DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Part 571

[Docket No. NHTSA-2019-0036]

[RIN 2127-AM00]

Removing Regulatory Barriers for Vehicles with Automated Driving Systems

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

ACTION: Advance notice of proposed rulemaking (ANPRM).

SUMMARY: NHTSA is seeking public comment on the near- and long-term challenges of testing and verifying compliance with existing crash avoidance (100-series) Federal Motor Vehicle Safety Standards (FMVSSs) for Automated Driving System-Dedicated Vehicles (ADS-DVs) that lack traditional manual controls necessary for a human driver to maneuver the vehicle and other features intended to facilitate operation of a vehicle by a human driver, but that are otherwise traditional vehicles with typical seating configurations. This document seeks comments on the suitability of various approaches that could be used to address compliance verification challenges that exist for crash avoidance standards that either require a manual control; or specify the use of manual controls in a compliance test procedure. NHTSA's long-term goal is to use what the agency learns from this ANPRM, as well as the agency's other research efforts, to develop a proposal to amend the crash avoidance FMVSSs in ways that address these and other compliance challenges with a continued focus on safety. This ANPRM builds on NHTSA's efforts to identify and address regulatory barriers to ADS technologies, including the request for comments (RFC) on this topic in January 2018. NHTSA intends to

issue two additional documents to remove barriers in the crashworthiness FMVSSs (200-series standards) and address issues in the FMVSSs pertaining to telltales, indicators, and warnings in ADS-DVs.

DATES: Comments on this advanced notice of proposed rulemaking are due no later than [INSERT DATE 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Comments must be identified by Docket Number NHTSA-2019-0036 and may be submitted using any of the following methods:

- *Federal eRulemaking Portal*: *www.regulations.gov*. Follow the online instructions for submitting comments.
- *Mail*: Docket Management Facility, U.S. Department of Transportation, Room W12–140, 1200 New Jersey Avenue, S.E., Washington, DC 20590–0001.
- *Hand Delivery or Courier*: West Building, Ground Floor, Room W12–140, 1200 New Jersey Avenue, S.E., Washington, DC, between 9 a.m. and 5 p.m. E.T., Monday through Friday, except Federal holidays.
- Fax: 1–202–493–2251.

Regardless of how you submit your comments, you must include the docket number identified in the heading of this document. Note that all comments received, including any personal information provided, will be posted without change to *www.regulations.gov*. Please see the "Privacy Act" heading below.

You may call the Docket Management Facility at 202-366-9826.

Docket: For access to the docket to read background documents or comments received, go to *www.regulations.gov* or the street address listed above. We will continue to file relevant information in the Docket as it becomes available.

Privacy Act: In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, to *www.regulations.gov*, as described in the system of records notice, DOT/ALL-14 FDMS, accessible through *www.transportation.gov/privacy*. To facilitate comment tracking and response, we encourage commenters to provide their name, or the name of their organization; however, submission of names is completely optional. Whether or not commenters identify themselves, all timely comments will be fully considered.

FOR FURTHER INFORMATION CONTACT: For technical issues: David Hines, Director, Office of Crash Avoidance Standards (Phone: 202-366-1810; Fax: 202-493-0073). For legal issues: Sara R. Bennett, Attorney-Advisor, Vehicle Rulemaking and Harmonization, Office of Chief Counsel (Phone: 202-366-2992; Fax: 202-366-3820).

SUPPLEMENTARY INFORMATION:

Table of Contents

I. Executive Summary

This Advance Notice of Proposed Rulemaking (ANPRM) is a continuation of NHTSA's efforts to gather input from stakeholders and the public regarding what approaches to propose to address potential challenges to the verification of the compliance with the Federal Motor Vehicle Safety Standards (FMVSSs) of Automated Driving System-Dedicated Vehicles (ADS-DVs)[1] that

[1] An ADS is the hardware and software that are collectively capable of performing the entire dynamic driving task (DDT) on a sustained basis, regardless of whether it is limited to a specific operational design domain. The term "ADS" specifically refers to SAE Level 3, 4, or 5 driving automation systems as described in SAE J3016_201806 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles. However, the focus of this document is on ADS-DVs that lack traditional manual controls, but have traditional seating configurations. ADS-DVs which are defined as vehicles designed to be operated exclusively by a level 4 or level 5 ADS for all trips within its given ODD limitations (if any). *Id*. For the purposes of this ANPRM, manual controls include traditional driving input mechanisms, such as the steering wheel, accelerator pedal, brake pedal, and

lack traditional manual controls, but have traditional seating configurations. In this document, the agency first discusses the types of barriers posed by the existing crash avoidance standards and, second, what types of test methods could be employed to test vehicles that lack traditional controls. NHTSA believes that safety should be the preeminent consideration when evaluating whether and how the test methods discussed in this document could be used to address regulatory barriers to ADS-DVs. NHTSA notes that the focus of this document is ADS-DVs, and that the agency is not at this time considering changing the applicability of current requirements to traditional vehicles.

Comments are requested on these approaches and specifically on their feasibility and permissibility as additions to relevant crash avoidance FMVSSs.

To address barriers posed by the rest of the FMVSSs, NHTSA intends to issue two additional documents, one for the crashworthiness FMVSSs (200-series standards) and another for telltales, indicators, and warnings.

I. Introduction

The development of ADSs brings the possibility of associated reductions in the number of motor vehicle crashes, deaths, injuries, and associated economic costs. This document is one of three documents[2] NHTSA is issuing to begin the development and implementation of a comprehensive strategy to update the FMVSSs to maintain the required performance levels of existing standards for ADS-DVs without traditional manual controls while addressing regulatory barriers to the compliance verification of these vehicles. This ANPRM is intended to solicit

---

transmission gear selector controls. We refer to these vehicles in the balance of the document as "ADS-DVs without traditional manual controls."

[2] See https://www.reginfo.gov/public/do/eAgendaMain. The Regulatory Identification Numbers for the two other documents are RIN 2127-AM06, RIN 2127-AM07.

focused feedback on the feasibility and permissibility of a number of approaches to addressing the challenges in certifying or verifying compliance to certain crash avoidance (100-series) for ADS-DVs without manual controls.[3]

While some ADS-DVs are equipped with manual controls, and thus NHTSA can conduct compliance verification testing of those vehicles using current test procedures, this is not the case with all ADS-DVs. Specifically, this ANPRM focuses on ADS-DVs without traditional manual controls and that may also lack other features intended to facilitate operation of a vehicle by a human driver. NHTSA believes that modifications of the existing regulatory text, including definitions and test methods used to perform some existing 100-series FMVSS compliance tests, may be necessary for the agency to assess the vehicles' compliance with certain existing FMVSS. The agency intends to explore modifications to the standards with a continued focus on safety.

NHTSA notes that some equipment required under the current FMVSSs provide safety benefits beyond what the agency had originally contemplated at the time each FMVSS was promulgated. For instance, while the agency may have established rear visibility mirror performance requirements based on the safety need for a driver's visibility while driving, outside rearview mirrors have come to serve an additional safety function when a vehicle is parked by providing occupants information regarding whether it is safe to exit the vehicle. Such additional

---

[3] This document, therefore, does not address the regulation of ADS equipment or its performance, but rather focuses on determining and specifying in the FMVSS the processes that the agency will use in conducting compliance verification for vehicles without manual controls. This document is also not intended to address regulatory challenges relating to information or visibility requirements in the FMVSS (e.g., telltales, indicator lamps), the occupant protection requirements in the "crashworthiness" (200-series) FMVSS, dual-mode vehicles (i.e., that can be either driven using manual controls or by the ADS), bi-directional vehicles, or vehicles with non-traditional seating configurations (e.g., "campfire" seating arrangement). NHTSA intends to address these and other related topics in research and future documents.

safety benefits must be considered in evaluating their continued necessity on an ADS-DV without traditional manual controls.

In this document, NHTSA discusses two potential types of regulatory barriers for ADS-DVs without traditional manual controls, describes a FMVSS that exemplifies each challenge, and presents a brief overview of comments on the request for comment (RFC). The agency also presents and seeks comment regarding the safety impacts of using alternative compliance test verification methods to conduct compliance verification testing for these types of vehicles, assuming that the standards and procedures could be revisited to appropriately ensure the existing standard of performance without requiring, directly or indirectly, manual controls. NHTSA has initiated work in these areas, including an internal evaluation of regulatory requirements as well as an ongoing research project with the Virginia Tech Transportation Institute (VTTI). The agency anticipates significant overlap between the standards identified and discussed in this ANPRM and the provisions and requirements identified by VTTI through its research activity and analysis. The comments received in response to this document will supplement the research to ensure that NHTSA is considering all stakeholders' perspectives when developing proposals to modify the existing FMVSSs.

II. Background

NHTSA's primary exercise of its regulatory authority under the National Traffic and Motor Vehicle Safety Act, as amended ("Safety Act"), involves the development, establishment, and enforcement of the FMVSSs.[4] FMVSSs, including the tests they specify, must be: practicable, both technologically and economically; objective, meaning that they must produce

[4] 49 U.S.C. 30111.

identical results when tests are conducted in identical conditions and determinations of compliance must be based on scientific measurements, not subjective opinion; and meet the need for safety.[5] In addition, in issuing a FMVSS, the agency must consider whether the standard is reasonable, practicable, and appropriate for the types of motor vehicles or motor vehicle equipment for which it is prescribed.[6] NHTSA possesses broad general rulemaking authority to issue regulations to assist in implementing the Safety Act.[7]

Manufacturers must certify that their motor vehicles comply with all applicable standards before the vehicles can be sold, offered for sale, introduced or delivered for introduction in interstate commerce, or imported into the United States.[8] Generally speaking, certification to a standard means that the manufacturer, in exercising reasonable care, certifies that the vehicle meets the requirements of that standard, and that if the vehicle were to be tested according to the test procedures contained in the FMVSSs, the vehicle would meet or exceed the level of performance specified in the standard. That is, while NHTSA verifies that vehicles are compliant with the FMVSSs by conducting compliance tests as they are set forth in the FMVSSs and NHTSA's corresponding compliance test procedures, manufacturers are not required to follow the compliance test procedures, and, instead, simply may not certify a vehicle as compliant, if "in exercising reasonable care, the [manufacturer] has reason to know the

