Driving the Future of AV Regulations

Barriers to Large-Scale Development

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Introduction

Since the first Federal Safety Standards for cars became effective on January 1, 1968, motor vehicle regulations have been designed with drivers as an assumed constant. However, much has changed in the intervening 53 years, and the United States’ regulatory framework has not been able to keep pace with the rapid technological development of autonomous vehicles (AVs).

Level 4 and 5 AVs, which do not require drivers and may be specialized for tasks that do not involve passengers, no longer fit squarely into existing regulations. While there has been recent bipartisan interest in introducing legislation regarding self-driving cars, most recently as part of the Endless Frontier Act, Congress has not passed AV legislation thus far. Similarly, federal regulators have issued guidance—but no binding regulations—on AV operations. States have filled this vacuum, creating a patchwork of regulations that could hinder deployment of this technology at scale. As a result, the AV industry faces an uneven and uncertain regulatory environment and lacks a clear path to large-scale deployment.

Such deployment is necessary for AVs to deliver on their potential. First, AV adoption could reduce road-fatality fatalities, cut emissions, and mitigate congestion. Second, more AVs on the road result in more data that can inform safer, more efficient mobility systems. Third, the public would have more opportunities

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1 The National Highway Traffic Safety Administration uses the following scale when referring to vehicle automation: Level 0 (zero autonomy), the driver performs all driving tasks; Level 1 (driver assistance), the vehicle is controlled by the driver but some driving assist features may be included in the vehicle design; Level 2 (partial automation), the vehicle has combined automated functions such as acceleration and steering but the driver must remain engaged at all times; Level 3 (conditional automation), the driver is a necessity and, while not required to monitor the environment, must remain ready to take control of the vehicle at any time; Level 4 (high automation), the vehicle is capable of performing all driving tasks under certain conditions, but the driver may have the option of taking control of the vehicle; and Level 5, the vehicle is capable of performing all driving functions under all conditions.
to interact with AVs, which would hasten the consumer acceptance of the technology that is vital to reaping its benefits.

The National Highway Traffic Safety Administration (NHTSA) is in the process of formulating a framework to ensure automated driving systems (ADS) are deployed safely. The framework is likely to include non-binding guidance and, for the first time at the federal level, binding regulations on AVs. NHTSA will likely implement the framework in phases, which will give the agency time to iterate based on stakeholder input. This set of federal regulations will be important for both manufacturers—who can scale production across all states—and consumers—who can feel safe knowing AVs follow consistent, clear, and defined standards.

The United States has an opportunity to play a leading role in AV legislation and can capitalize on its early-mover advantage to develop comprehensive standards with trading partners. This paper outlines the current regulatory barriers to AV deployment at scale and offers recommendations for a path forward.

**Regulatory Barriers**

**FEDERAL MOTOR VEHICLE SAFETY STANDARDS**

Level 4 and 5 autonomous vehicles do not require drivers and, in some cases, will not be designed to carry passengers. As a result, the vehicle design space for Level 4 and 5 AVs is unlike that of traditional automobiles. For example, AVs that do not require a driver would not need a steering wheel or mirrors. Furthermore, a vehicle that is not designed to carry passengers would also not require seats or airbags.

Federal Motor Vehicle Safety Standards (FMVSS), which create a framework for the design of the traditional vehicle, were developed for vehicles with human-operated controls. For example, the FMVSS require manual controls, a steering wheel, pedals, and mirrors and regulate the internal layout of the vehicle, such as the location of doors and seats.

Updating these standards is critical to unlocking the benefits of AVs, while inaction on amending these requirements for driverless vehicles could at best hinder innovation and at worst lead to less safe vehicles. New standards for autonomous vehicles, some of which will be specialized for certain tasks or driving conditions (often referred to as Operational Design Domains), must ensure safety at least equivalent to that ensured by traditional ones. However, new standards should be performance-oriented and technology-neutral, meaning that they should not require conformity to specific design features that may become outmoded.

Once FMVSS have been adapted to AVs, continuing the practice of self-certification by original equipment manufacturers (OEMs) will be necessary to maintain the U.S. edge in artificial intelligence. Additionally, the Department of Transportation should not require premarket government testing or approval of each OEM-certified AV model before it becomes available to the public.

