department of Mechanical Engineering, May 2023, https://mdl.mndot.gov/items/202323; and Stefan Biermeier et al., "Road Marking Visibility for Automated Vehicles: Machine Detectability and Maintenance Standards," *Case Studies in Construction Materials*, vol. 22, art. e04430 (July 2025), https://doi.org/10.1016/j.cscm.2025.e04430.

[21] IIHS, "Drivers Quickly Learn to Skirt Limits Set by Partial Automation Systems," September 17, 2024, https://www.iihs.org/news/detail/drivers-quickly-learn-to-skirt-limits-set-by-partial-automation-systems; Ian J. Reagan et al., "Disengagement from Driving when Using Automation During a 4-Week Field Trial," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 82 (October 2021), pp. 400-411, https://doi.org/10.1016/j.trf.2021.09.010; Alexandra S. Mueller et al., "Finding Windows of Opportunity: How Drivers Adapt to Partial Automation Safeguards Over Time," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 111 (May 2025), pp. 112-129, https://doi.org/10.1016/j.trf.2025.02.019; Eric T. Greenlee et al., "Driver Vigilance Decrement Is More Severe During Automated Driving than Manual Driving," *Human Factors*, vol. 66, no. 2 (February 2024), pp. 574-588, https://doi.org/10.1177/00187208221103922.

these driver engagement issues include driver monitoring systems, driver education programs, crash-reporting requirements, and attention reminders.

Level 4

The safety evaluations of highly (Level 4) automated vehicles showcase some safety improvements over human-driven vehicles though researchers have identified nuances in the evaluation metrics. Industry stakeholders have evaluated the safety of highly automated vehicles, primarily using miles driven as a safety performance metric. Industry reviews of highly automated vehicle deployments found that in roughly 7 million miles driven, the technologies led to an 85% reduction in injury-causing crashes and a 57% reduction in police-reported crashes.[22] Additional research found that during deployments of highly automated vehicles, bodily injury claims reduced by 100% and property damage reduced claims by 76%.[23] Other research suggests that the metric of vehicle miles driven without crashes may require a very high threshold to surpass the performance of humans.[24] Frequent technology updates to an automated vehicle can also affect the reliability of a "miles driven without crashing" metric as the updated technology may perform differently from the prior versions. Additionally, these highly automated vehicle deployments are restricted to specific and limited areas, challenging comparisons to a more general miles driven metric and reducing available data for comparisons using solely the particular roads on which these vehicles operate.

Safety Advocacy Perspective on Highly Automated Vehicles

Several safety advocacy organizations identify potential safety benefits of highly automated vehicles but posit that these benefits may not be immediate. Highly automated vehicle technologies could bridge gaps in mobility options for people with disabilities by supporting driving and offering alternative transportation solutions.[25] Safety advocates also express concerns that pedestrian detection systems could underperform in a variety of situations.[26] Some safety

[22] Waymo, "Waymo Significantly Outperforms Comparable Human Benchmarks Over 7+ Million Miles of Rider-Only Driving," December 20, 2023, https://waymo.com/blog/2023/12/waymo-significantly-outperforms-comparable-human-benchmarks-over-7-million/.

[23] Luigi Di Lillo et al., "Comparative Safety Performance of Autonomous- and Human Drivers: A Real-World Case Study of the Waymo One Service," *ArXiv* (preprint), September 3, 2023, p. 3; https://doi.org/10.48550/arXiv.2309.01206.

[24] Nidhi Kalra and Susan M. Paddock, "Driving to Safety: How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability?," RAND, December 2016, pp. 9-10, https://www.rand.org/content/dam/rand/pubs/research_reports/RR1400/RR1478/RAND_RR1478.pdf.

[25] Sherrilene Classen et al., "A Randomized Controlled Trial on Automated Vehicle Technologies for Drivers With Parkinson's Disease," *Occupational Therapy Journal of Research*, vol. 45, no. 2 (September 23, 2024), pp. 219-231, https://doi.org/10.1177/15394492241271115; Fahimeh Golbabaei et al., "Enabling Mobility and Inclusion: Designing Accessible Autonomous Vehicles for People with Disabilities," *Cities*, vol. 154 (November 2024), Article 105333, https://doi.org/10.1016/j.cities.2024.105333.

[26] Ian Moura, "Addressing Disability and Ableist Bias in Autonomous Vehicles: Ensuring Safety, Equity and Accessibility in Detection, Collision Algorithms and Data Collection," Disability Rights Education & Defense Fund, November 7, 2022, pp. 7-11, https://dredf.org/addressing-disability-and-ableist-bias-in-autonomous-vehicles-ensuring-safety-equity-and-accessibility-in-detection-collision-algorithms-and-data-collection/; Xinyue Li et al, "Bias Behind the Wheel: Fairness Testing of Autonomous Driving Systems," *ACM Trans. Softw. Eng. Methodol.*, vol. 1, no. 1 (October 17, 2024), pp. 1-24, https://doi.org/10.48550/arXiv.2308.02935; and Philip Koopman and William H. Widen, "A Reasonable Driver Standard for Automated Vehicle Safety," University of Miami School of Law Legal Studies, Research Paper no. 4475181, June 10, 2023, p. 3, https://dx.doi.org/10.2139/ssrn.4475181.

advocates state that the technology requires further maturation and evaluation before it can broadly outperform human-driven vehicles in most circumstances.[27]

Public Perception of the Safety of Automated Vehicles

Public concern about the safety of highly automated vehicles may lead consumers to choose not to purchase or use automated vehicle technologies.[28] An analysis by the RAND Corporation indicates inconsistent consumer enthusiasm for these technologies.[29] In a survey conducted by J.D. Power, respondents indicated declining confidence in highly automated vehicles from 2022 to 2023, but results from 2024 indicated slight growth in consumer confidence.[30]

A quarter to a third of consumers who own partially automated vehicles rarely use optional automation technologies, according to surveys.[31] The reasons given include safety concerns, not knowing how to use the technology, and a desire to independently drive the vehicle. Demonstrating that these technologies are safer than humans could support higher adoption rates of automated vehicles.