---

[5] 49 U.S.C. 30102(a)(9), 30111(a).
[6] 49 U.S.C. 30111(b)(3).
[7] The National Traffic and Motor Vehicle Safety Act, *as amended* (Public Law No. 89-563, 80 Stat. 730) contained a section that authorized the Secretary to issue, amend, and revoke rules and regulations that the Secretary deemed necessary to carry out the subchapter (i.e., "general rulemaking authority"). *See* S. Rep. No. 91-559, at 3136, 3141 (1969) That section was repealed as surplus during codification. *See* 15 U.S.C.A. § 1406. 49 USC 322(a) separately provides the Secretary with such authority. The Secretary has, in turn, delegated that authority to all modal Administrators. 49 CFR 1.81 (a)(3).
[8] 49 U.S.C. 30115(a).

certificate is false or misleading in material respect."[9] Absent an exemption or exception, ADS-DVs must comply with all applicable FMVSSs.[10]

As the federal agency charged with reducing crashes and deaths and injuries resulting from crashes on the nation's roadways,[11] NHTSA is encouraged by the potential for safety improvements through new ADS technologies being developed by automobile manufacturers and other innovators. NHTSA anticipates that ADS-DVs can serve a vital safety role on the Nation's roads, particularly since human error and choice are critical factors behind the occurrence of a large number of crashes.[12]

However, for ADS technologies to develop fully, technological and regulatory barriers must be overcome. NHTSA wants to take this opportunity to reaffirm that, despite the use of the term "regulatory barrier" in this and other future documents, the existing FMVSSs neither have any provisions addressing the self-driving capability of an ADS nor prohibit inclusion of ADS components on a vehicle. Likewise, nothing in those standards poses testing or certification challenges for vehicles with ADSs so long as the vehicles have means of manual control and conventional seating, and otherwise meet the performance requirements of the FMVSSs. Thus, it is a manufacturer's design of a motor vehicle without manual driving controls, design of a motor vehicle with novel seating configurations or orientations, or a covered party's disabling of any part of a device or element of design of a motor vehicle or motor vehicle equipment that is currently in compliance with applicable FMVSSs, that could complicate the compliance of the

---

[9] *Id*.
[10] 49 U.S.C. 30112.
[11] 49 U.S.C. 30101.
[12] *See* Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey (February 2015), *available at* https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812115.

vehicle to the existing FMVSSs[13] – not solely the inclusion of the hardware and software that make up an ADS. For ADS-DVs not designed to ever be driven by a human, requiring installation of traditional manual controls results in unnecessary design restrictions and regulatory expense.

III. NHTSA's Efforts to Provide Guidance and Regulatory Certainty

This ANPRM builds on NHTSA's efforts in recent years to identify and address regulatory barriers to ADS technologies. NHTSA has already taken steps to address technological barriers through the publication of agency guidance to ensure the safe development and deployment of ADS technologies. In September 2017, the DOT released the guidance document *Automated Driving Systems 2.0: A Vision for Safety* to provide guidance to the public, particularly industry stakeholders and the States. *A Vision for Safety* discussed 12 priority safety design elements for manufacturers and other innovators involved in ADS development, including vehicle cybersecurity, human machine interface, crashworthiness, consumer education and training, and post-crash ADS behavior. More recently, DOT released *Preparing for the Future of Transportation: Automated Vehicles 3.0,* a complementary document to the 2017 guidance that introduces guiding principles that will support Departmental programs and policies and describes the DOT's multi-modal strategy to address

[13] A covered party is defined as a manufacturer, distributor, dealer, rental company, or motor vehicle repair business. 49 U.S.C. 30122. Covered parties are prohibited from knowingly making inoperative any part of a device or element of design installed in a new or used motor vehicle or motor vehicle equipment in compliance with an applicable FMVSS. *Id*. The make inoperative prohibition contains an exception that applies when the covered party "reasonably believes" the vehicle or equipment with the inoperative device or element will only be used "for testing or a similar purpose during maintenance and repair." *Id*. NHTSA has additional exemption authority with regard to the "make inoperative" prohibition and may prescribe regulations to exempt a person or a class of persons from this prohibition if the Agency decides the exemption is consistent with motor vehicle safety and the purposes of the Act. 49 U.S.C. 30122(c). NHTSA has issued regulatory exemptions to the make inoperative prohibition for the installation of airbag on/off switches and other modifications to accommodate people with disabilities. 49 CFR part 595.

existing barriers to safety innovation and progress. It also communicates DOT's agenda to the public and stakeholders on important policy issues and identifies opportunities for cross-modal collaboration. DOT's automation principles are: (1) We will prioritize safety; (2) We will remain technology neutral; (3) We will modernize regulations; (4) We will encourage a consistent regulatory and operational environment; (5) We will prepare proactively for automation; and (6) We will protect and enhance the freedoms enjoyed by Americans.

NHTSA has also conducted research activities to help inform its decision-making with regard to identifying and resolving regulatory barriers. NHTSA, in collaboration with the Volpe National Transportation Systems Center, conducted a preliminary report identifying barriers to the compliance testing and self-certification of ADS-DVs without traditional manual controls. In March 2016, that report was published (the "Volpe Report"). [14] The report focused on FMVSS requirements that present barriers to the compliance testing and self-certification of ADS-DVs without traditional manual controls because they refer to a human driver.[15]

Based on the Volpe Report findings, in 2017, NHTSA initiated work with VTTI to expand upon the work performed by Volpe by performing analysis and industry outreach to identify potential approaches for addressing compliance verification barriers.[16] Through this contract with NHTSA, VTTI is going beyond the initial work in the Volpe Report and taking a

---

[14] Kim, Perlman, Bogard, and Harrington (2016, March) Review of Federal Motor Vehicle Safety Standards (FMVSS) for Automated Vehicles, Preliminary Report. US DOT Volpe Center, Cambridge, MA. Available at: https://rosap.ntl.bts.gov/view/dot/12260

[15] The term 'driver' is defined in §571.3 as follows: "Driver means the occupant of the motor vehicle seated immediately behind the steering control system."

[16] Contract No. DTNH2214D00328L/DTNH2217F00177, "Assessment, Evaluation, and Approaches to Modification of FMVSS that may Impact Compliance of Innovative New Vehicle Designs Associated with Automated Driving Systems." The task award document states "[t]he overall goal of this Task Order is to provide NHTSA findings and results needed to make informed decisions regarding the modification of FMVSS in relation to the certification and compliance verification of innovative new vehicle designs precipitated by automated driving systems."

broader look at possible modifications to the current FMVSS regulatory text and test procedures that would both maintain safety and ensure regulatory certainty for manufacturers of ADS-DVs without traditional manual controls. The VTTI project, as currently scoped, is separated into two phases. Phase I, which will include the technical translation of 30 FMVSSs and associated test procedures, concludes by the end of 2019. Phase II, which will focus on the remaining FMVSSs and associated test procedures, is expected to start in 2019 and conclude in mid-2021. These efforts are anticipated to inform NHTSA's decisions on updates to the FMVSSs.

In addition to these research efforts, NHTSA has also requested input from stakeholders through a January 2018 RFC to identify regulatory barriers in the FMVSS to the testing, compliance certification, and compliance verification of ADS-DVs without traditional manual controls.[17] [18] This ANPRM continues the discussion on topics covered in the January 2018 RFC. NHTSA also recently published an ANPRM requesting public input on a possible future national pilot program for the safe on-road testing and deployment of vehicles with high or full driving automation.[19] [20]

Finally, NHTSA has received and evaluated an interpretation request and petition for exemption that helped inform this document. The first was an interpretation request received from Google, to which the agency responded on February 4, 2016.[21] The response covered a variety of Google's concerns relating to how it could certify a vehicle that does not include

---

[17] See the table in Appendix A for explanations of these terms.
[18] 83 FR 2607 (Jan. 18, 2018).
[19] 83 FR 50872 (Oct. 10, 2018).
[20] Deployment in this context refers to the manufacturing for sale, selling, offering for sale, introducing or delivering for introduction in interstate commerce, or importing of vehicles in the U.S.
[21] *Available at* https://isearch.nhtsa.gov/files/Google%20--%20compiled%20response%20to%2012%20Nov%20%2015%20interp%20request%20--%204%20Feb%2016%20final.htm.

manual controls, such as a steering wheel, accelerator pedal, or brake pedal. The response also provided tables listing those standards that NHTSA could interpret Google's ADS as the "driver" or "operator," and a table listing those standards that NHTSA could interpret the human occupant seated in the left front designated seating position as the "driver."[22] The agency interpreted the term "driver" as applying to the ADS. Even so, NHTSA's response highlighted that interpreting the driver to be the ADS "does not end the inquiry or determine the result" – many of the interpretive requests would require rulemaking and/or exemption for resolution.[23]

The second request that helped inform this document is a petition for exemption from General Motors (GM), which the agency received on January 11, 2018.[24] In that petition, GM categorized what they described as "human-driver-based requirements" into three categories: (1) features designed to interface with a human driver, such as manual controls; (2) features designed to provide human drivers with information, such a telltales and indicator lamps; and (3) features to protect human occupants, such as air bags. GM's contention is that its ADS-DVs without traditional manual controls require only the third category of requirements. GM states that the ADS-DV provides the controls and information to the ADS, and that doing so meets the safety objectives of the FMVSS. Additionally, the GM petition states that their vehicle applies the occupant protection required for the right front seating position to the left front seating position.

Based on these efforts, NHTSA has determined that most of the potential regulatory barriers to the certification of ADS-DVs without traditional manual controls in the 100-series

---

[22] *Id*.
[23] *Id*.
[24] Information available at: https://www.nhtsa.gov/laws-regulations/petitions-nhtsa.

FMVSSs fall into three categories: (1) the standard requires a manual control; (2) the standard specifies how the agency will use manual controls in the regulatory description of how it will test for compliance; or (3) the definition or use of particular terms (e.g., "driver") become so unclear that clarification is necessary before certification and compliance verification testing is possible.

To address these barriers, NHTSA considered stakeholder input and conducted an internal analysis of the translations of the regulatory text necessary to remove barriers, and has identified in the ANPRM a number of regulatory approaches for how to amend the FMVSSs to accommodate compliance verification of ADS-DVs without traditional manual controls. Using two primary crash avoidance standards as illustrative examples, this ANPRM provides a discussion of the first two identified categories of potential regulatory barriers.