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Other jurisdictions, such as the European Union and Japan, require national authorities to approve new vehicle models before they enter the market. Self-certification provides a smoother and faster path to
deployment and has historically not compromised safety outcomes. Premarket checks by national authorities may be burdensome or incompatible with AVs that regularly receive updates and patches that impact performance.

NHTSA's proposed approach to a framework for deployment of AVs includes revisiting FMVSS. The proposed framework rightly seeks to assess the safety purpose of existing standards for manual controls as the basis for establishing a safety framework for AVs. Viewing standards through objectives (such as ensuring safe braking performance or consistent detection of objects to the side or rear of the vehicle) rather than design (such as a requirement for brake pedals and mirrors that meet certain standards) would encourage innovation and result in a safer product. Prescriptive design standards could be counterproductive in an industry whose goal is to fundamentally redesign vehicles to ensure higher safety standards. More generally, economies that embrace prescriptive regulations—such as the European Union—sacrifice innovation, while those that embrace goal-based regulations maintain safety and provide superior space for innovation.

Understanding the objectives of the current FMVSS will also better guide new standards for testing and certifying Level 4 and 5 AVs. Some testing may be unnecessary if fleet operators intend to deploy certain vehicles only under certain conditions. For example, tests to gauge performance in winter conditions would not be relevant for a fleet of last-mile autonomous delivery trucks that will operate only in Phoenix. Tests that gauge high-speed braking performance for vehicles traveling over 60 miles per hour would not be relevant for autonomous buses that operate only on college campuses.

Moving forward, NHTSA should begin the rulemaking process by making FMVSS less complex, providing alternative criteria for compliance, and determining which current standards should—and should not—be applied to AVs. While NHTSA works to establish a framework for testing AV compliance with FMVSS, automakers should also be able to submit alternative compliance-testing methodologies to NHTSA for evaluation. This would create an interim path to deployment while NHTSA establishes a certification framework for AVs.

THE EXEMPTION PROCESS

Beyond the AV approval, the number of AVs that can be deployed on U.S. roads remains at issue. Currently, automakers’ only legal path to bypassing FMVSS certification requirements for AVs is to petition NHTSA for narrow, temporary exemptions. “Exemption” is somewhat of a misnomer because manufacturers are required to demonstrate to NHTSA that the nonconforming vehicles provide an equivalent or greater safety level than that of a fully FMVSS-compliant, non-prototype vehicle. FMVSS certification requirements for standards that are not applicable to driver- or passenger-less vehicles limit the deployment of AVs. Furthermore, the existing exemptions process is slow, temporary, difficult, and limited to 2,500 vehicles annually per manufacturer.

Only two manufacturers—Nuro and General Motors—have applied for temporary exemptions from FMVSS requirements for AVs, with both companies first submitting their petitions in 2018. In February 2020, Nuro made automotive history as the first company to obtain a federal exemption for a driverless vehicle. As a low-speed automobile, Nuro’s R1 delivery AV was already subject to fewer FMVSS requirements than typical passenger cars and trucks. For its second-generation R2 prototype, Nuro successfully petitioned to be exempt from requirements for sideview mirrors, a windshield, and the rearview camera by showing that the removed features in fact enhanced the safety of the R2 relative to the R1. For example, without sideview mirrors, the R2 has a narrower profile; without a windshield, the risk of shattered material upon impact is lessened.
General Motors sought temporary exemptions for sixteen FMVSS requirements for the limited deployment of its zero-emission autonomous vehicles (ZEAV) based on the Chevrolet Bolt platform. Nearly three years after submitting the petition, General Motors announced it was withdrawing its request and instead seeking approval for its newer, purpose-built Cruise Origin model. AV developers’ minimal use of the exemption process suggests it is too slow and unpredictable to keep up with the pace of technological change.

Exemptions are intended to be temporary and limited to a small number of automobiles, not to be a pathway for the indefinite deployment of fleets of nonconforming vehicles. However, given that adapting FMVSS for AVs will likely be a prolonged endeavor, improving the exemption process should be an interim step toward deploying AVs at scale. Increasing the number of AVs that can obtain exemptions from inapplicable FMVSS certification requirements while continuing to ensure equivalent safety levels are met would increase consumer exposure, allow for better data collection, and encourage investment in AV manufacturing.