NHTSA's Role in Safety of Automated Vehicles

NHTSA is the federal agency primarily responsible for passenger vehicle safety. Congress empowered NHTSA to execute safety programs that would reduce traffic fatalities, injuries, and monetary losses.[32] Under Title 49 of the *U.S. Code*, several chapters grant NHTSA varying motor vehicle safety responsibilities,[33] including administering statutes that pertain to motor vehicle safety (ch. 301), fuel economy (ch. 329), setting vehicle regulations, offering guidance on relevant programs, and issuing Federal Motor Vehicle Safety Standards (FMVSS; 49 C.F.R. Part 571).[34]

[27] Testimony of Catherine Chase, president, Advocates for Highway and Auto Safety, in U.S. Congress, House Transportation and Infrastructure Committee, Highways and Transit Subcommittee, *The Future of Automated Commercial Motor Vehicles: Impacts on Society, the Supply Chain, and U.S. Economic Leadership*, 117th Cong., 2nd sess., September 13, 2023, https://democrats-transportation.house.gov/download/cathy-chase-testimony.

[28] Zsófia Kenesei et al., "Trust and Perceived Risk: How Different Manifestations Affect the Adoption of Autonomous Vehicles," *Transportation Research Part A: Policy and Practice*, vol. 164 (September 7, 2022), pp. 379-393, https://doi.org/10.1016/j.tra.2022.08.022; Zsófia Kenesei et al., "The Central Role of Trust and Perceived Risk in the Acceptance of Autonomous Vehicles in an Integrated UTAUT Model," *European Transport Research Review*, vol. 17 (February 12, 2025) Article 8, https://etrr.springeropen.com/articles/10.1186/s12544-024-00681-x; and Zsófia Kenesei et al., "Trust and Perceived Risk: How Different Manifestations Affect the Adoption of Autonomous Vehicles."

[29] Marjory S. Blumenthal et al., *Safe Enough: Approaches to Assessing Acceptable Safety for Automated Vehicles*, pp. 57-65.

[30] J.D. Power, "AV Readiness Increases After a Two-Year Decline, J.D. Power Finds," press release, October 22, 2024, https://www.jdpower.com/business/press-releases/2024-us-mobility-confidence-index-mci-study.

[31] Eike Ebel et al., "Hands Off: Consumer Perceptions of Advanced Driver Assistance Systems," *McKinsey & Company*, July 19, 2023, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/hands-off-consumer-perceptions-of-advanced-driver-assistance-systems.

[32] See the following statutory authority and public laws: 23 U.S.C. §401, P.L. 89-563, P.L. 91-605.

[33] NHTSA, "Laws and Regulations," accessed February 20, 2025, https://www.nhtsa.gov/laws-regulations; 49 U.S.C. chs. 301, 303, 321, 323, 325, 327, 329, 331.

[34] NHTSA, "Laws and Regulations."

FMVSS

NHTSA uses FMVSS to ensure safety in performance and design. NHTSA has the authority to issue standards that promote a minimum safety threshold and further its mission to save lives and prevent injuries.[35] FMVSS fall into the following categories: crash avoidance, crashworthiness, post-crash survivability, and other regulations.[36] These standards include design mandates for features such as brake hoses, rearview mirrors, warning devices, seat belts, airbags, and steering columns. Since NHTSA's inception in 1968, it has issued dozens of vehicle safety standards, and in December 2024, the agency asserted that these standards saved 865,706 lives between 1968 and 2019.[37]

The design of automated vehicles may present challenges in conforming with FMVSS. Many FMVSS were designed for vehicles with a driver and conventional manual controls, such as pedals and a steering wheel. Highly automated vehicles that do not require a driver might not require the presence of such controls. Level 0 through Level 3 vehicles comply with FMVSS because of the necessity to provide the driver with conventional manual controls.[38] Vehicle manufacturers may wish to design vehicles with higher levels of automation without conventional manual controls. However, most Level 4 deployments to date conform with FMVSS by keeping conventional manual controls in the vehicle.

Some Members have introduced legislation that proposed reworking FMVSS for automated vehicles (e.g., H.R. 3388 and S. 1885, both in the 115th Congress). These proposals either attempted to integrate automated vehicle requirements into the existing FMVSS framework or proposed creating separate safety standards for automated vehicles. None of these bills were enacted.

NHTSA can offer an alternative path for automated vehicles that are not compliant with FMVSS. NHTSA may grant exemptions from FMVSS under 49 C.F.R. Parts 555 and 591.[39] Under 49 C.F.R. Part 555, manufacturers can petition NHTSA for an exemption of up to 2,500 noncompliant vehicles per year, which may include commercial purposes. Legislators and regulators have proposed new criteria for receiving exemption approval or adjusting the limit of 2,500 noncompliant vehicles.[40] These proposals attempted to offer less prohibitive design standards for highly automated vehicles and make the exemptions more accessible for manufacturers. As of July 2025, NHTSA has issued one exemption.[41] Under 49 C.F.R. Part 591, entities importing vehicles for noncommercial purposes can apply for an exemption if they do not

[35] 49 U.S.C. ch. 301; 49 C.F.R. Part 571.

[36] NHTSA, "Federal Motor Vehicle Safety Standards and Regulations," DOT HS 808 878, March 1999, https://web.archive.org/web/20140507031818/http://www.nhtsa.gov/cars/rules/import/FMVSS/index.html.

[37] C. J. Kahane and J. F. Simons, *Fatalities, Injuries, and Crashes Prevented by Vehicle Safety Technologies and Associated FMVSS, 1968 to 2019 – Passenger Cars and LTVs*, DOT HS 813 611, December 2024, p. 3, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813611.pdf.

[38] NHTSA, *Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety*, September 2016, pp. 32-33, https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf.

[39] 49 C.F.R. Parts 555 and 591.

[40] H.R. 3388; S. 1885; and NHTSA, "ADS-Equipped Vehicle Safety, Transparency, and Evaluation Program," 90 *Federal Register* 4130, January 15, 2025, https://www.federalregister.gov/documents/2025/01/15/2024-30854/ads-equipped-vehicle-safety-transparency-and-evaluation-program.

[41] Nuro, a delivery vehicle that does not carry passengers, is the only automated vehicle that received this exemption. NHTSA, "Nuro, Inc.; Grant of Temporary Exemption for a Low-Speed Vehicle With an Automated Driving System," 85 *Federal Register* 7826, February 11, 2020, https://www.federalregister.gov/documents/2020/02/11/2020-02668/nuro-inc-grant-of-temporary-exemption-for-a-low-speed-vehicle-with-an-automated-driving-system.

comply with FMVSS; 347 vehicles with automated vehicle technologies received this exemption between 2016 and 2024.[42]

On April 24, 2025, Secretary of Transportation Sean Duffy announced the development of an automated vehicle framework with principles that include prioritizing safety, innovation, and commercial deployment.[43] The announcement stated an intention to allow domestic producers of noncommercial vehicles to apply for an exemption similar to the exemption that foreign vehicles may receive through 49 C.F.R. Part 591.[44] On June 13, 2025, NHTSA announced plans to release exemption application instructions and further adjust the exemption program in 49 C.F.R. Part 555 to make it more flexible for automated vehicles.[45] The letter cited a static set of exemption conditions as a challenge for the commercial deployment of automated vehicles and expressed an intent to adjust exemption conditions as automated vehicles develop.