Removal of barriers posed by references to traditional manual controls in the standards or test procedures, however, does not resolve all issues, as NHTSA itself must still be able to test these vehicles to ensure their compliance. This ANPRM, therefore, provides several alternative compliance verification test methods that commenters briefly mentioned in their comments. NHTSA has made no judgment at this time regarding which compliance verification test method would be best for addressing the particular regulatory barriers, if any, and expects that it may be possible that the feasibility, including meeting the requirements of the Safety Act, of a particular compliance strategy would depend on the context in which it is used. It is NHTSA's hope that the feedback received in response to this ANPRM will support this and future rulemaking activities and clarify the compliance methods that would best address any crash avoidance regulatory barriers that may exist today.

IV. Stakeholder Feedback

On January 18, 2018, the agency issued an RFC seeking public comments to identify regulatory barriers in the existing FMVSS to the testing, compliance certification, and compliance verification of motor vehicles equipped with ADS and certain unconventional interior designs (83 FR 2607). The agency received roughly 100 comment submissions to the RFC.[25] Comments were received from a diverse group of stakeholders including safety advocates; trade associations; individual vehicle manufacturers; automotive suppliers; state and local government agencies; international standards organizations working groups; insurance/legal; research institutions; policy centers; consultants; workers'/union representatives; and individuals. In addition, to support the RFC, NHTSA held a public meeting on March 6, 2018 (83 FR 6148) in Washington, D.C., at which VTTI presented an overview of their NHTSA-funded project focused on the development of options for potential FMVSSs and compliance test procedure revisions.

Comments were requested in two main areas: (1) barriers to testing, certification, and compliance verification and (2) research needed to address those barriers and NHTSA's role in conducting such research. Topics discussed by commenters included, for example, suggestions for regulatory strategies for ADS-DVs without traditional manual controls; specific barriers; suggestions about the use of interpretations and exemptions to remove regulatory barriers; importance of maintaining and ensuring safety for all road users; activities being conducted by industry standard organizations; potential impacts to the environment and the workforce; considerations from local and state government organizations; data acquisition, use and

[25] Docket No. NHTSA-2018-0009

protection; research needs; among others. Input received from these stakeholders, as it relates to the focus of this ANPRM, is included and referenced throughout this document. A brief summary of comments follows.

Vehicle manufacturers and technology companies suggested that NHTSA consider all regulatory tools in the near term, including interpretations and exemptions, to address regulatory uncertainty instead of relying on the notice and comment rulemaking process. While NHTSA is utilizing these processes, where appropriate, the agency is concurrently pursuing regulatory action to address issues that require changes to the regulatory text.

Some safety advocates stated that, before removing regulatory barriers, new FMVSSs are needed for ADSs to avoid unintended safety consequences. Vehicle manufacturers and technology companies also generally stated that NHTSA should focus on conventional vehicles equipped with ADSs first, and that barriers unaffected by the absence or presence of traditional manual controls could be addressed later. Further, there was some disagreement amongst commenters regarding which FMVSSs should be retained, even for ADS-DVs without traditional manual controls.

The agency agrees that the existing FMVSSs neither have provisions addressing the capabilities of ADSs nor prohibit ADS hardware or software, but believes that unique aspects of ADSs warrant further research to assess how to best structure any new regulation in a way that appropriately addresses safety issues. Accordingly, the agency's focus in this document is on the narrower question of how to amend the FMVSS to safely permit ADS-DVs without traditional manual controls... The agency, therefore, discusses an approach to address challenges for crash avoidance standards, with an emphasis on what the agency could do to clarify how it will conduct compliance verification testing for the two previously identified categories of barriers.

The agency also received comments on other topics such as data, cybersecurity, and impact of ADS-DVs without traditional manual controls on traffic congestion, transit, land use, the environment, jobs, and training. Although, not the focus of this document, the agency has reviewed and appreciates stakeholders' perspectives on these topics. Other NHTSA and DOT activities, including the Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation ANPRM, Study on the Impacts of Automated Vehicle Technologies on the Workforce, and voluntary guidance documents, are examining some of these issues and may inform future regulatory proposals.

V. Addressing Barriers in the FMVSS

In the ANPRM, NHTSA furthers the discussion begun in the RFC by seeking comment on potential strategies to safely address regulatory barriers to the compliance verification of ADS-DVs without traditional manual controls. Because the agency believes that safety should be the primary focus of its efforts to address barriers to ADS-DVs, we ask that commenters explain how the use of the different regulatory approaches discussed in this document would affect vehicle safety.

In this section, the agency describes and provides illustrative examples of the two predominant categories of regulatory barriers to compliance certification that exist in the crash avoidance standards.

The crash avoidance standards, located in the FMVSS 100-series, are designed to reduce the likelihood of a crash occurring or, failing that, reduce the severity of a crash by reducing the velocity of vehicles involved in a crash. This is in contrast to the agency's crashworthiness standards, located in the FMVSS 200-series, which are designed to reduce the risk of injury to occupants in a crash. Thus, the most prominent historical examples of crash avoidance standards

concern: lighting, mirrors and other measures to enhance visibility; braking requirements; and measures related to tires. More recently, this category of standards includes the agency's requirements that rely on advanced safety systems, including electronic stability control (ESC), rear visibility systems, and sound alerts for pedestrians, as these technologies, like more advanced ADS technologies, are designed to decrease the likelihood of a crash.

The agency has established that most of the barriers within the crash avoidance standards fall into one of the following three types:

1. The standard requires a manual control.
2. The standard specifies how the agency will use manual controls in the regulatory description of how it will test.
3. The definition or use of terms (e.g., "driver") in the FMVSS that assume human control of vehicles.

The following sections discuss these first two types of barriers by focusing on a prominent example of each barrier and how the agency could address this type of barrier. The third type of barrier has impacts on all of NHTSA's standards, and therefore will be addressed in the agency's future documents.

A. Example #1 (FMVSS No. 135): Manual control required

The first type of barrier to the compliance verification of an ADS-DV without traditional manual controls is when a safety standard directly requires a manual control be provided in the vehicle.

FMVSS No. 135, "Light vehicle brake systems," provides an illustrative example of a standard that serves as a potential barrier because it requires that vehicles be equipped a manual control and requires that this manual control be used to test compliance. Specifically, per

FMVSS No. 135, S5.3, all light vehicles must be equipped with service brakes that "*shall be activated by means of a foot control.*"

Evaluation and discussion of this barrier is not new – NHTSA's interpretation letter to Google stated that the agency would need to commence rulemaking to consider an amendment to FMVSS No. 135.[26] The agency is carefully assessing the overall safety impacts of removing any potential barriers in FMVSS No. 135.

RFC Comments: A number of commenters to the RFC specifically discussed the FMVSS No. 135 "foot control" requirement as a potential barrier to the design of their ADS-DVs without traditional manual controls. Overall, many of the industry commenters requested that NHTSA remove the reference to a foot control. However, other commenters, including some safety advocates, requested that NHTSA focus its efforts on creating additional standards to regulate the ADS rather than removing or modifying components of current standards. Some commenters also requested that NHTSA examine any risks associated with permitting the removal of brake system controls and advocated for a holistic assessment of all risks each FMVSS mitigates.

NHTSA's Preliminary Analysis: To consider how best to address a regulatory barrier such as that imposed by the FMVSS No. 135 "foot control" requirement, NHTSA believes it is important to first consider the safety purpose of the standard. For example, the stated purpose of FMVSS No. 135 is to "ensure safe braking performance under normal and emergency driving

[26] https://isearch.nhtsa.gov/files/Google%20--%20compiled%20response%20to%2012%20Nov%20%2015%20interp%20request%20--%204%20Feb%2016%20final.htm.

conditions."[27] A foot-controlled brake serves several interests. First, it ensures that a driver can decelerate the vehicle while maintaining maximum control over the steering input. Second, it ensures that a driver will always know that brakes are actuated by foot controls. Third, absent power brake technology, a driver can apply more force with a foot pedal than by using a hand-operated control. Some of these interests are less relevant today than in the past. For example, power brake technology can substantially reduce the force required to actuate the service brakes and is found in the vast majority of new vehicles produced today.

In considering whether to remove a requirement for a manual control such as a foot-actuated service brake control, it is critical to consider broader impacts on safety. Specifically, in order to assess the overall impact of removing the requirement that service brakes be operated by foot control, NHTSA must consider the reasoned expectation that a human driver will reliably use the service brakes to avoid obstacles.

Thus, NHTSA is considering four possible approaches to address requirements for manual controls such as the foot-actuated brake pedal requirement in FMVSS No. 135. As these are general approaches to this issue, they are not intended to address specific standards, which may have underlying statutory mandates that could limit the agency's flexibility.

- First, if the required control is necessary for motor vehicle safety on all vehicles, NHTSA would retain the requirement for all vehicles, even if that requires potentially redundant technologies for certain ADS-DVs without traditional manual controls.

[27] 49 C.F.R. § 571.135.

- Second, if the required control is no longer necessary for motor vehicle safety for any vehicle, NHTSA could remove or otherwise modify the requirement, if permitted to by law.
- Third, if the required control is still necessary for motor vehicle safety for traditional vehicles, but not necessary for the safety of ADS-DVs without traditional manual controls, NHTSA could retain the requirement only for traditional vehicles and, if permitted by law, exclude ADS-DVs without manual controls.
- Fourth, if the required control is necessary for motor vehicle safety, but a different control (i.e., a non-human-actuated control) would be necessary for an ADS-DV to perform the same function, NHTSA may retain the existing requirement for traditional vehicles, but have a separate, different control or equipment requirement for ADS-DVs without traditional manual controls.

B. Example #2 (FMVSS No. 126): Existing test procedures that cannot be executed absent traditional manual controls

The second type of barrier is when the test procedure for a standard specifies how the agency will use manual controls in the regulatory description of how it will test vehicles' compliance with the performance requirements of an FMVSS, even though the standard itself does not require a manual control. Typically, NHTSA's safety standards outline performance requirements that must be met under certain test procedures and NHTSA will conduct compliance verification tests in accordance with these procedures. Some descriptions of how NHTSA will conduct a FMVSS compliance verification test reference controls that are not

present on ADS-DVs without traditional manual controls, or not provided in the same capacity as a vehicle with manual controls.