Congress has previously taken steps to address this gap and create a path for deploying this promising technology. In 2017, the House of Representatives passed the Self Drive Act (H.R. 3388) by a unanimous voice vote. This bill would have created a new category of exemptions specifically for AVs and allowed manufacturers to obtain exemptions for up to 100,000 vehicles after four years—progressively increasing from 25,000 exemptions in the first year. The bill also would have precluded state and local legislation or regulations regarding the design, construction, or performance of AVs. Senators John Thune (R-SD) and Gary Peters (D-MI) led the efforts to develop parallel legislation in the Senate. The Senate Commerce Committee reported on their AV Start Act in November 2017; however, it did not reach a floor vote after a group of senators raised several concerns, including the magnitude of increased exemptions and insufficient reporting requirements for exempted vehicles. In December 2018, a revised draft of the AV Start Act and a summary of the changes were circulated among the Senate in a last-minute push to pass legislation in the 115th Congress, but it did not proceed further.

Senator Thune attempted to revive the AV legislation by attaching an amendment to the Endless Frontier Act (S. 1260)—a bipartisan proposal for more than $100 billion in research and development funding to maintain U.S. competitiveness with China. The language of the AV amendment, which Senator Thune named the American Vehicle Competitiveness Act, according to reports appeared to be an updated, narrower version of the AV Start Act.

The proposal would, among other measures, reportedly authorize NHTSA to exempt 15,000 self-driving vehicles per manufacturer in the first year, rising to 80,000 vehicles in the third year. The expanded and phased increases in exemptions would allow more AVs to be on the road and bolster consumer familiarity with the technology while continuing to require equivalent levels of safety and protection. There is a seemingly cyclical phenomenon in which higher exposure and greater ubiquity of AVs will increase consumers’ acceptance of the technology. And with more consumer support, manufacturers will be able to create safer, faster, and more reliable vehicles.

On May 12, the Senate Commerce Committee debated a number of amendments to the Endless Frontier Act, including the American Vehicle Competitiveness Act. Senator Thune pleaded his case for the amendment, saying, “The U.S. regulatory framework has got to catch up with private sector innovation in order for these technologies to advance.” But ultimately, the amendment was withdrawn before the committee voted to advance the Endless Frontier Act to the Senate floor. However, Congress continues to consider the issue. On May 18, the House Energy and Commerce Committee held a hearing to discuss the potential consumer protection concerns of increased AV use and how the federal government should respond.
DATA COLLECTION AND LIABILITY ISSUES
The scaled increase of production could also allow for substantial data collection, which manufacturers can use to improve the safety and efficiency of AVs. A massive amount of data is necessary for them to make sound decisions instantaneously: IBM estimates that each autonomous test vehicle currently gathers terabytes of data per day. Humans are able to respond quickly to any number of events while driving, whether it be a changing traffic light, an abrupt decision by another vehicle on the road, a pedestrian thinking of crossing the street, an animal jumping into the road, or a sudden change in driving conditions. To not only replicate human behavior but operate with a higher degree of safety than human drivers, AVs will need to gather and process data from such occurrences. With more data readily available, developers can simulate and measure the performance of AI systems under variable conditions and ensure they are adequately trained for real-world deployment.

The collection of data is undoubtedly important and necessary, but regulators must also grapple with the complexities of data ownership and liability issues. Even in standard, non-autonomous vehicles, a car can collect personal data on the driver, especially if the owner connects a phone to it. However, there is also growing concern over data sharing between cars. An integral part of AV operation is the transmission of data back and forth as vehicles move on the road, but as vehicles sort and utilize the mountain of accumulated data, policymakers will have to implement adequate safeguards to address privacy concerns.