Investigations and Information Gathering

NHTSA uses its investigative process to evaluate the safety performance of vehicles. NHTSA may receive notification of a safety problem from sources such as manufacturers, consumers, dealers, law enforcement, or online reports.[46] After this notification, NHTSA may choose whether to address this safety problem, for example, by gathering information or launching an investigation.[47] NHTSA can gather information by requesting information from a manufacturer or obtaining equipment to evaluate compliance.[48] NHTSA may launch an investigation after information gathering to determine defects or compliance with FMVSS. These investigations generally span 4 to 18 months and contain different degrees of evaluation and engineering analysis.[49]

The National Transportation Safety Board (NTSB) also conducts investigations at its discretion and provides NHTSA with recommendations.[50] Even though NHTSA and NTSB investigate separately, NTSB may share information with NHTSA. NHTSA and NTSB have investigated several automated vehicle crashes, fatal and nonfatal.[51] The vehicles evaluated had a range of automation, from Level 0 to Level 4.

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[42] Letter from Peter Simshauser, NHTSA Chief Counsel, to automated vehicle developers, April 24, 2025, https://www.nhtsa.gov/sites/nhtsa.gov/files/2025-04/automated-vehicle-exemption-program-domestic-exemptions-2025.pdf; and 49 C.F.R. Part 591.

[43] Department of Transportation (DOT), "Trump's Transportation Secretary Sean P. Duffy Unveils New Automated Vehicle Framework as Part of Innovation Agenda," press release, April 24, 2025, https://www.transportation.gov/briefing-room/trumps-transportation-secretary-sean-p-duffy-unveils-new-automated-vehicle-framework.

[44] Letter from Peter Simshauser, NHTSA Chief Counsel, to automated vehicle developers.

[45] Letter from Peter Simshauser, NHTSA Chief Counsel, to stakeholders, June 13, 2025, https://www.nhtsa.gov/sites/nhtsa.gov/files/2025-06/part-555-letter-june-2025.pdf.

[46] NHTSA, *Motor Vehicle Safety Defects and Recall: What Every Vehicle Owner Should Know*, August 2017, https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/mvdefectsandrecalls_808795.pdf.

[47] P.L. 89-563.

[48] 49 C.F.R. Part 510.

[49] NHTSA, "Resources Related to Investigations and Recalls," accessed February 20, 2025, https://www.nhtsa.gov/resources-investigations-recalls.

[50] National Transportation Safety Board (NTSB), "The Investigative Process," https://www.ntsb.gov/investigations/process/Pages/default.aspx.

[51] NTSB, "Investigative Outcomes and Recommendations," December 4, 2024, https://www.ntsb.gov/Advocacy/SafetyIssues/Pages/Vehicle-Automations-Investigative-Outcomes.aspx; and DOT, "NHTSA Investigations by Manufacturer Chart," accessed February 23, 2025, https://data.transportation.gov/Automobiles/NHTSA-Investigations-by-Manufacturer-Chart/44xh-amqx.

In 2021, NHTSA implemented a crash-reporting requirement for automated vehicles through a Standing General Order (SGO) for partially automated and automated-driving-systems-equipped technology on publicly accessible roads.[52] NHTSA's ability to access data and gather information after an incident expanded after this SGO. The SGO requires manufacturers to submit a report if automated vehicle technologies were in use within 30 seconds of a crash. The SGO was amended in 2021, 2023, and 2025.[53] Secretary Duffy's April 2025 announcement sustained the SGO and amended it by extending reporting deadlines for certain incidents and revising requirements for what qualified as a reportable incident.[54]

NHTSA also gathers information through voluntary programs, such as the Automated Vehicle Transparency and Engagement for Safe Testing (AV TEST) Initiative and the Automated Driving Systems Voluntary Safety Self-Assessments (VSSA).[55] AV TEST is a voluntary program for states and companies to submit information regarding automated vehicle deployments.[56] States may submit data they require from automated vehicle deployments to NHTSA. The data from AV TEST are incorporated into a NHTSA database to provide visibility on automated vehicle deployments across the country. VSSAs are a voluntary disclosure that allow companies to provide an assessment of how they are addressing the safety of the public. Since NHTSA introduced VSSAs in 2017, 33 companies have provided these disclosures with descriptions of their safety measures, and 27 of these disclosures are publicly available.

Recalls

NHTSA may require a manufacturer to issue a recall if an investigation reveals noncompliance with FMVSS or a defect, or NHTSA determines that a technology poses an unreasonable safety risk.[57] NHTSA has the authority to enforce recalls and investigations, but regulatory compliance is the responsibility of the manufacturers.[58] Recalls, or recall campaigns, are initiated by manufacturers to remediate safety-related defects and noncompliance of vehicles.[59] Recalls require manufacturers to notify vehicle owners of a defect or noncompliance. Manufacturers must

[52] NHTSA, "In Re: Third Amended Standing General Order 2021-01: Incident Reporting for Automated Driving Systems (ADS) and Level 2 Advanced Driver Assistance Systems (ADAS)," April 2021, https://www.nhtsa.gov/sites/nhtsa.gov/files/2025-04/third-amended-SGO-2021-01_2025.pdf.

[53] NHTSA, "Standing General Order on Crash Reporting: For Incidents Involving ADS and Level 2 ADAS," accessed May 6, 2025, https://www.nhtsa.gov/laws-regulations/standing-general-order-crash-reporting.

[54] NHTSA, "In Re: Third Amended Standing General Order 2021-01: Incident Reporting for Automated Driving Systems (ADS) and Level 2 Advanced Driver Assistance Systems (ADAS)," April 24, 2025, https://www.nhtsa.gov/sites/nhtsa.gov/files/2025-04/third-amended-SGO-2021-01_2025.pdf; DOT, "Trump's Transportation Secretary Sean P. Duffy Unveils New Automated Vehicle Framework as Part of Innovation Agenda," press release, April 24, 2025, https://www.transportation.gov/briefing-room/trumps-transportation-secretary-sean-p-duffy-unveils-new-automated-vehicle-framework.

[55] NHTSA, "Voluntary Safety Self-Assessment," March 31, 2025, https://www.nhtsa.gov/automated-driving-systems/voluntary-safety-self-assessment.