An example of this type of barrier is in FMVSS No. 126; Electronic Stability Control (ESC) Systems for Light Vehicles. The purpose of FMVSS No. 126 is to reduce the numbers of deaths and injuries that result from crashes in which the driver loses directional control of the vehicle, including those resulting in vehicle rollover, by requiring that vehicles be installed with an ESC system that meets the performance requirements established in the standard.[28] The FMVSS, therefore, is about the performance of the ESC system, not any traditional manual control. However, the compliance test included in the regulation states that "a steering machine programmed to execute the required steering pattern must be used."[29] This paragraph says that the agency will use a steering machine, which mounts to the vehicle steering wheel and, through computer programming, is used to apply steering inputs at specific magnitudes, rates, and timing, when conducting the tests within the ESC standard. This requirement is based on the assumption at the time of the standard's promulgation that all vehicles subject to FMVSS No. 126 would have steering wheels. However, for an ADS-DV without a traditional steering wheel, the manufacturer of the vehicle is left without the necessary information as to how the agency will conduct a compliance verification test, and therefore, lacks the regulatory certainty it would normally have when conducting its certification testing for a traditional vehicle. Further, NHTSA would also not be able to conduct its own compliance test. Thus, in this scenario, it is impossible to determine whether the ESC is adequately functioning.

---

[28] 49 C.F.R. § 571.126.

[29] 49 C.F.R. § 571.126, S6.3.5.

RFC Comments: Several commenters provided feedback on possible alternate test methods to verify compliance with FMVSS No. 126. Many of these comments concerned how compliance could be verified once the agency has determined how to modify the test procedure to remove the reference to the traditional manual control. These issues are addressed in the following section. With regard to how the procedures themselves could be modified, some commenters suggested that the agency focus on identifying alternate performance criteria to address the safety intent of the standard using different metrics (i.e., lateral displacement, peak yaw rate, and instant yaw rate). Specific to the ESC test, one commenter suggested an alternate metric to steering wheel angle suggested by commenters was the angle of the front wheels relative to the longitudinal axis of the vehicle. Other commenters suggest that, instead of making substantial changes to existing standards, NHTSA should consider issuing a separate set of standards specifically for ADS-DVs.

NHTSA's Preliminary Analysis: Considering the FMVSS No. 126 example above, the purpose of this standard is to "reduce the number of deaths and injuries that result from crashes in which the driver loses directional control of the vehicle, including those resulting in vehicle rollover." That is, the agency did not promulgate the rule for the purpose of requiring a steering wheel or regulating the performance of the steering wheel, but used the equipment it reasonably anticipated at the time would be included in any of the vehicles for which ESC would be required. The agency tentatively believes that other standards that present similar types of barriers were also intended to address the performance of some other part of the vehicle, rather than the manual control. Therefore, the agency could modify the test procedure in such a way that removes or modifies the reference to the control without affecting the performance of the regulated aspect of the vehicle.

There are numerous ways that this could be done. For example, if an ADS-DV lacks traditional manual controls but continues to have some way to control the vehicle (e.g., through a wireless application), the agency could revise the test procedure to reference alternative types of controls. Alternatively, it may be that these vehicles will also continue to have equipment that the agency can use to test the performance of a regulated component. For example, although vehicles without traditional manual controls will not have a steering wheel, they will have a steering system that controls the directional motion of the vehicle based on inputted path or destination information.[30] NHTSA may be able to identify a different point within the steering system at which the magnitude of a turn can be measured. If such a point can be identified and a means of commanding the translated input to the vehicle can be developed, NHTSA could conduct the ESC compliance test in the same manner as it is done on vehicles with steering wheels. NHTSA requests comment on this analysis and possible approaches for addressing test procedures that presume the presence of manual controls, such as the steering wheel angle portion of FMVSS No. 126. Another approach may be to identify and evaluate other relevant performance metrics. For example, replacing the steering wheel angle requirements with a wheel angle requirement. Further, the agency could more dramatically revise the standard to address the performance of the regulated feature or component by considering the safety intent of the

[30] Separately, FMVSS No. 203; "Impact protections for the driver from the steering control system" defines a steering control system as "the basic steering mechanism and its associated trim hardware, including any portion of a steering column assembly that provides energy absorption upon impact. SAE documents refer to "lower steering system", the "upper steering system", "power assist systems," and "advanced steering systems." The lower steering system includes, but is not limited to, the wheel end, suspension geometry, linkages, and steering gear. The upper steering system includes, but is not limited to, the steering column and intermediate shaft. The power assist system includes, but is not limited to, any hydraulic, electro-hydraulic, and electric power steering functionalities. Finally, the advanced steering systems include, but are not limited to, rear wheel steer, active front steer, active park assist, and other driver assistance systems. See SAE C0716 "Fundamentals of Steering Systems," *available at* https://www.sae.org/learn/content/c0716/.

standard. For example, for ESC, the safety intent is to reduce deaths and injuries from crashes in which the driver loses directional control of the vehicle. If NHTSA took this type of broad view, it could potentially replace the sine-with-dwell maneuver with some type of road course that would assess the ADS-DV's ability to steer to avoid obstacles, potentially including a variant of the sine-with-dwell maneuver, thereby testing the associated lateral accelerations, yaw rates, etc. However, to develop an objective, repeatable road course to replace the sine-with-dwell maneuver and adequately evaluate a vehicle's ESC system would require considerable research, so other nearer-term solutions would still need to be considered.

The agency seeks comment on the feasibility of these and other approaches, including explanation of how any potential changes to the regulatory text will affect vehicle safety.[31]

C. Additional Barrier Examples

The above two examples demonstrate different types of barriers that exist for manufacturers interested in certifying ADS-DVs that lack traditional manual controls to existing requirements in the FMVSSs. These barriers are not mutually exclusive, as a particular standard could include both types of barriers.

The agency has tentatively identified the types of barriers in the following provisions: In FMVSS No. 108, hazard warning signal flashers and operating units, beam switching devices, and turn signal operating units; in FMVSS No. 114, depressing the brake pedal and references to the parking brake; in FMVSS No. 138, driving the vehicle on the Uniform Tire Quality Grading (UTQG) public roadways as part of the compliance test procedure; as well as similar provisions

[31] The agency understands that FMVSS No. 136, Electronic Stability Control for Heavy Vehicles, presents similar issues as those discussed for FMVSS No. 126.

in the standards that apply specifically for heavy vehicles, including FMVSS No. 105, 121, and 136. See the table below categorizing each of these additional examples by the type of barrier it represents.

	Barrier type 1-- requires a manual control	Barrier type 2--specifies the use of manual controls in a compliance test procedure
FMVSS No. 108		
Hazard warning signal flasher or operating unit	X	X
Beam switching device	X	X
Turn signal operating unit	X	X
FMVSS No. 114		
Reference to parking brake		X
Depressing the brake pedal	X	
FMVSS No. 138		
Driving the vehicle on the UTQG public roadways as part of the compliance test procedure		X
FMVSS No. 105		
Reference to a specific device that reduces operator effort and mentions muscular force in the	X	

definition of brake power assist		
Manual control to be used during testing of the hydraulic and electric brake systems		X
FMVSS No. 121		
Mention a "service brake control"	X	X
Mentions "actuation of the parking brake control"	X	X
Parking brake control—trucks and buses. The parking brake control shall be separate from the service brake control. It shall be operable by a person seated in the normal driving position. The control shall be identified in a manner that specifies the method of control operation. The parking brake control shall control the parking brakes of the vehicle and of any air braked vehicle that it is designed to tow.	X	X
FMVSS No. 136		
Transmission and Brake Controls.		X

The transmission selector control is in a forward gear during all maneuvers. A vehicle equipped with an engine braking system that is engaged and disengaged by the driver is tested with the system disengaged.		

The agency has a series of questions relating to the examples listed above in this section and to the next section. Thus, the questions will be listed after the following section.

VI. Possible Approaches to Revising Crash Avoidance Test Procedures

The above discussion concerns how the agency could remove references to traditional manual controls in both the standards and test procedures. However, that begs the question: once vehicles no long have traditional manual controls, how will NHTSA be able to test them to ensure that they meet the revised standards? Without traditional controls, NHTSA will have to confront such varied issues as: how to get a vehicle it purchases for compliance testing from the test facility; how it will direct the vehicle to perform the required test procedure; how it will deal with a vehicle whose ODD does not include a test facility; and so on.

Below are several general approaches NHTSA could consider in developing a document proposing to amend the existing 100-series FMVSS requirements and test procedures for ADS-DVs without manual controls in a way that allows NHTSA to conducts testing for vehicles that are not required to have traditional manual controls. NHTSA developed these approaches in response to certain comments[32] received in response to the January 2018 RFC, as well as NHTSA's own internal analysis. NHTSA's goal is to ensure that the testing methods it specifies for its use in testing ADS-DVs without traditional manual controls are practicable and objective, and otherwise meet the requirements of the Safety Act.

The agency requests comment on the following approaches: (1) Normal ADS-DV operation; (2) Test Mode with Pre-Programmed Execution (TMPE); (3) Test Mode with External

[32] The agency's discussions of those approaches do not include a summary of what the commenters said about the approaches. This is because the commenters simply identified them; they did not describe them or explore of their possible advantages/disadvantages. Where possible, the agency does provide a citation to an example of the comments that mention one or more of those approaches.

Control (TMEC); (4) Simulation; (5) Technical Documentation for System Design and/or Performance Approach; and (6) Use of Surrogate Vehicle with Human Controls. The agency also requests comment on whether any additional alternatives are possible. In addition to answers to the questions that appear after the discussion of each approach, NHTSA requests that commenters answer these questions for each of the approaches:

1. What are the possible advantages and disadvantages of each approach?
2. Discuss whether each approach fits the requirements and criteria of the Safety Act and enables effective enforcement of the FMVSSs. Explain the basis for your answers.
3. Can more than one of these approaches be specified by the agency as alternative ways for the agency to determine compliance with the same requirement in the same FMVSS? If so, please describe how this could be done consistent with the Vehicle Safety Act, using one or more specific FMVSS requirements as illustrative examples. If more than one approach could be specified for the same requirement in the same FMVSS, do commenters believe that the agency, in assessing compliance with the same requirement in the same FMVSS, choose one approach for one vehicle model, but another approach for a different model? If so, explain why.
4. If only one of these approaches can be used to enforce a particular FMVSS requirement, what factors should be considered in selecting that approach? What policy or other considerations should guide the agency in choosing one alternative approach versus another for determining the compliance of a particular vehicle or item of equipment?
5. With respect to any single approach or combination of approaches, could it be ensured that the compliance of all makes and models across the industry is measured by the same yard

stick, i.e., that all vehicles are held to the same standard of performance, in meeting the same FMVSS requirement?

