DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

[Docket No. NHTSA-2018-0009]

Removing Regulatory Barriers

for Vehicles with Automated Driving Systems

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

ACTION: Request for comment (RFC).

SUMMARY: NHTSA seeks public comments to identify any regulatory barriers in the existing Federal Motor Vehicle Safety Standards (FMVSS) to the testing, compliance certification and compliance verification of motor vehicles with Automated Driving Systems (ADSs) and certain unconventional interior designs. NHTSA is focusing primarily, but not exclusively, on vehicles with ADSs that lack controls for a human driver; e.g., steering wheel, brake pedal or accelerator pedal. The absence of manual driving controls, and thus of a human driver, poses potential barriers to testing, compliance certification and compliance verification. For example, many of the FMVSS refer to the "driver" or "driver's seating position" in specifying where various vehicle features and systems need to be located so that they can be seen and/or used by a person sitting in that position. Further, the compliance test procedures of some FMVSS depend on the presence of such things as a human test driver who can follow instructions on test driving maneuvers or a steering wheel that can be used by an automated steering machine. NHTSA also seeks comments on the research that would be needed to determine how to amend the FMVSS in order to remove such barriers, while retaining those existing safety requirements that will be needed and appropriate for those vehicles. In all cases, the Agency's goal would be to ensure the maintenance of currently required levels of safety performance. These comments will aid the

Agency in setting research priorities as well as inform its subsequent actions to lay a path for innovative vehicle designs and technologies that feature ADSs.

DATES: Comments are due no later than [INSERT DATE 45 DAYS AFTER PUBLICATION IN THE **FEDERAL REGISTER**.]

ADDRESSES: Comments must refer to the docket number above and be submitted by one of the following methods:

- *Federal eRulemaking Portal*: Go to http://www.regulations.gov. Follow the online instructions for submitting comments.
- *Mail*: Docket Management Facility, M-30, U.S. Department of Transportation, West Building, Ground Floor, Room W12-140, 1200 New Jersey Avenue, SE, Washington, DC 20590.
- *Hand Delivery or Courier*: U.S. Department of Transportation, West Building, Ground Floor, Room W12-140, 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m. Eastern time, Monday through Friday, except Federal holidays.
- *Fax*: 202-493-2251.

Regardless of how you submit your comments, you must include the docket number identified in the heading of this notice.

Note that all comments received, including any personal information provided, will be posted without change to http://www.regulations.gov. Please see the "Privacy Act" heading below.

You may call the Docket Management Facility at 202-366-9324.

Docket: For access to the docket to read background documents or comments received, go to http://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 decision-making process. DOT posts these comments, without edit, including any personal information the commenter provides, to http://www.regulations.gov, as described in the system of records notice (DOT/ALL-14 FDMS), which can be reviewed at https://www.transportation.gov/privacy. Anyone can search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.).

FOR FURTHER INFORMATION CONTACT:

For research issues, John Harding, Intelligent Technologies Research Division, Office of Vehicle Crash Avoidance and Electronic Controls Research, telephone: 202-366-5665, email: John.Harding@dot.gov;

For rulemaking issues, David Hines, Director, Office of Crash Avoidance Standards, telephone 202-366-1810, email David.Hines@dot.gov;

For legal issues, Stephen Wood, Assistant Chief Counsel, Vehicle Rulemaking and Harmonization, Office of Chief Counsel, 202-366-2992, email Steve.Wood@dot.gov.

SUPPLEMENTARY INFORMATION:

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I. Overview

NHTSA wants to avoid impeding progress with unnecessary or unintended regulatory barriers to motor vehicles that have Automated Driving Systems (ADS) and unconventional designs, especially those with unconventional interior designs. These barriers may complicate or may even make impossible the testing and certification of motor vehicles. At this stage, the Agency is primarily, but not exclusively, concerned with vehicles with ADSs that do not have the means for human driving, e.g., a steering wheel and brake and accelerator pedals. NHTSA is also interested in the additional testing and certification problems for vehicles with ADSs and with seating or other systems that have multiple modes, such as front seats that rotate. Some FMVSS, therefore, may pose barriers to the testing and certification of these vehicles.