[56] NHTSA, "ADS-Equipped Vehicle Safety, Transparency, and Evaluation Program," 90 *Federal Register* 4130, January 15, 2025, https://www.federalregister.gov/documents/2025/01/15/2024-30854/ads-equipped-vehicle-safety-transparency-and-evaluation-program; and NHTSA, "AV TEST Initiative," https://avtest.nhtsa.dot.gov/av-test/home.

[57] P.L. 91-605; and NHTSA, *Motor Vehicle Safety Defects and Recall: What Every Vehicle Owner Should Know*.

[58] NHTSA, "Tips for Increasing Recall Completion Rates," July 3, 2024, https://www.nhtsa.gov/vehicle-manufacturers/tips-increasing-recall-completion-rates.

[59] NHTSA, "NHTSA and the Recall Campaigns," in *Motor Vehicle Safety 1977: A Report on Activities Under the National Traffic and Motor Vehicle Safety Act of 1966 and the Motor Vehicle and Cost Savings Act of 1972* (GPO, 1978), pp. 35-36, https://www.yumpu.com/en/document/read/11544692/lltotor.

cover the cost of the repair, whether up front or by reimbursing the consumer, or provide a replacement. Auto manufacturers may issue recalls on a voluntary basis.

NHTSA has required recalls for automated vehicles for various issues, including software errors, braking issues, and technology operating beyond its limited operating condition.[60] In some cases, recalls were direct responses to a NHTSA investigation.[61] NHTSA deemed several recalls as being in sufficient compliance and closed investigations. NHTSA has continued investigations to determine whether the recall remedied the identified flaw.[62] In other cases, manufacturers of automated vehicles have issued recalls without being prompted by NHTSA. These manufacturers voluntarily recalled the affected vehicles by augmenting automated vehicle technologies, sometimes through over-the-air updates.[63]

Rulemaking

NHTSA's initiation, evaluation, and completion of rulemaking is a multistep process. The time frame associated with this multistep process depends on the complexities associated with rulemaking, such as interest in the proposed rule and the volume of comments, competing priorities, available resources and data, and other factors. [64] Because of these complexities with rulemaking, NHTSA may choose to prioritize or deprioritize rulemakings.

NHTSA has evaluated rulemakings related to automated vehicle technologies since 2018. NHTSA issued one final rule; six others are undergoing development and evaluation (see **Table 1**).

[60] David Shepardson, "Waymo Recalls 444 Self-Driving Vehicles Over Software Error," Reuters, February 15, 2024, https://www.reuters.com/technology/waymo-updates-software-over-400-recalled-vehicles-nhtsa-2024-02-15/; David Shepardson and Aakash Sriram, "GM's Cruise Recalls Nearly 1,200 Robotaxis to Close US Probe," Reuters, August 22, 2024, https://www.reuters.com/technology/us-auto-safety-regulator-closes-probe-into-cruise-robotaxis-2024-08-22/ ; Emily DeLetter, "Tesla Recall: 2 Million Vehicles to Receive Software Update as Autopilot Deemed Insufficient," *USA Today*, December 13, 2023, https://finance.yahoo.com/news/tesla-recall-2-million-vehicles-121450643.html.

[61] David Shepardson and Aakash Sriram, "GM's Cruise Recalls Nearly 1,200 Robotaxis to Close US Probe"; and Emily DeLetter, "Tesla Recall: 2 Million Vehicles to Receive Software Update as Autopilot Deemed Insufficient."

[62] For example, see the NTHSA incident report filed on October 17, 2024, by the Office of Defects Investigation (https://static.nhtsa.gov/odi/inv/2024/INOA-PE24031-23232.pdf).

[63] Fred Lambert, "Tesla Issues Recall on Over 200,000 Vehicles for the Self-Driving Computer Failure," *electrek*, January 10, 2025, https://electrek.co/2025/01/10/tesla-issues-recall-on-over-200000-for-the-self-driving-computer-failure/.

[64] NHTSA, *Report to Congress: Rulemaking Status Report*, December 2024, https://www.nhtsa.gov/sites/nhtsa.gov/files/2024-12/report-congress-status-rulemakings-december-2024.pdf; and DOT, "Rulemaking Process: What Is the Role of Congress in the Rulemaking Process?."

Table 1. National Highway Traffic Safety Administration (NHTSA) Regulatory Actions

Automated-Vehicle-Safety-Related Regulatory Action

Rule Name	Year of Initial Action	Most Recent Action	Current Status	Summary
Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation[a]	2018	ANPRM	NHTSA is analyzing comments.	This rule would allow NHTSA to assess how to develop a national program that would validate advanced vehicle technologies through a pilot program. The pilot program would be designed to assess the safety of highly automated vehicles, including vehicles without conventional manual controls. The pilot program would allow NHTSA to monitor and learn from testing activities while ensuring that these technologies were safely deployed.
Removing Regulatory Barriers for Vehicles with Automated Driving Systems (ADS)[b]	2019	ANPRM	NHTSA is analyzing comments.	This rule would address challenges that ADS-equipped vehicles face when complying with FMVSS, specifically the crash avoidance standards (100 series). This rule would identify how to implement test procedures and crash avoidance requirements for ADS-equipped technologies that lack conventional manual controls.
Considerations for Telltales, Indicators, and Warnings in Vehicles Equipped with ADS[c]	2020	Published in unified agenda.	NHTSA is developing the NPRM.	This rule would evaluate safety messaging for ADS-equipped vehicles. This would amend FMVSS to support safety messaging in ADS-equipped vehicles, similar to the telltale and display standards included in FMVSS 101, "Controls and displays."
Occupant Protection for Vehicles with Automated Driving Systems[d]	2020	Final rule	Rule is finalized.	This rule was finalized in 2022 and ensures that FMVSS include ADS designs while maintaining the same rigorous safety standards as conventional passenger vehicles. The final rule adjusted crashworthiness standards (the 200 series of FMVSS) for ADS-equipped vehicles. It clarified existing terminology so that standards for traditionally designed vehicles were not applied to ADS-equipped vehicles.
Framework for Automated Driving System Safety[e]	2020	ANPRM	NHTSA is analyzing comments.	This rule would establish a performance-based safety framework for ADS developers. The framework is intended to "objectively define, assess, and manage the safety of ADS performance." The rule would establish a performance threshold through guidance, consumer information, or regulation.
Incident Reporting Requirements for Automated Driving Systems and Level 2 Advanced Driver Assistance Systems[f]	2024	Published in unified agenda	NHTSA is developing the NPRM.	This rule is expected to address the SGO that mandates crash-reporting requirements from manufacturers and operators of partially automated and ADS-equipped on publicly accessible roads.