6. What other potential revisions or additions to terms, in addition to 'driver', are necessary for crash avoidance standards that NHTSA should consider defining or modifying to better communicate how the agency intends to conduct compliance verification of ADS vehicle
7. Should NHTSA consider an approach to establish new definitions that apply only to ADS-DVs without traditional manual controls?
8. For compliance testing methods involving adjusting current test procedures to allow alternative methods of controlling the test vehicle during the test (normal ADS-DV function, TMPE, TMEC), or to allow the use of a surrogate vehicle:
    a. How could NHTSA ensure that the test vehicle's performance using the compliance method is an accurate proxy for the ADS-DV's performance during normal operation?
    b. If NHTSA were to incorporate the test method into its test procedures, would NHTSA need to adjust the performance requirements for each standard (in addition to the test procedures) to adequately maintain the focus on safety for an ADS-DV?
9. For compliance testing methods that replace physical tests with non-physical requirements (simulation, documentation):
    a. If the test method is used to determine compliance with a real-world test, how can NHTSA validate the accuracy of a simulation or documentation?

b. If NHTSA must run real-world tests to validate a simulation or documentation, what is the advantage of non-physical requirements over these other compliance methods?

10. Would non-physical requirements simply replicate the existing physical tests in a virtual world? If not, what would be the nature of the non-physical requirements (that is, what performance metrics would these requirements use, and how would NHTSA measure them)? Are there ways that NHTSA could amend the FMVSSs to remove barriers to ADS-DVs that would not require using the compliance test methods described in below?
    a. Are there any barriers in the FMVSS or NHTSA's test procedures that could be addressed by altering or removing references to manual controls in the test procedures without substantively changing the FMVSS performance requirement?
    b. Are there any changes that NHTSA could make to the FMVSS test procedures that could incorporate basic ADS capabilities to demonstrate performance, such as using an ADS-DV's capability to recognize and obey a stop sign to test service brake performance?
11. What research or data exists to show that the compliance test method would adequately maintain the focus on ADS-DV safety? What modifications of the safety standards would be necessary to enable the use of the test method?

A. Normal ADS-DV Operation

One possible approach for vehicle manufacturers to use for self-certification, and the agency to use for compliance verification, is the "Normal ADS-DV Operation" approach. This approach involves operating the ADS-DV without traditional manual controls "as-is" with no

extra programming and/or installation of any kind of manual controls for test maneuver execution. The ADS would be in control of the vehicle during compliance testing with all of its operational restrictions and decision-making capabilities in place. In its most basic form, compliance verification using Normal ADS-DV Operation would require the engineer performing the compliance test to input an appropriate destination using the same input method indicated by the ADS-DV's manufacturer for real-world operation. Vehicle performance would be observed and assessed during the period of normal on-road vehicle operation.

Analysis:

The Normal ADS-DV Operation approach may provide the most "realistic" representation of how the vehicle would perform during normal use. This approach could allow NHTSA to continue acquiring vehicles in the same way that U.S. consumers do, from commercial dealerships, and testing actual vehicles to verify they meet the FMVSS requirements.[33] NHTSA is interested in maintaining its policy to buy and test new production vehicles from dealership lots, to the extent possible. NHTSA believes that there are several test requirements in the FMVSSs for which Normal ADS-DV Operation may be a feasible compliance option if certain assumptions are correct. For example, the FMVSS No. 138 procedure for testing a vehicle's tire pressure monitoring system requires that the test vehicle is driven on a specific public roadway for a specified distance at the posted roadway speeds. During the test, the vehicle is stopped along the way to reduce tire inflation pressure and then driven again until a low inflation pressure indication is obtained. This test procedure could be modified to permit use of the Normal ADS-DV Operation approach for ADS-DVs by allowing

[33] This statement assumes that ADS-DVs will be sold or leased to individual owners, similarly to how traditional vehicles are sold. This assumption may be incorrect if the majority of ADS-DVs are used as rideshare vehicles.

the driving portion of the test to be performed by the ADS, which would be commanded by the test engineer using the ADS-DV's normal input method to select a destination.

The primary drawback to the Normal ADS-DV Operation approach for ADS-DVs that lack manual controls is that its application is limited to test procedure requirements capable of being performed within the Operational Design Domain (ODD)[34] of the ADS. As such, tests involving vehicle maneuvers or operation at speeds, locations, or other operating conditions not experienced within the vehicle's ODD could not be performed using this method. For example, a vehicle whose ODD does not include the specified test track for the above TPMS test, whether for geographic or road-type restrictions, could not use this approach to conduct the test. Another drawback of this approach, which several of the alternatives below attempt to correct, is that, even if a vehicle's ODD could allow it to perform a test, the vehicle may not be equipped with the controls necessary to allow NHTSA to actually conduct the test.

For NHTSA to evaluate the feasibility of the Normal ADS-DV Operation approach for compliance verification, the agency would need more information about the extent to which an ADS-DV can be controlled under normal operation. In addition, it is possible that normal control could be used on some vehicles but not on others, since manufacturers may implement different methods for vehicle operators to communicate with and command the vehicle to accomplish on-road driving. To the extent that some but not all ADS-DVs could be designed to allow for this type of testing, at least for certain standards, it may be challenging for NHTSA to

[34] The ODD is the operating conditions under which a given driving automation system or feature thereof is specifically designed to function, including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics. SAE J3016_201806 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles.

design appropriately objective standards to cover all ADS-DVs. To address these issues, NHTSA believes it is essential to better understand how operators will interface with and operate these ADS-DVs without traditional manual controls under normal conditions.

To better understand the "Normal ADS-DV Operation" approach and its possible applications, the agency asks the following questions.

Questions specific to this testing method (general questions precede this section):

12. What design concepts are vehicle manufacturers considering relating to how an ADS-DV passenger/operator will interface with, or command (e.g., via verbal or manual input), the ADS to accomplish any driving task within its ODD? Please explain each design concept and exactly how each would be commanded to execute on-road trips.
13. Are there specific challenges that will be encountered with this kind of approach for vehicle compliance verification? Please be specific and explain each challenge.
14. Will all ADS-DVs without traditional manual controls be capable of receiving and acting upon simple commands not consisting of a street address based destination, such as "drive forward or backwards a distance of 10 feet and stop"; "shift from park to drive and accelerate to 25 mph"; "drive up onto a car hauler truck trailer"; etc.? Please explain projected challenges for ADS-DVs without traditional manual controls to complete discrete driving commands and tasks.
15. How would NHTSA ensure that the performance of the ADS-DV during testing is consistent with how the vehicle would perform during actual normal use?

B. Test Mode with Pre-Programmed Execution (TMPE)

A TMPE is an approach to compliance testing in which the manufacturer programs into the ADS-DV a test mode that gives the test engineer access to a pre-programmed "compliance

test library" from which pre-programmed testing scenarios can be selected and executed. The testing programs in the compliance library would be used to automatically perform the driving actions necessary for each applicable FMVSS compliance test. Pre-programmed execution is conceptually similar to that achieved via use of an external controller, discussed in detail below, in that it involves specific commands being sent to the ADS for purposes of executing compliance test procedures, with the key difference being the source of the commands. TMPE-based tests would be performed by using a manufacturer-installed suite of compliance testing programs; no external controller interface with the ADS-DV would be required to perform specified FMVSS compliance tests. A means of maneuvering the vehicle for purposes other than compliance tests may be necessary to load it onto or off of a transport vehicle and to move it in areas not part of its ODD, such as between a garage and test course at a compliance test facility.

Comments:

While GM and ZF Group (ZF) briefly suggested that concepts similar to TMPE may be a viable approach, Mercedes and the Alliance of Automobile Manufacturers (Alliance), who discussed TMPE in greater detail, raised a number of potential problems that NHTSA believes may need to be addressed for it to be a viable method for compliance testing. Both Mercedes and the Alliance noted that pre-programmed execution may not be possible for test procedures that require driving maneuvers that are outside of an ADS's ODD. For example, an ADS-DV that is designed to be operated by the ADS only at lower speeds, but that does not qualify as a low-speed vehicle as defined by 571.3 (allowing it to be subject to the limited performance requirements of FMVSS No. 500), may lack the functionality to perform higher-speed maneuvers required for demonstrating compliance with certain standards (e.g., FMVSS Nos. 126; Electronic stability control systems and 135; Light vehicle brake systems). In addition, both

Mercedes and the Alliance also raised the concern that the TMPE's test mode present a vulnerability for cybersecurity-related issues, and that issues such as providing mapping data for the specific proving grounds or other facilities at which test procedure is executed would need to be addressed.

Analysis:

TMPE may be useful for assessing FMVSS compliance with test track-based performance requirements because it enables a test engineer to directly instruct an ADS-DV to execute the driving maneuvers necessary to perform the FMVSS test procedures. Since the ADS-DV would be programmed with the compliance library by the manufacturer at the time of production, compatibility of the commands within the library and vehicle being evaluated should be ensured (i.e., translation of the commands defined within the FMVSS test procedures to a format understood by the ADS is not required).

TMPE also has the potential for streamlining the testing process. Rather than performing tests intended to characterize the ADS-DV without traditional manual controls (i.e., the brake application needed to activate ABS during an FMVSS No. 135 evaluation, or the steering input needed to achieve 0.3g during an FMVSS No. 126 assessment), the ADS-DV would be pre-programmed with testing information that presumably would precisely execute the FMVSS test procedures. In addition, NHTSA could validate (i.e., confirm that the characterization tests that provide the data needed to define the input parameters used to perform tests used in standards like FMVSS No. 126 and 135 have been correctly performed and have output the expected values) these pre-programmed configurations relatively easily by equipping the ADS-DV with conventional instrumentation during conduct of the FMVSS assessments in a manner consistent with that presently in use. NHTSA also imagines TMPE could be implemented at a relatively

low cost, because manufacturers could simply program the vehicles' TMPE compliance library with the same compliance test programs the manufacturer uses for its own development testing.