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Along with concerns over data sharing, there are also unaddressed questions over liability. In a collision involving self-driving cars, legal responsibility remains unclear. Would liability attach to a potential passenger, the automaker, the manufacturer of particular parts such as sensors, or perhaps the software company responsible for programming the vehicle’s automated response? Currently, it appears litigation may be the most likely route to liability clarification, which, in turn, may prompt state or federal laws. The latter would be the best way to avoid a patchwork of different state laws that could produce different outcomes depending on where an accident occurred. Failure to resolve these issues may delay consumer acceptance and increase the cost of owning an AV as insurance companies demand higher premiums from both manufacturers and consumers to hedge against the possibility of large jury awards in accident cases.

HARMONIZATION AND COORDINATION
Historically, the delineation between the federal government’s role and the responsibility of the states has been well-defined as it pertains to vehicle systems safety. The federal government currently handles automobile safety, which includes enforcing the performance and design requirements established by FMVSS, and states regulate driver licensing, vehicle registration, insurance, inspections, and traffic laws. However, in the absence of federal AV regulation, states are shouldering the responsibility. As of May 2021, 38 states have enacted legislation related to AVs, including 23 states that have established requirements for AV operators, use of public roads, or vehicle testing. The automobile industry would face an unworkable market if all 50 states implemented unique legislation in areas concerning testing, certification, safety, design, and performance. Automakers can only achieve economies of scale by manufacturing for national or international markets, not markets the size of individual states. A patchwork of state regulation would make economies of scale impossible to achieve, as automakers and suppliers would need to manufacture
and program automobiles to meet specific state regulations. Conflicting state regulations could also slow testing on public roads, which would ultimately slow deployment. To build a foundation of trust, it is necessary to have harmonization through federal regulation—consumers should feel comfortable that a vehicle system tested in Pittsburgh will provide the same level of safety in Albuquerque.

A uniform approach to standard setting is necessary for the United States to lead in the global AV industry, as it is not the only country crafting AV regulations. The complexity of AVs necessitates new regulations covering data protection, privacy, cybersecurity, safety standards, design requirements, performance, and more. Diverging regulatory approaches in foreign markets would limit opportunities for U.S. AV exports. Foreign governments currently use trade agreements to cement recognition of vehicle standards among partners—a tactic that U.S. automakers claim limits export opportunities. By acting as a first mover and striking a cooperative stance, the United States has the opportunity to engage with global automakers and trading partners to develop common standards.

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Common standards matter if use of AVs is to grow, and U.S. leadership is important from the standpoint of competitiveness. It is also a matter of security, as CSIS's James Lewis explains:

Cars have become rolling computers, loaded with cameras and other sensors and dependent on software and microprocessors. Increasingly, they connect to the internet, collect information on location, speed and, perhaps on driver communications. Future cars will collect even more data. China engages in massive domestic digital surveillance, and it extends its surveillance to foreign targets. There is always risk in buying items that are digitally connected to China, since there is a high likelihood that China exploits or will consider exploiting such devices for espionage purposes.

Agreement on common global standards can help reduce this security risk.

The federal government should continue to lead by coordinating AV operators’ data collection and sharing, in line with NHTSA’s safety mandate, through the AV TEST Initiative. Making collected data accessible to regulators is essential to formulating new FMVSS, establishing industry standards with stakeholder buy-in, and supporting the integration of AVs with transit systems and services. The federal government must also play a leading role in standardization to ensure all vehicles continue to be able to connect to infrastructure—such as other vehicles and mobility systems, which are the building blocks to building urban and regional mobility platforms.

**Conclusion**

For AV developers to remain competitive against other countries while upholding strong safety standards, the U.S. regulatory framework must be updated with clear, comprehensive federal standards. The innovation of self-driving cars is at an inflection point, and current standards—if not adjusted to facilitate innovation—will continue to impede the growth, safety, consumer acceptance, and economic potential of AVs.

Updating FMVSS, improving the exemption process, and addressing questions surrounding data and liability issues are crucial to ensuring that manufacturers can act and compete accordingly.
Bipartisan legislative proposals in Congress demonstrate significant interest at the federal level in addressing some of these barriers. The latest proposal—the American Vehicle Competitiveness Act of 2021—would expand the exemptions process, granting AV developers greater flexibility and more opportunities to engage in testing and scaled deployment. However, in the long term, FMVSS must be updated to adapt outdated feature- and design-based requirements to better reflect the evolution of vehicle development toward increasingly autonomous capabilities.

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