Rule Name	Year of Initial Action	Most Recent Action	Current Status	Summary
ADS-Equipped Vehicle Safety, Transparency, and Evaluation Program (AV STEP)[g]	2025	NPRM	NHTSA closed the public comment period on March 17, 2025.	This rule would create a voluntary framework to evaluate vehicles equipped with ADS. Manufacturers, developers, and operators of ADS-equipped vehicles could opt into a program that would evaluate the performance of their vehicles. The program would provide NHTSA with information that would support the development of ADS safety standards while offering regulatory oversight in the interim. Participants accepted into the program may receive exemptions from FMVSS, which would provide an alternate path to exemptions from the current mechanism available.

Source: Compiled by CRS from sources listed below.

Notes: ANPRM = advance notice of proposed rulemaking; NPRM = notice of proposed rulemaking; ADS = automated driving systems; FMVSS = Federal Motor Vehicle Safety Standards; SGO = Standing General Order.

a. NHTSA, "Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation; Extension of Comment Period," 83 *Federal Register* 59353, November 23, 2018, https://www.federalregister.gov/documents/2018/11/23/2018-25532/pilot-program-for-collaborative-research-on-motor-vehicles-with-high-or-full-driving-automation.

b. NHTSA, "Removing Regulatory Barriers for Vehicles with Automated Driving Systems," 84 *Federal Register* 24433, May 28, 2019, https://www.federalregister.gov/documents/2019/05/28/2019-11032/removing-regulatory-barriers-for-vehicles-with-automated-driving-systems.

c. NHTSA, "Considerations for Telltales, Indicators and Warnings in ADS Vehicles," 2127 Unified Agenda AM07, 2020, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201904&RIN=2127-AM07.

d. NHTSA, "Occupant Protection for Vehicles with Automated Driving Systems," 87 *Federal Register* 18560, March 30, 2022, https://www.federalregister.gov/documents/2022/03/30/2022-05426/occupant-protection-for-vehicles-with-automated-driving-systems.

e. NHTSA, "Framework for Automated Driving System Safety," 85 *Federal Register* 78058, December 3, 2020, https://www.federalregister.gov/documents/2020/12/03/2020-25930/framework-for-automated-driving-system-safety.

f. NHTSA, "Incident Reporting Requirements for Automated Driving Systems and Level 2 Advanced Driver Assistance Systems," 2127-AM63 Unified Agenda, 2024, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202404&RIN=2127-AM63.

g. NHTSA, "ADS-Equipped Vehicle Safety, Transparency, and Evaluation Program," 90 *Federal Register* 4130, January 15, 2025, https://www.federalregister.gov/documents/2025/01/15/2024-30854/ads-equipped-vehicle-safety-transparency-and-evaluation-program.

State and Federal Interactions

Federal and state agencies have separate regulatory authority over vehicle safety and regulate many aspects of automated vehicle safety differently. Among other responsibilities, NHTSA generally sets vehicle standards, ensures compliance, and conducts certain investigations, while states are responsible for driver licensing, traffic law enactment and enforcement, safety

inspections, and vehicle insurance liability.[65] Federal law also imposes express limits on states' ability to prescribe vehicle safety standards.[66]

DOT and NHTSA have issued some guidance to states on how to regulate automated vehicles. From 2016 to 2020, NHTSA issued four guidance documents on automated vehicles, three of which offered guidance to states on how to regulate automated vehicle technologies.[67]

As of June 2025, 34 states have enacted automated-vehicle-related legislation,[68] though state policies vary in permitting and licensing. According to some experts, this variation increases the difficulty for industry to deploy automated vehicle technologies in some states.[69] These state policies also offer varying rules on the types of deployment permitted (e.g., commercial, testing, and pilot), requirements for a backup driver in the vehicle, and permitting procedures.[70]

Congressional Action

Surface Transportation Reauthorization Acts

Two acts relevant to automated vehicle safety are the Fixing America's Surface Transportation Act (FAST Act; P.L. 114-94) and the Infrastructure Investment and Jobs Act (IIJA; P.L. 117-58). These include comprehensive surface transportation reauthorization with sections addressing aspects of automated vehicles.

The FAST Act required a review of policies related to automated vehicles and created a grant program that affected automated vehicles. It also required the Government Accountability Office (GAO) to review policies related to automated vehicle technologies and DOT's ability to address policy challenges related to automated vehicles. GAO responded to Congress in 2017 with a report titled *Automated Vehicles: Comprehensive Plan Could Help DOT Address Challenges*.[71] Additionally, the FAST Act created a grant program, the Advanced Transportation and

[65] NHTSA, *Automated Driving Systems 2.0: A Vision for Safety*, September 12, 2017, https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.

[66] 49 U.S.C. §30103(b) provides in relevant part that "[w]hen a motor vehicle safety standard is in effect under [Chapter 301], a State or a political subdivision of a State may prescribe or continue in effect a standard applicable to the same aspect of performance of a motor vehicle or motor vehicle equipment only if the standard is identical to the standard prescribed under [Chapter 301]."

[67] NHTSA, *Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety*, September 2016, pp. 32-33, https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf; NHTSA, *Automated Driving Systems 2.0: A Vision for Safety*, September 12, 2017, https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf; DOT, *Automated Vehicles 3.0: Preparing for the Future of Transportation*, September 8, 2018, https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf; and National Science & Technology Council and DOT, *Automated Vehicles 4.0: Ensuring American Leadership in Automated Vehicle Technologies*, January 2020, https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/360956/ensuringamericanleadershipav4.pdf.

[68] National Conference of State Legislatures, "Autonomous Vehicles Legislation Database," January 31, 2025, https://www.ncsl.org/transportation/autonomous-vehicles-legislation-database.

[69] William Hubbard, "Drivers of Effective Laws for Automated Vehicles," *Villanova L. Rev.*, vol. 70, no. 1 (September 19, 2024), pp. 115-167; and Mark MacCarthy, "The Evolving Safety and Policy Challenges of Self-Driving Cars," *Brookings*, July 31, 2024, https://www.brookings.edu/articles/the-evolving-safety-and-policy-challenges-of-self-driving-cars/.

[70] IIHS, Highway Loss Data Institute, "Highly Automated Vehicles: Laws and Regulations," July 2025, https://www.iihs.org/research-areas/advanced-driver-assistance/highly-automated-vehicle-laws.