Notwithstanding these potential benefits, additional information regarding the way in which a pre-programmed FMVSS compliance test library may be implemented is needed to allow NHTSA to better understand the viability of the concept. For example, how would the test engineer responsible for performing the tests access the compliance library so they may select a specific test to perform? This could conceivably be via a "test menu" presented on an original equipment visual display within the ADS-DV. However, an OEM may not want to provide an obvious or visual means of accessing a pre-programmed compliance test library to minimize the opportunity for individuals not performing compliance testing to access the test library. If access to a test menu is not provided, some means of communicating with the vehicle to select and initiate specific tests will be necessary, such as through the use of an external controller. However, NHTSA understands that granting access to the ADS-DV by means of any external controller represents a potential security risk, and would therefore like to better understand the way(s) a test engineer may be expected to securely access the compliance library and test menu required for performing FMVSS evaluations.

NHTSA also seeks to better understand transportation concerns with moving the vehicle to the desired test location and testing the vehicle at that location. The test areas used for FMVSS certification on test tracks and proving grounds can be very different than public roads and potentially outside the ODD of the test vehicle. Even if the ADS-DV is transported (i.e., not driven) to, and unloaded at, a designated test area, test instrumentation (and potentially the vehicle itself) typically requires a sequence of short driving maneuvers be performed to initialize vehicle- and instrumentation-based sensors, and for the vehicle to be positioned at a staging point

that may not necessarily be the same day-to-day or even trial-to-trial. Should the vehicle need to return to the staging point after completion of a trial, it is expected that the return path will need to be made in accordance with test facility operating guidelines to safely avoid other traffic, and obey any direction of travel and facility use restrictions, etc. The return path may not necessarily be the most direct one.

For the sake of maximizing test safety, it may be desirable to terminate a test performed with an ADS-DV if it is not being performed correctly, if the vehicle experiences a malfunction, or other traffic unexpectedly appears, etc. In some cases, it may be necessary to quickly brake the vehicle to a stop. One means of doing so could be through use of an emergency stop (E-stop) option within the test menu. To maximize the effectiveness of the E-stop, the mechanism would need to be quickly and easily accessible by the test engineer responsible for performing and/or observing test conduct. NHTSA is interested in better understanding the feasibility of incorporating an E-stop function into the ADS-DV for use during compliance testing, and what potential security risks doing so may introduce.

While attempting to perform advanced driver assistance system (ADAS) and/or Level 2 automation system tests within the confines of a test track, NHTSA has observed that certain features of some test vehicles are not available due to the location where the tests occurred (e.g., GM's Super Cruise cannot be enabled within the confines of most test tracks since the roads at these facilities do not reside within the system's ODD). For this reason, NHTSA is interested in better understanding the feasibility of having vehicle manufacturers remove any geofence-based operating restrictions while the ADS-DV is being operated in a "test mode" intended to assess FMVSS compliance.

One disadvantage of using an FMVSS compliance library with pre-programmed tests not modifiable by the test engineer, is that test input characteristics would presumably be fixed and not able to be adjusted to be suitable for a particular test surface. Therefore, variation in test results across test locations in different geographic areas may be worse, since pre-programmed test inputs would be based on characterization tests (or even simulations) performed using a different test surface, etc. Better understanding the likelihood of this variability being great enough to affect maneuver severity is of interest to the agency. Also of interest is understanding what test tolerances an ADS-DV operating with commands from a compliance library may be expected to achieve. For example, FMVSS No. 126 requires a test maneuver entrance speed of 50 ± 1 mph (80 ± 2 km/h).

Questions specific to this testing method (general questions precede this section):

16. How could engineers responsible for performing FMVSS compliance assessments of an ADS-DV without manual controls be expected to access and interface with the compliance test library menu?
17. Would the FMVSS need to specify the libraries available to NHTSA to test the vehicle?
18. Is it practical to expect that an ADS-DV without any traditional manually-operated controls can be safely and efficiently operated within the confines of a test track with only a pre-programmed test menu (i.e., without some form of external controller or other means of vehicle control input)?
19. Can an ADS-DV be expected to perform within tight tolerance levels using the regular on-board sensors?
20. How much variation in test results across various test locations (i.e., proving grounds) is expected to result from testing an ADS-DV equipped with the same FMVSS compliance

library at different locations? Could the ability to satisfy FMVSS performance requirements depend on the location the tests are performed?

21. Is it reasonable to assume any geofence-based operating restrictions could be suspended while the ADS-DV is operating in a "test mode" intended to assess FMVSS compliance?
22. How could vehicle-based electronically accessible libraries for conducting FMVSS testing be developed in a way that would allow NHTSA to access the system for compliance testing but not allow unauthorized access that could present a security or safety risk to an ADS-DV?
23. Are there other considerations NHTSA should be aware of when contemplating the viability of programmed execution-based vehicle compliance verification?
24. When changes or updates are made to the ADS, how will the TMPE content be updated to reflect the changes and how often would it be updated?

C. Test Mode with External Control (TMEC)

The TMEC approach suggested by the commenters could largely maintain existing 100-series FMVSS test procedures, but allow for test procedure steps that require an action by a human driver (e.g., instructions relating to the accelerator or brake pedals) to be accomplished using an external controller that is not controlled by the ADS, but by a test engineer. This option is closely related to the pre-programmed execution option also discussed in this ANPRM; however, rather than requiring the tests defined in FMVSS procedures be pre-programmed within the vehicle, the commands used to perform the FMVSS test procedures (including, but not limited to, those associated with the steering wheel, accelerator pedal, brake pedal, and transmission shifter) would be sent to the ADS-DV via an external controller operated by a test engineer. Under this approach, the external controller sending the commands used to perform the FMVSS test procedures may be located inside or outside the vehicle and could be connected to

the vehicle either wirelessly or through a physical connection, but would not be part of the vehicle itself. Instead, it would be a device either designed and provided to NHTSA by the manufacturer or, alternatively, a standard device designed by NHTSA.

Comments:

The external control approach was discussed by commenters GM and ZF, who both suggested that FMVSS compliance could be demonstrated by a human remotely piloting the vehicle. GM suggested that NHTSA could collaborate with industry to explore using external control devices and facilities that interact with the vehicle. ZF commented that ADS-DVs without traditional manual controls "will have alternate methods of inputting driving commands for normal situations (e.g., to input an initial destination or route), and also for emergency situations (e.g., rerouting to a new destination, an emergency stop button for occupants), in order to provide its desired functionality and level of safety."

Analysis:

Like a test mode with programmed execution, a test mode with external control would preserve an ability to assess FMVSS compliance with test track-based performance requirements because it enables a test engineer to directly instruct an ADS-DV to execute the driving maneuvers necessary to perform the FMVSS test procedures. NHTSA recognizes that some vehicle manufacturers may choose to include provisions to accept external controller functionality in their ADS-DVs so that the vehicle is able to navigate with areas outside of the ADS's ODD, such as during maintenance or on dealer lots.

NHTSA assumes that an external controller for compliance test purposes could provide test engineers with control over all vehicle functions that are relevant to compliance verification and would provide a test engineer with a straight-forward way of selecting the desired tests and

input parameters associated with the test being performed. However, there may be other advantages of an external controller. For example, external control capabilities that support manual operation (e.g., vehicle speed, steering or braking magnitude, transmission gear) could be used to safely facilitate transportation of the ADS-DV without manual controls between garages and to test pads or courses at compliance test facilities. During the conduct of compliance testing, an external controller could be used to command maneuvers used to initialize the test vehicle and/or test equipment, facilitate pre-test staging, and could be configured to provide the test engineer with an E-stop function.

Questions specific to this testing method (general questions precede this section):

25. Is it reasonable to assume a common (universal) interface, translator, and/or communication protocol between an external controller and any ADS-DV will be developed?
26. What is the most viable method for securely interfacing an external controller with the ADS-DV (e.g., wireless or physical access)?
27. Could a means of manual control be developed that would allow NHTSA to access the system for compliance testing but not allow unauthorized access that could present a security or safety risk to an ADS-DV?
28. Is it reasonable to assume any geofence-based operating restrictions could be suspended while an external controller intended to assess FMVSS compliance is connected to the ADS-DV?
29. Are there other considerations NHTSA should be aware of when contemplating the viability of using an external controller-based vehicle certification?

D. Simulation

Simulation is an approach for compliance verification by which NHTSA could verify that an ADS-DV complies with a FMVSS requirement using software or hardware-in-the-loop[35] based evaluations rather than performing on-road or track-based tests with a complete physical vehicle. Simulations may be useful for determining how a modeled computer system will respond to a given set of inputs. The accuracy of a simulation strongly depends on its fidelity to the actual performance of the vehicle and validation of the models used to define it.

Comments:

Commenters to the RFC suggested that simulations could be particularly useful for certifying compliance with a performance standard like FMVSS No. 126, in which the purpose of the test is to ensure that the vehicle interprets sensor inputs properly, and that the vehicle translates those sensor inputs into outputs to the vehicle's driving functions that meet performance requirements. Mercedes noted that FMVSS No. 126 effectively already uses a simulation, since the required steering mechanism ensures that the vehicle receives a standardized set of steering inputs to limit variability. The Alliance also noted simulation as a possible "short-term" method of demonstrating FVMSS No. 126 compliance (as well as other FMVSS) and suggested that NHTSA should collaborate with industry stakeholders to develop a simulation "tool," which NHTSA could validate as necessary.

While some of the comments focused on a manufacturer's own ability to use simulation in its certification testing, NHTSA is primarily interested in learning more about how NHTSA

[35] Hardware-in-the-loop simulation is a type of simulation in which the control loop components are comprised of some real hardware parts and some simulated parts. R. Isermann, J. Schaffnit, S. Sinsel, Hardware-in-the-Loop Simulation for the Design and Testing of Engine-Control Systems, Algorithms and Architectures for Real-Time Control, Cancun, Mexico, 1998.

could potentially use simulation to verify compliance, and whether this method is sufficient from a legal and technical perspective.

Analysis:

Historically, NHTSA has not used a simulation approach for crash avoidance FMVSS compliance verification because the most accurate, economical, and feasible means of conducting tests has been to perform them on a test track, thereby avoiding any questions of simulation accuracy. Furthermore, the agency believes there could be additional safety benefits of buying and testing actual production vehicles as delivered to the consumer, which in the past has identified test failures due to vehicle design changes and equipment malfunctions that would not ordinarily have been found during vehicle simulations. For simulations, it may not be possible to accurately model proprietary control algorithms like those within an ADS electronic control unit (ECU). Complex simulation models with many inputs (such as those that would be necessary to demonstrate compliance with many of the FMVSS) are expensive to develop and difficult to validate without performing the actual test that is being simulated.