To enable vehicles with ADSs and with unconventional interiors while maintaining those existing safety requirements that will be needed and appropriate for those vehicles, NHTSA is

developing plans and proposals for removing or modifying existing regulatory barriers to testing and compliance certification in those areas for which existing data and knowledge are sufficient to support decision-making. In other areas, plans and proposals cannot be developed until the completion of near term research to determine how to revise the test procedures for those vehicles. In all cases, the Agency's goals would be to ensure that the safety performance currently required by the FMVSS is as effective and needed for safety in vehicles with unconventional interiors (or exteriors) as in conventionally-designed vehicles.

The Agency is mindful that, in some cases, the most appropriate response to an existing requirement in a FMVSS that may complicate or may even make impossible to test a motor vehicle to assess compliance with that requirement may not be to ask how the requirement can be adapted to apply to motor vehicles without manual driving controls. Instead, a more appropriate response may be to ask whether the requirement should be applied in any form to those motor vehicles. These requirements may serve a safety purpose in vehicles with manual driving controls, but may not in vehicles without such means of control. For example, there may not be any need to require that the telltales[1] and other displays in a vehicle that does not have any manual driving controls be visible either to the occupant of a particular seating position or even to any occupant at all. In addition, some requirements may serve a safety purpose in vehicles that carry human occupants, but not in vehicles that will not carry any occupants.

To these ends, NHTSA is soliciting public comments on (1) the barriers identified thus far, (2) any as of yet unidentified, barriers, (3) whether the requirements or test procedures creating those barriers should be modified to eliminate the testing difficulties or should simply be amended so that the requirements do not apply to vehicles without means of manual control, (4)

[1] As defined in FMVSS No. 101, Control and Displays, "telltale means an optical signal that, when illuminated, indicates the actuation of a device, a correct or improper functioning or condition, or a failure to function."

the research that needs to be done to determine how to remove some of the barriers; (5) and how to prioritize this research and any follow-on rulemaking proceedings.

This input will help NHTSA to plan and undertake more comprehensive and strategic efforts to remove barriers and to develop a stronger, more collaborative research plan that will complement research by the motor vehicle industry and other stakeholders. This will enable the Agency to use its resources as efficiently as possible in moving toward eliminating potential regulatory barriers to innovation.

II. Automation Revolution

Automotive transportation is evolving faster today than it has at any time since the introduction of the first motor vehicle. Artificial intelligence, combined with rapid improvements in sensors, such as cameras, lidar,[2] and radar, is beginning to enable motor vehicles to drive themselves.

The introduction of vehicles with ADSs into the fleet has the potential to reduce injuries, the loss of life, and property damage, reduce congestion, enhance mobility, and improve productivity.[3] NHTSA anticipates that automation can serve a vital safety role given that human error or choice are estimated to be the critical reason in 94 percent[4] of crashes. In the best of

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[2] Lidar (light detection and ranging) is a type of sensor that continually fires beams of laser light, and then measures how long it takes for the light to return to the sensor. The measurements are used to create three-dimensional images of a vehicle's surroundings, everything from cars to cyclists to pedestrians to fixed objects like poles and trees, in a variety of environments and under a variety of lighting conditions.

[3] U.S. Department of Transportation, Automated Driving Systems – A Vision for Safety, 2017, p. i-11 (https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf; last accessed November 8, 2017).

[4] The National Motor Vehicle Crash Causation Survey (NMVCCS), conducted from 2005 to 2007, was aimed at collecting on-scene information about the events and associated factors leading up to crashes involving light vehicles. Several facets of crash occurrence were investigated during data collection, namely the pre-crash movement, critical pre-crash event, critical reason, and the associated factors. A weighted sample of 5,470 crashes was investigated over a period of two and a half years, which represents an estimated 2,189,000 crashes nationwide. About 4,031,000 vehicles, 3,945,000 drivers, and 1,982,000 passengers were estimated to have been involved in these crashes. The critical reason, which is the last event in the crash causal chain, was assigned to the driver in 94 percent (±2.2%)† of the crashes. In about 2 percent (±0.7%) of the crashes, the critical reason was assigned to a vehicle component's failure or degradation, and in 2 percent (±1.3%) of crashes, it was attributed to the environment

circumstances, people make errors in judgment or action. In the best of circumstances, human drivers make errors in judgment or action. Many people drive in less favorable circumstances as a result of the choices they make. Despite decades of efforts by NHTSA, States, local jurisdictions, safety groups, and industry, many people continue to choose to drive when they are fatigued, intoxicated, speeding, unbelted, or distracted. To the extent that ADSs are able to support and perhaps eventually replace human drivers, human error and unsafe choices would likely be reduced as causes of crashes. As the Federal agency whose primary mission is to reduce motor vehicle related deaths and injuries, NHTSA is excited about these prospects and is working with industry and other stakeholders to help make them a reality.