[71] David Wise, *Automated Vehicles: Comprehensive Plan Could Help DOT Address Challenges*, GAO-18-132, November 30, 2017, https://www.gao.gov/products/gao-18-132.

Congestion Management Technologies Deployment (ATCMTD) program, that funded automated-vehicle-related projects. Under the IIJA, this grant program was renamed the Advanced Transportation Technologies and Innovative Mobility Development (ATTIMD) program. FHWA refers to it as the Advanced Transportation Technology and Innovation (ATTAIN) program.[72] These grant programs supported efforts by transit agencies, states, cities, and research institutes "to deploy, install, and operate advanced transportation technologies to improve safety" among other goals.[73] These advanced transportation technologies included automated vehicles.

The IIJA established the Strengthening Mobility and Revolutionizing Transportation (SMART) grant program. SMART is a DOT grant program that provides funding to "public sector agencies to conduct demonstration projects focused on advanced smart community technologies and systems in order to improve transportation efficiency and safety."[74] These projects were awarded to public sector agencies deploying and testing several types of smart technologies, with automated vehicle deployments supported by some of these smart technologies.

Annual Appropriations Acts

Congress requested that NHTSA generate biannual reports on automated vehicles as part of the explanatory statements accompanying the Consolidated Appropriations Act of 2024 (P.L. 118-42) and the Consolidated Appropriations Act, 2023 (P.L. 117-328). These reports inform Congress on the development of automated vehicles and NHTSA's progress on proposed rules related to automated vehicles.[75] The information from these reports may inform congressional decisionmaking in regard to legislation or oversight of the deployment of automated vehicles, the modernization the safety standards, and the United States' competitiveness in the automotive industry.

119th Congress

In the 119th Congress, one bill related to automated vehicle safety has been introduced, the Autonomous Vehicle Acceleration Act of 2025 (S. 1798). This bill would require the Secretary of Transportation to review and overcome barriers to the deployment of highly automated vehicles as found by DOT's Volpe National Transportation Systems Center in its 2016 report.[76] These barriers include the need for a human backup driver, performance specifications, testing

[72] Federal Highway Administration (FHWA), "Advanced Transportation and Congestion Management Technologies Deployment," February 8, 2017, https://www.fhwa.dot.gov/fastact/factsheets/advtranscongmgmtfs.cfm; FHWA, "Advanced Transportation Technologies and Innovation," January 31, 2025, https://www.fhwa.dot.gov/infrastructure-investment-and-jobs-act/attain.cfm.

[73] DOT, "Advanced Transportation Technologies and Innovative Mobility Deployment," press release, April 22, 2024, https://www.transportation.gov/rural/grant-toolkit/advanced-transportation-technologies-and-innovative-mobility-deployment.

[74] DOT, "SMART Grants Program," February 26, 2025, https://www.transportation.gov/grants/SMART.

[75] NHTSA, *Report to Congress: NHTSA Research and Rulemaking Activities on Vehicles Equipped with Automated Driving Systems*, January 2025, https://www.nhtsa.gov/document/report-congress-research-and-rulemaking-activities-vehicles-equipped-automated-driving; NHTSA, *Report to Congress: NHTSA Rulemakings Related to Automated Driving System-Equipped Vehicles*, May 2024, https://www.nhtsa.gov/document/report-congress-rulemakings-related-automated-driving-system-equipped-vehicles; NHTSA, *Report to Congress: Automated Vehicles*, 2023, https://www.nhtsa.gov/document/report-congress-automated-vehicles-june-2023; and NHTSA, *Research on the Accessibility of Automated Vehicles Report*, 2021, https://www.nhtsa.gov/node/136936.

[76] Anita Kim et al., *Review of Federal Motor Vehicle Safety Standards (FMVSS) for Automated Vehicles: Identifying Potential Barriers and Challenges for the Certification of Automated Vehicles Using Existing FMVSS*, DOT, John A. Volpe National Transportation Systems Center, Technology Innovation and Policy Division, March 11, 2016, https://rosap.ntl.bts.gov/view/dot/12260.

procedures, and equipment requirements that may not apply to a highly automated vehicle. The bill also would require the Secretary of Transportation to develop a roadmap for commercial-scale deployment of Level 4 and Level 5 automated vehicles.

Previous Congresses

In the 114th through 118th Congresses, some Members introduced bills that included automated vehicle safety topics. These bills took several different approaches to automated vehicle safety. Proposals included establishing an advisory council for the safe implementation of automated vehicle technologies, reworking FMVSS to fit with automated vehicle technologies, creating grant programs to further the safe deployment of automated vehicles, altering exemption requirements for automated vehicles, and establishing programs to facilitate the deployment of automated vehicle technologies.

Selected Legislative Proposals on Automated Vehicle Safety

The American Vision for Safer Transportation Through Advancement of Revolutionary Technologies (AV START) Act (S. 1885, 115th Congress) was referred to the Senate Committee on Commerce, Science, and Transportation. The committee reported the bill, but it was not scheduled for a floor vote. AV START included several measures related to automated vehicles and some provisions focused on safety. These provisions included measures to limit certain state regulation of automated vehicles, adjust language in the *U.S. Code* to create exceptions for the testing of highly automated vehicles, amend vehicle exemption language to expand their applicability to automated vehicles, require the Secretary of Transportation to establish a technical committee on highly automated vehicles, require manufacturers to submit safety evaluation reports to the Secretary, and for the Secretary to review safety standards that may relate to automated vehicles.

The Safely Ensuring Lives Future Deployment and Research in Vehicle Evolution (SELF DRIVE) Act (H.R. 3388, 115th Congress) was referred to the House Committee on Energy and Commerce, which voted to report it. The bill passed the House without amendment by voice vote, and it was referred to the Senate Committee on Commerce, Science, and Transportation. Members of the House of Representatives introduced iterations of the SELF DRIVE Act in the 116th (H.R. 8350) and 117th (H.R. 3711) Congresses. The SELF DRIVE Act included safety-related provisions for automated vehicles, such as proposals to limit certain state regulation of automated vehicles; mandates for NHTSA rulemaking on safety standards and alterations of exemptions for non-FMVSS compliant vehicles; and requirements for consumer education from the manufacturers. The act also included provision for the Secretary of Transportation to appoint an advisory council on highly automated vehicles and establish a safety assessment certification threshold for highly automated vehicles.