However, the agency acknowledges that simulation may play a larger role in future performance standards specific to ADS-DVs and other ADS-equipped vehicles, because simulations could provide a practical and cost-effective means for evaluating a wide array of test and real-world operating conditions to which these vehicles will be exposed, and for which physical testing to a sufficient degree may be infeasible.

For a simulation to be considered for compliance verification, there are a number of considerations that the agency believes must be accounted for. The most difficult aspect of using simulation as a compliance verification method is the validation of the models used. This is because a simulation suitable for an accurate and representative assessment of an ADS-equipped

vehicle, whether it be an ADS-DV without traditional manual controls or one that could allow for manual control at times, would likely need to model both the vehicle (including but not limited to its chassis, drivetrain, suspension, brake system, tires, and ADS-relevant sensors, and any potential discrepancy between a modeled version of the vehicle and real-world production model) and the elements used to define the road surface and other characteristics of the environment in which the tests are performed. Accurate modelling by NHTSA would likely require the agency to incorporate vehicle-specific parameters and proprietary control algorithms, which may not be available for use by NHTSA and, if not available, would require extensive testing at a substantial cost for NHTSA to develop a model.

As mentioned above, a key part of NHTSA's enforcement responsibilities includes buying and testing actual production vehicles to verify, "as-sold" to the public, that these vehicles meet the FMVSS requirements. These actual "on-track" tests are important to verify compliance but also to help identify a manufacturer's certification shortcomings (e.g., suspension design changes that inadvertently change the performance of the ESC system, or a part replacement that inadvertently changes the performance of a brake system) and possible safety-related defects problems that would not necessarily be identified through simulation.

For research purposes, NHTSA is considering the feasibility of working with vehicle manufacturers to develop an application programming interface (API) designed to allow a common set of operating conditions (which could potentially include those associated with FMVSS compliance tests), to interface with their (the vehicle manufacturer's) ADS. Conceptually, the API would function as a translator; a means of ensuring that simulated input conditions are properly interpreted by the ADS so that it, and the vehicle it resides in, responds in the same way it would in the real world.

Questions specific to this testing method (general questions precede this section):

30. How can simulations be used to assess FMVSS compliance?
31. Are there objective, practicable ways for the agency to validate simulation models to ensure their accuracy and repeatability?
32. Is it feasible to perform hardware-in-the-loop simulations to conduct FMVSS compliance verification testing for current FMVSS?
33. Is it feasible to perform software-in-the-loop simulations to conduct FMVSS compliance verification testing?

E. Technical Documentation for System Design and/or Performance Approach

For the Technical Documentation approach, vehicle-specific technical design and/or build documentation (e.g., a system function description and logic and/or schematic diagrams) could be provided to allow NHTSA to permit an assessment of FMVSS compliance. It should be noted that this is different than the technical design documentation that is provided to NHTSA today. It is technical design documentation used by the manufacturer in the design and construction of the vehicle.

Comments:

Several industry commenters discussed the approach of using technical documentation for compliance verification of vehicles for specified FMVSS requirements. The commenters noted that documentation could be used to address two different kinds of requirements. The first kind of requirements include those without performance specifications (e.g., the ESC system must have the capability to apply brake torques at each wheel and to determine yaw rate). The second kind of requirements include those with system performance specifications (e.g., during an ESC system sine-with dwell test the yaw rate must not exceed 35% of the peak yaw rate 1

second after completion of the steering input; or during service brake system tests, with the test vehicle operating at 100km/h, the service brake system must be able to stop the vehicle within a specified distance).

For the first kind of requirements, those that do not include performance specifications, the Alliance explained that, "where there are no specific performance requirements within a FMVSS, but there is a desire to verify the general component and functional capability, NHTSA has included provisions for technical documentation to demonstrate FMVSS compliance in the appropriate standards." GM stated that, "[t]echnical documentation is particularly useful for identifying components and functions for which no discrete performance requirement needs to be measured through testing."[36] Both the Alliance and GM mentioned FMVSS No. 126 as an example of a standard that NHTSA could request technical documentation for certain functionality portions of the standard.

Considering ADS-DVs without manual controls, for the second kind of requirements that do specify system performance requirements, GM stated that, in reference to allowing flexibility to demonstrate performance requirements specified in FMVSS No. 126 and FMVSS No. 135, manufacturers could be required to provide technical documentation explaining the methodology used and associated test results. GM stated that "the performance requirements currently specified in FMVSS Nos. 126 and 135 should be preserved for self-driving vehicles, with 'technical documentation' to report how the manufacturer certified to those requirements." The Alliance stated that there are methods that could be used as the basis for technical documentation (e.g., simulation, whole vehicle testing, hardware-in-the-loop testing, etc.) and believes that

[36] https://www.regulations.gov/document?D=NHTSA-2018-0009-0079.

research is required to adapt the FMVSS No. 126 "sine with dwell" test procedure for ADS-DVs. The Alliance recommended that NHTSA consider adopting a technical documentation approach to the "sine with dwell" test requirements in the near-term. Mercedes stated that manufacturers could demonstrate ADS-DV compliance with ESC requirements via technical documentation, although in their opinion this approach would be more burdensome both for manufactures and for NHTSA.

Analysis:

Technical documentation is currently permitted for use in demonstrating compliance for a portion of one crash avoidance standard, FMVSS No. 126. For this standard, the agency requires manufacturers to make available upon request, documentation (i.e., a system diagram, a written explanation of how the system works, and a logic diagram) demonstrating that a vehicle is equipped with an ESC system that is consistent with the definition described in the standard.[37] During the development of the rule, the agency was not able to finalize an objective and repeatable performance test to evaluate understeer conditions. For this reason, the agency resorted to developing the compliance documentation requirements for describing the ESC system's capability to address understeer conditions described in S 5.6. FMVSS No. 126 S 5.6 states that the manufacturer must make available to the agency upon request, documentation that includes a discussion on the pertinent inputs to the ESC computer or calculations within the computer and how the algorithm uses that information and controls ESC system hardware to limit understeer. A system diagram, depicting all the ESC system hardware is used as part of the compliance verification of the ESC definition to identify the components used for brake torque

[37] 49 C.F.R. § 571.126, S5.6.

generation at each wheel and yaw rate monitoring. An additional written explanation and the logic diagrams are also used, as part of the compliance verification, to better describe how all the components work together to address vehicle instabilities. While NHTSA has used technical documentation for one portion of one standard, the agency did so as a measure of last resort because technical documentation does not confirm the level of performance for the physical vehicle.

For the second kind of requirements (i.e., requirements that include system performance specifications) the commenters discussed using various kinds of performance or test data documentation for compliance verification. In the regulatory language of many FMVSS, NHTSA provides test procedures so vehicle manufacturers know how NHTSA will test their vehicles and equipment. In addition to testing, occasionally, and typically in the context of an enforcement investigation into potential noncompliance with a FMVSS, NHTSA requests a manufacturer submit documentation/data that illustrates its basis for certification. Upon NHTSA's request, most manufacturers provide test reports similar to the reports generated by NHTSA contracted test labs (showing the results of the manufacturer's testing, just as NHTSA would have reports exhibiting the results of its own testing). For many of the crash avoidance FMVSSs, as their basis for compliance, vehicle manufacturers conduct testing in a similar manner as NHTSA conducts compliance verification, namely, using the same test procedures, test equipment and data collecting process If this process changes and manufacturers solely provide NHTSA with the reports that include the performance test results without NHTSA testing the vehicle, it is not clear how the agency would properly verify compliance and ensure at least the same level of performance has been achieved. Furthermore, it has always been critical for the agency to establish objective, repeatable, and reproducible test procedures for

manufacturers and the agency to both use ensuring the same test results regardless of who executes the test, or when and where the test is executed.

As mentioned above under the simulation discussion, the agency believes it is important to buy and test new vehicles as produced and sold. If documentation is used as a tool in the future, NHTSA would continue to focus on real-world testing of actual vehicles being operated on public roads. These actual "on-track" tests conducted by the agency are important to verify compliance but also to help identify a manufacturer's certification shortcomings (e.g., suspension design changes that inadvertently change the performance of the ESC system, or a part replacement that inadvertently changes the performance of a brake system) and possible safety related defects; problems that would not necessarily be identified through documentation.

Questions specific to this testing method (general questions precede this section):

34. How can the documentation-focused approach ensure compliance with FMVSS, considering it neither verifies that the vehicles on the road match the documentation nor confirms that the vehicles on the road comply with the FMVSSs?
35. If technical documentation were acceptable for compliance verification, how would the manufacturer assure the agency that the documentation accurately represents the ADS-DV and that the system is safe?
36. Exactly what kind of documentation could be submitted for each kind of FMVSS requirement? Provide specific examples with detailed explanation of the documentation required.

F. Use of Surrogate Vehicle with Human Controls

Using the surrogate vehicle with human controls approach, the vehicle manufacturer would demonstrate that all relevant aspects of the surrogate vehicle are identical to those of the

ADS-DV without traditional manual controls and then complete compliance verification using that surrogate vehicle and apply the results to the ADS-DV without traditional manual controls.

Comments:

Several commenters suggested that a short-term solution for compliance verification testing of ADS-DVs is to certify a manually-operated "sister" (i.e., surrogate) vehicle that shares the same platform, but differs from the ADS-DV because it has manual controls included for testing purposes. The Alliance, for example, suggested this as an approach to testing FMVSS No. 126. Ford agreed with this approach.

Analysis:

Attempting to specify in a FMVSS test procedure that NHTSA will use surrogate vehicles in its compliance testing would create several challenges. First, if, in lieu of testing an ADS-DV, NHTSA were to test a surrogate vehicle, the agency may have difficulty demonstrating that such a test establishes the noncompliance of the ADS-DV. Since an ADS-DV would be equipped with components that provide the means to perform automated driving, a task the conventional surrogate vehicle is either not expected to perform or can perform while still including manual controls, inherent differences would be expected between the two vehicles. The implications of these differences must be understood to assess the viability of this approach. The agency would need to attempt to develop criteria for identifying suitable surrogates. These criteria would need to be universal in that they need to demonstrate equivalence for any vehicle, not only for a specific vehicle design. Second, even if it were possible to establish criteria for reliably identifying suitable surrogate vehicles, if it would nevertheless be more difficult for the agency to find suitable surrogates for some ADS-DVs than others, the agency might find it

difficult to ensure that it could treat all ADS-DVs in an equitable manner. Third, the suitable surrogate vehicles must be available for sale in the United States.