III. Changes in Vehicle Interior Designs and their Effect on Testing, Certification and Compliance Verification under the Federal Safety Standards

Part of NHTSA's responsibility in carrying out its safety mission is not only to develop and set new safety standards for new motor vehicles and motor vehicle equipment, but also to modify existing standards as necessary to respond to changing circumstances such as the introduction of new technologies. Some old standards or portions of standards may no longer be needed or at least need to be updated to keep them relevant. Examples of previous technological transitions that triggered the need to adapt and/or replace requirements in the FMVSS include the replacing of analog dashboards by digital ones,[5] the replacing of mechanical control systems by

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(slick roads, weather, etc.). Among an estimated 2,046,000 drivers who were assigned critical reasons, recognition errors accounted for about 41 percent (±2.1%), decision errors 33 percent (±3.7%), and performance errors 11 percent (±2.7%) of the crashes.
A fact sheet containing more detail can be found at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812115.

[5] 70 Fed. Reg. 48295 (August 17, 2005).

electronic ones[6] and then by wireless ones, and the first production of electric vehicles in appreciable numbers.[7]

The existing FMVSS can be found in the Code of Federal Regulations at 49 CFR Part 571. NHTSA has over 60 FMVSS today.

The FMVSS specify minimum performance requirements and test procedures for brakes, accelerator controls, electronic stability control, seat belts, airbags, exterior lighting and interior warning telltales that illuminate to alert the driver when there is a vehicle malfunction, and for other equipment. Manufacturers are prohibited from selling vehicles and vehicle equipment unless they comply with all applicable FMVSS and their compliance has been self-certified by their manufacturer.[8]

Almost all of NHTSA's FMVSS were developed and established well before vehicles with ADSs became a practicable possibility. As a result, the performance requirements and test procedures in many of the FMVSS are based on the assumption that the driver will be human, will sit in the vehicle's left front seat to drive (in left-hand drive vehicles), and will need certain controls to be accessible and telltales and other displays to be viewable in order to do the driving. A further and even more basic assumption is that there will be at least one occupant in each vehicle. In the case of ADS delivery vehicles without manual driving controls, this assumption may prove incorrect. If, instead, a vehicle is designed so that only an ADS can drive it and vehicle designers modify the passenger compartment to take advantage of the flexibility afforded them if a human driver is not needed, then many of those assumptions will likely be invalid for that vehicle, and some may be actually problematic from a testing perspective.

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[6] 60 Fed. Reg. 62061 (December 4, 1995).
[7] *See, e.g.,* 59 Fed. Reg. 11004 (March 9, 1994) and 59 Fed. Reg. 49901 (September 30, 1994).
[8] 49 U.S.C. § 30112(a)(1).

NHTSA has set out below some illustrative examples of potential problems with the existing FMVSS. The Agency requests commenters to identify other potential problems.

- If the FMVSS can no longer specify where controls and displays are located by requiring them to be visible to or within the reach of a person sitting in the driver's seat, then it is unclear for which person or persons in which seating position or positions must they be visible to or within the reach of or even if they are necessary at all.
- After the barriers to determining compliance are removed from the FMVSS, the Agency will turn to other closely related questions such as whether there is a continued need for certain current performance requirements in the FMVSS. For example, among the questions that the agency would need to address are: Would occupants still need warning telltales and other displays to be viewable if they did not have any means of driving their vehicles? Could there be any risk of adverse safety consequences if some or all of those warnings and messages were not provided to the occupants of those vehicles either before or during trips? If a vehicle, such as an ADS delivery vehicle without manual driving controls, were unlikely to be occupied during trips, would there be any safety need for warning telltales and other displays to be viewable?
- If future vehicles with ADSs lack any means of human control, it is unclear how the Agency and the manufacturers can conduct compliance tests (such as those for stopping distance) that are currently performed by human test drivers performing prescribed driving maneuvers on test tracks.
- FMVSS No. 126, Electronic stability control systems for light vehicles, specifies the use of an automated steering machine that depends on a vehicle's steering wheel to steer vehicles when they are tested for compliance. If a vehicle with ADS is not equipped with

a steering wheel because the ADS will do all of the driving, the agency would need to determine how to amend the standard to enable the agency to conduct stability control testing and maintain the current level of effectiveness.