Options for Congress

Congress has established certain authorities and requirements in NHTSA and may choose to engage in oversight over them. Depending on the development of automated vehicle technologies, Congress may decide that additional action is necessary. If Congress were to decide action is necessary, it would have a range of options available depending on its goals. These options include setting requirements for automated vehicle safety and monitoring and evaluating manufacturers' progress in implementing them. Congress could require NHTSA to issue new rulemakings on automated vehicles. Rulemaking activities could include topics related to design and performance, data reporting, technology standardization, or driver monitoring. Congress also could choose to refrain from requiring NHTSA to issue rulemakings and allow the Secretary of Transportation to direct rulemaking about automated vehicle safety instead. Congress could also require NHTSA to research and evaluate the competencies of the technologies.

Some stakeholders assert that the current state-based regulatory approach lacks uniformity.[77]

If NHTSA were to issue automated vehicles standards, those standards may preempt certain state regulations under existing federal law.[78] If Congress were to direct NHTSA to develop new automated vehicle standards, Congress could include a tailored preemption provision regarding those new standards.[79] Federal limits on state regulation of autonomous vehicles could promote a more uniform regulatory framework across states, avoiding adjustments in deployment or differing data reporting requirements on a state-by-state basis. Congress could also limit states' regulation of automated vehicles absent new federal standards. Legislative attempts and industry proposals have included language to limit state regulation of automated vehicles.[80]

Congress could also choose to continue to allow states to regulate this issue. This approach would leave manufacturers to continue to develop technology within the existing policy environment. Congress could continue to require regular reporting and rulemaking activities on automated vehicle technologies from NHTSA. Congress also could increase or decrease the amount of ongoing automated vehicle oversight.

Design and Performance

Congress might provide direction to NHTSA regarding the extent that design or performance standards explicitly address automated vehicles. For example, Congress might direct NHTSA to adjust FMVSS for automated vehicle technologies. These options include requiring amendments to FMVSS, setting safety performance thresholds, or providing perspectives regarding prescriptive versus performance-based standards. NHTSA shifted its approach for some rules from amending FMVSS to frameworks that offer more flexibility, citing in part the evolving nature of the technology as a reason for flexibility in these frameworks.[81] Congress could set timelines for NHTSA to finalize current or future rules, set criteria for exemptions, or direct NHTSA to implement other regulatory approaches.

Congress could consider exemptions from FMVSS. For example, such exemptions could expand, reduce, or eliminate the current limit of 2,500 non-FMVSS-compliant automated vehicles approvable by the Secretary of Transportation. Depending on the approach, Congress could, for example, require NHTSA to mandate that technologies meet specific safety thresholds or to obligate the manufacturer to provide vehicle performance data demonstrating specific compliance criteria. Less stringent criteria for exemptions, or raising the limit, could increase the number of non-FMVSS compliant vehicles available for testing. Industry stakeholders have proposed raising

[77] Autonomous Vehicle Industry Association, *Securing American Leadership in Autonomous Vehicles*, January 6, 2025, http://cdn.prod.website-files.com/67ee365c25e6530594bd40c2/683d8d2fa60ac22d542b1049_Securing%20American%20Leadership%20in%20Autonomous%20Vehicles1.pdf; William Hubbard, "Drivers of Effective Laws for Automated Vehicles"; and Mark MacCarthy, "The Evolving Safety and Policy Challenges of Self-Driving Cars."

[78] See 49 U.S.C. § 30103(b). For a general discussion of federal preemption principles, see CRS Report R45825, *Federal Preemption: A Legal Primer*, by Bryan L. Adkins, Alexander H. Pepper, and Jay B. Sykes.

[79] For an example of a bill with that provision, see H.R. 3388.

[80] H.R. 3388 (115th Congress); S. 1885 (115th Congress); and Autonomous Vehicle Industry Association, *Federal Policy Framework for Our AV Future*, March 2023, https://www.autovision-news.com/wp-content/uploads/2023/03/AVIA-Federal-Policy-Framework-for-Our-AV-Future.pdf.

[81] See, for example, NHTSA, "Framework for Automated Driving System Safety," 85 *Federal Register* 78058, December 3, 2020, https://www.federalregister.gov/documents/2020/12/03/2020-25930/framework-for-automated-driving-system-safety; and NHTSA, "ADS-Equipped Vehicle Safety, Transparency, and Evaluation Program," 90 *Federal Register* 4130, January 15, 2025, https://www.federalregister.gov/documents/2025/01/15/2024-30854/ads-equipped-vehicle-safety-transparency-and-evaluation-program.

the exemption limits and altering standards to support the expansion of the use of such technology.[82] Advocacy groups generally have opposed exemptions, raising concerns about the stringency of evaluation necessary to support what they consider to be a safe deployment of the technology.[83]

Data Reporting

Congress may choose to guide NHTSA's practices on data reporting requirements for automated vehicle technologies. For instance, Congress could consider whether mandated data reporting should include crash data, like the NHTSA SGO that requires crash reporting.[84] Alternatively, Congress could choose to extend the collection of crash and performance data for operating automated vehicles. The current crash-reporting SGO expires in 2026; Congress may consider directing NHTSA to extend the SGO. Alternatively, Congress may opt to codify the SGO with or without a sunset provision that could be associated with a certain date or certain performance thresholds. Conversely, Congress might determine that the reporting requirement is too stringent or unnecessary and direct NHTSA to revise or end the SGO.

Beyond the context of the crash-reporting SGO, Congress could consider whether a requirement to standardize federal data reporting would ease the burden on companies that are currently reporting various data metrics to several states. Options for data collection include for NHTSA to collect these data from manufacturers on a regular basis, require reporting through the states, or introduce a voluntary reporting program for manufacturers or operators, such as those found in AV STEP, AV TEST, and VSSA. Advocates of data reporting assert that this access is important to the evaluation of this technology, while opponents in the industry reportedly assert that this data reporting requirement is burdensome and gives a misleading perspective of the vehicle's performance.[85]

[82] Autonomous Vehicle Industry Association, *Federal Policy Framework for Our AV Future*, March 2023, https://www.autovision-news.com/wp-content/uploads/2023/03/AVIA-Federal-Policy-Framework-for-Our-AV-Future.pdf.

[83] National Association of City Transportation Officials (NACTO), "NACTO Opposes Automaker Requests for Safety Exemptions for Autonomous Vehicles," September 22, 2022, https://nacto.org/latest/nacto-opposes-automaker-requests-for-safety-exemptions-for-autonomous-vehicles/; and letter from Advocates for Highway and Auto Safety et al. to Rep. Gus M. Bilirakis, chair, and Rep. Jan Schakowsky, ranking member, Committee on Energy and Commerce Subcommittee on Innovation, Data, and Commerce, July 19, 2023, https://www.apha.org/-/media/Files/PDF/advocacy/letters/2023/230719ECAVhearing.pdf.