Questions specific to this testing method

(general questions precede this section):

37. To what extent could equivalence of the vehicle components used for conventional and ADS-DVs be demonstrated to assure that surrogate vehicle performance would be indicative of that of a surrogate ADS-DV?
38. How can the agency confirm that the maneuver severity performed by a surrogate manually-drivable vehicle, during FMVSS compliance tests, is equal to that of the subject ADS-DV? For example, how can the characterization maneuvers and subsequent scaling factors in the FMVSS No. 126 ESC test on the surrogate vehicle be confirmed as equivalent on the ADS-DV?
39. If results from FMVSS compliance tests of a conventional vehicle performed by its manufacturer differ from the results of NHTSA tests of an equivalent ADS-DV (particularly if the conventional vehicle complies with the agency's standards, but the ADS-DV does not), can the conflicting results be reconciled? If so, how?

VII. Public Participation

How can I influence NHTSA's thinking on this subject?

Your comments will help NHTSA improve this regulatory action. NHTSA invites you to provide different views on options NHTSA discusses, new approaches the agency has not considered, new data, descriptions of how this ANPRM may affect you, or other relevant information.

NHTSA welcomes public review of on all aspects of this ANPRM. NHTSA will consider the comments and information received in developing its eventual proposal for how to remove regulatory barriers to ADS-DVs that lack manual controls by updating and modifying current FMVSS. As noted thorough this document, we are especially interested in comments that focus on how the test methods discussed ensure vehicle safety. Your comments will be most effective if you follow the suggestions below:

- Explain your views and reasoning as clearly as possible.
- Provide solid evidence and data to support your views.
- If you estimate potential costs, explain how you arrived at that estimate.
- Tell NHTSA which parts of the ANPRM you support, as well as those with which you disagree.
- Provide specific examples to illustrate your concerns.
- Offer specific alternatives.
- Refer your comments to the specific sections of (or questions listed in) the ANPRM.

How do I prepare and submit comments?

Your primary comments should be written in English. To ensure that your comments are filed in the correct docket, please include the docket number of this document (NHTSA-2019-0036) in your comments.

Your primary comments should not be more than 15 pages long (49 C.F.R. §553.21), however, you may attach additional documents, such as supporting data or research, to your primary comments. There is no limit on the length of the attachments.

Please submit one copy (two copies if submitting by mail or hand delivery) of your comments, including the attachments, to the docket following the instructions given in the

ADDRESSES section at the beginning of this document. Please note, if you are submitting comments electronically as a PDF (Adobe) file, we ask that the documents submitted be scanned using the Optical Character Recognition (OCR) process, thus allowing NHTSA to search and copy certain portions of your submission.

Please note that pursuant to the Data Quality Act, in order for substantive data to be relied upon and used by the agency, it must meet the information quality standards set forth in the Office of Management and Budget (OMB) and DOT Data Quality Act guidelines. Accordingly, we encourage you to consult the guidelines in preparing your comments. DOT's guidelines may be accessed at *www.transportation.gov/regulations/dot-information-dissemination-quality-guidelines* (last accessed May 22, 2018).

How can I be sure that my comments were received?

If you submit comments by hard copy and wish Docket Management to notify you upon its receipt of your comments, enclose a self-addressed, stamped postcard in the envelope containing your comments. Upon receiving your comments, Docket Management will return the postcard by mail. If you submit comments electronically, your comments should appear automatically in Docket No. NHTSA-2019-0036 on *www.regulations.gov*. If they do not appear within two weeks of posting, NHTSA suggests that you call the Docket Management Facility at 202-366-9826.

How do I submit confidential business information?

If you wish to submit any information under a claim of confidentiality, you must submit three copies of your complete submission, including the information that you claim to be confidential business information, to the Office of the Chief Counsel, NHTSA, U.S. Department of Transportation, 1200 New Jersey Avenue SE, Washington, DC 20590.

In addition, you should submit a copy (two copies if submitting by mail or hand delivery) from which you have deleted the claimed confidential business information to the docket by one of the methods given above under **ADDRESSES**. When you submit a comment containing information claimed to be confidential business information, you should include a cover letter setting forth the information specified in NHTSA's confidential business information regulation (49 CFR Part 512).

Will the agency consider late comments?

NHTSA will consider all comments that the docket receives before the close of business on the comment closing date indicated in the **DATES** section. To the extent possible, NHTSA will also consider comments that the docket receives after that date.

How can I read the comments submitted by other people?

You may read the comments received by the docket at the address given in the **ADDRESSES** section. The hours of the docket are indicated above in the same location. You may also read the comments on the internet, identified by the docket number at the heading of this document, at *www.regulations.gov*. Please note that, even after the comment closing date, NHTSA will continue to file relevant information in the docket as it becomes available. Further, some people may submit late comments. Accordingly, NHTSA recommends that you periodically check the docket for new material.

VIII. Rulemaking Analyses

a. Executive Orders 12866 and 13563 and DOT Regulatory Policies and Procedures

Executive Order 12866, ''Regulatory Planning and Review'' (58 FR 51735, Oct. 4, 1993), provides for making determinations whether a regulatory action is ''significant'' and therefore subject to OMB review and to the requirements of the Executive Order.

b. Executive Order 13771 (Reducing Regulation and Controlling Regulatory Costs)

This action is not subject to the requirements of E.O. 13771 (82 FR 9339, (Feb. 3, 2017)) because it is an advance notice of proposed rulemaking.

c. Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act, 5 U.S.C. 601 *et seq*., no analysis is required for an ANPRM. However, vehicle manufacturers and equipment manufacturers are encouraged to comment if they identify any aspects of the potential rulemaking that may apply to them.

d. Executive Order 13132 (Federalism)

NHTSA does not believe that there would be sufficient federalism implications to warrant the preparation of a federalism assessment.

e. Executive Order 12988 (Civil Justice Reform)

With respect to the review of the promulgation of a new regulation, section 3(b) of Executive Order 12988, "Civil Justice Reform" (61 FR 4729, February 7, 1996) requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect; (2) clearly specifies the effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct, while promoting simplification and burden reduction; (4) clearly specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issues by the Attorney General. This document is consistent with that requirement.

f. Paperwork Reduction Act

Under the Paperwork Reduction Act of 1995 (PRA), a person is not required to respond to a collection of information by a Federal agency unless the collection displays a valid OMB

control number. There are no information collection requirements associated with this ANPRM. Any information collection requirements and the associated burdens will be discussed in detail once proposed rules have been issued.

g. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act (NTTAA) requires NHTSA to evaluate and use existing voluntary consensus standards in its regulatory activities unless doing so would be inconsistent with applicable law (e.g., the statutory provisions regarding NHTSA's vehicle safety authority) or otherwise impractical. Voluntary consensus standard (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies, such as SAE International. The NTTAA directs us to provide Congress (through OMB) with explanations when we decide not to use available and applicable voluntary consensus standards. While NHTSA is considering options regarding the modification of various FMVSS, it has not yet developed specific regulatory requirements, and thus the NTTAA does not apply for purposes of this ANPRM.

h. Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure of State, local, or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually (adjusted for inflation with base year of 1995). NHTSA has determined that this rulemaking action would not result in expenditures by State, local, or tribal governments, in the aggregate, or by the private sector, in excess of $100 million annually.

i. National Environmental Policy Act

NHTSA has analyzed this rulemaking action for the purposes of the National Environmental Policy Act. The agency has preliminarily determined that implementation of this rulemaking action would not have any significant impact on the quality of the human environment. The agency will consider this further in any future proposed rules.

j. Plain Language

Executive Orders 12866 and 13563 require each agency to write all documents in plain language. Application of the principles of plain language includes consideration of the following questions:

- Have we organized the material to suit the public's needs?
- Are the requirements in the document clearly stated?
- Does the document contain technical language or jargon that is not clear?
- Would a different format (grouping and order of sections, use of headings, paragraphing) make the rule easier to understand?
- Would more (but shorter) sections be better?
- Could we improve clarity by adding tables, lists, or diagrams?

If you have any responses to these questions, please include them in your comments on this proposal.

k. Regulatory Identifier Number (RIN)

The Department of Transportation assigns a regulation identifier number (RIN) to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year.

You may use the RIN contained in the heading at the beginning of this document to find this action in the Unified Agenda.

Issued in Washington, DC, under authority delegated in 49 CFR 1.95 and 501.5.

Heidi Renate King,

Deputy Administrator.

Billing Code: 4910-59-P

Appendix A – SAE Levels of Automation

To explain these levels of driving automation and put them in context with the other levels defined by SAE International, content from Table 1 of SAE J3016[38] describing the full array of driving automation levels is provided here:

Level of Automation	**Narrative Definition (i.e., What does the vehicle do, what does the human driver/occupant do, and when and where do they do it?)**
Level 0	No Automation of driving task: The performance by the driver of the entire DDT, even when enhanced by active safety systems.
Level 1	Driver Assistance: The sustained and ODD-specific execution by a driving automation system of either the lateral or the longitudinal vehicle motion control subtask of the DDT (but not both simultaneously) with the expectation that the driver performs the remainder of the DDT.
Level 2	Partial Driving Automation: The sustained and ODD-specific execution by a driving automation system of both the lateral and longitudinal vehicle motion control subtasks of the DDT with the expectation that the driver completes the OEDR subtask and supervises the driving automation system.
Level 3	Conditional Driving Automation: The sustained and ODD-specific performance by an ADS of the entire DDT with the expectation that the DDT fallback-ready user is receptive to ADS-issued requests to intervene,

[38] *See* SAE J3016_201806 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles.

Level of Automation	Narrative Definition (i.e., What does the vehicle do, what does the human driver/occupant do, and when and where do they do it?)
	as well as to DDT performance-relevant system failures in other vehicle systems, and will respond appropriately.
Level 4	High Driving Automation: The sustained and ODD-specific performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.
Level 5	Full Driving Automation: The sustained and unconditional (i.e., not ODD-specific) performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.

[FR Doc. 2019-11032 Filed: 5/23/2019 4:15 pm; Publication Date: 5/28/2019]