[84] NHTSA, "In Re: Third Amended Standing General Order 2021-01: Incident Reporting for Automated Driving Systems (ADS) and Level 2 Advanced Driver Assistance Systems (ADAS)," April 2021, https://www.nhtsa.gov/laws-regulations/standing-general-order-crash-reporting; NHTSA, "Exemption and Demonstration Framework for Automated Driving Systems," 2127 Unified Agenda AM60, 2023, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202304&RIN=2127-AM60; Autonomous Vehicle Industry Association, *Securing American Leadership in Autonomous Vehicles*, January 6, 2025, http://cdn.prod.website-files.com/67ee365c25e6530594bd40c2/683d8d2fa60ac22d542b1049_Securing%20American%20Leadership%20in%20Autonomous%20Vehicles1.pdf; Zachary LaCelle and Christopher Hill, "Safety Building Blocks of Highly Automated Vehicles," MITRE Corporation, June 29, 2021, https://www.mitre.org/sites/default/files/2021-09/pr-21-1757-safety-building-blocks-highly-automated-vehicles.pdf.

[85] Joel Rose, "Safety Advocates Fear Tesla Will Face Less Accountability for Car Crashes Under Trump," *NPR*, January 15, 2025, https://www.npr.org/transcripts/nx-s1-5234124; Jarrett Renshaw et al., "Exclusive: Trump Team Wants to Scrap Car-Crash Reporting Rule That Tesla Opposes," Reuters, December 17, 2024, https://www.reuters.com/business/autos-transportation/trump-transition-recommends-scrapping-car-crash-reporting-requirement-opposed-by-2024-12-13/.

Technology Standardization and Education

Congress might address automated vehicle technologies through establishing standards for implementation through NHTSA's rulemaking. For example, certain stakeholders have supported Congress requiring NHTSA to promulgate a rule on automated vehicles or particular components of automated vehicle technologies.[86] NHTSA has issued rules on certain standardized driver assistance technologies, such as the 2024 rule that standardized automatic emergency braking (AEB) on passenger vehicles.[87] Congress might also set deadlines or other time requirements for promulgation of NHTSA rules.

Congress may manage automated vehicle engagement issues by requiring NHTSA to explore or include measures such as driver monitoring technologies and driver education policies for automated vehicles. A driver monitoring technology could ensure driver engagement with the vehicle and mitigate overreliance on partially or conditionally automated technologies. However, some drivers have expressed concerns with the potential privacy implications of driver monitoring technologies.[88] Through the IIJA, Congress has required research from the Secretary of Transportation on driver monitoring technologies.[89] Additionally, Congress may consider establishing consumer information requirements, such as was proposed in the SELF DRIVE Act in the 115th (H.R. 3388), 116th (H.R. 8350), and 117th (H.R. 3711) Congresses. That proposal would have required manufacturers to inform consumers of the capabilities and limitations of partially and highly automated vehicles. Congress may also choose to address driver education regarding automated vehicles, as proposed in the AV START Act (S. 1885) in the 115th Congress. This proposal would have required the Secretary of Transportation to identify and provide the industry with voluntary strategies on the marketing of partially and highly automated vehicles.

Research on Automated Vehicle Technologies

Congress may evaluate options to expand or reduce research related to automated vehicle technologies. For example, Congress could require NHTSA to continue research-related activities in order to inform agency actions. Research could cover topics like the general safety performance of technologies, impacts on vulnerable populations, the applicability of safety standards to technologies, data collection practices, the implementation of a testing program, cost effectiveness, and safety reporting measurements. Congress directed NHTSA to produce several reports and conduct certain research studies regarding automated vehicles.[90] Congress might

[86] Testimony of Catherine Chase, President of Advocates for Highway and Auto Safety, in U.S. Congress, House Transportation and Infrastructure Committee, Highways and Transit Subcommittee, *The Future of Automated Commercial Motor Vehicles: Impacts on Society, the Supply Chain, and U.S. Economic Leadership*, 117th Cong., 2nd sess., September 13, 2023, https://democrats-transportation.house.gov/download/cathy-chase-testimony.

[87] NHTSA, "Federal Motor Vehicle Safety Standards; Automatic Emergency Braking Systems for Light Vehicles," 89 *Federal Register* 39686, May 9, 2024, https://www.federalregister.gov/documents/2024/05/09/2024-09054/federal-motor-vehicle-safety-standards-automatic-emergency-braking-systems-for-light-vehicles.

[88] Rory Coyne et al., "Understanding Drivers' Perspectives on the Use of Driver Monitoring Systems During Automated Driving: Findings from a Qualitative Focus Group Study," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 105 (July 24, 2024), pp. 321-335, https://doi.org/10.1016/j.trf.2024.07.015.

[89] See §24209 of P.L. 117-58 for requirements on the research of driver monitoring systems.

[90] NHTSA, *Report to Congress: NHTSA Research and Rulemaking Activities on Vehicles Equipped with Automated Driving Systems*, 2025, https://www.nhtsa.gov/document/report-congress-research-and-rulemaking-activities-vehicles-equipped-automated-driving; NHTSA, *Report to Congress: NHTSA Rulemakings Related to Automated Driving System-Equipped Vehicles*, May 2024, https://www.nhtsa.gov/document/report-congress-rulemakings-related-automated-driving-system-equipped-vehicles; NHTSA, *Report to Congress: Automated Vehicles*, 2023, https://www.nhtsa.gov/document/report-congress-automated-vehicles-june-2023; and NHTSA, *Research on the Accessibility of Automated Vehicles Report*, 2021, https://www.nhtsa.gov/node/136936.

require the agency to evaluate automated vehicles through DOT's in-house laboratory, the Vehicle Research and Test Center.[91]

Oversight and Stakeholder Input

Congress might address the role of stakeholder input with respect to NHTSA decisionmaking. Congress might encourage or require NHTSA to establish advisory councils or committees on automated-vehicle-related topics. An advisory council could provide external perspectives on the development of automated vehicle technologies. Such advisory councils could evaluate the maturity and the market viability of automated vehicles and their technologies and provide feedback.

Additionally, Congress could consider whether the federal government has a role in funding research in automated vehicle technologies. Congress established grant programs that promoted automated vehicle research and development. The extent to which these programs are meeting congressional expectations and what, if any, funding would support these aims may be areas of congressional interest.

[91] NHTSA, "Vehicle Research & Testing," accessed April 17, 2025, https://www.nhtsa.gov/research-data/vehicle-research-testing.

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