- Some vehicles with ADSs may have unique seating configurations that may make it impossible for existing crash protection requirements, test procedures and test devices (e.g., anthropomorphic dummies) to evaluate adequately the level of crashworthiness protection provided.
- There may be other existing performance requirements and test procedures that would fail to accommodate unconventional designs. If there are, the Agency will need to identify them and determine how the Agency should amend them in ways maintain the current level of effectiveness.
- There may be some safety attributes or testing procedures that will no longer have sufficient value in a vehicle whose usage is anticipated to be predominantly automated, but still retains manual driving controls.

The Agency wishes to address these issues (and many others) in the coming months and years. We anticipate doing so publicly, seeking all available research and public input to help us adapt the FMVSS and possibly adopt other measures that are well-calibrated to promote innovation, respond to changing circumstances and address emerging technologies while maintaining safety.

We want to emphasize, in an attempt to ensure that there is not any misunderstanding about the source and nature of the barriers or about the vehicles affected by those barriers, that the FMVSS (or any other kind of legally-binding standards) do not have any provisions designed to address the self-driving capability of a motor vehicle. Further, nothing in the existing FMVSS

prohibit ADS. 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.

If, however, manufacturers design vehicles with ADSs not only lack manual driving controls, but also have unconventional, flexible seating, i.e., seats that slide and./or rotate, then under the Agency's line of interpretations involving vehicle systems that have multiple modes, there may be testing or even compliance difficulties.[9] Similar problems might be encountered by vehicles with ADSs equipped with retractable manual driving controls.

Thus, it is not the inclusion of an ADS in a new vehicle that complicates testing and certifying the compliance of the vehicle to the existing FMVSS. Testing and certifying compliance potentially becomes complicated only if a manufacturer wishes to go a step further and design a vehicle with ADS but without a steering wheel, brake pedal and accelerator pedal or with novel configurations or orientations for certain vehicle systems. As noted above, this problem arises because the FMVSS, as currently written, are premised on the presence of means of manual control and on conventional seating configurations and orientations.

Although the Agency may have a degree of flexibility in interpreting some of its existing FMVSS to accommodate innovative interior designs, in most instances, it will be necessary to amend the FMVSS. The FMVSS and the rulemaking process through which they are established and amended are subject to the Administrative Procedure Act,[10] the National Traffic and Motor Vehicle Safety Act (Vehicle Safety Act),[11] other statutes, and various Executive Orders and

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[9] See, e.g., May 6, 1986 letter to Paul Utans regarding a Subaru with two adjustment positions for suspension—a high one and a low one. In it, NHTSA stated that it reserves the right to activate either mode in conducting compliance tests.

[10] 5 U.S.C. § 551 et seq.

[11] 49 U.S.C. § 30101 et seq.

guidance documents from the Office of Management and Budget. Together, they ensure the FMVSS meet the requirements and goals set by Congress and are adopted only after sufficient opportunities for public participation and careful consideration and analysis of available information and public comments. Under the Vehicle Safety Act, moreover, the FMVSS need to be "objective, practicable, and meet the need for safety" when initially issued and must remain so after being amended. If NHTSA revises a test procedure in an FMVSS to accommodate an innovative new vehicle design, it must make sure that the FMVSS continues to be objective and practicable and meet the need for safety. Accomplishing this goal will, in a number of instances, require research to develop revised test procedures and performance criteria. Defining the needed research and establishing priorities in conducting it is the subject of this RFC.

IV. Initial Agency Efforts to Identify Testing, Certification and Compliance Verification Issues

NHTSA began the process of evaluating existing FMVSS for potential barriers in 2015. In August of that year, NHTSA contracted with DOT's Volpe Center to conduct a review of the FMVSS and issue a report identifying the standards that pose potential barriers to the introduction of vehicles with ADSs and with unconventional interior designs.

While that review was underway, Google submitted a letter, dated November 12, 2015, requesting an interpretation regarding the application of certain FMVSS to vehicles with ADSs. In describing its ADS vehicle, Google indicated its intent to design the vehicle so that it does not include conventional manual driving controls, including a steering wheel, accelerator, or brake pedal. NHTSA responded to that letter on February 4, 2016.[12]

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

In its letter, NHTSA took the position that a motor vehicle's "self-driving system" (SDS) could be regarded as the driver or that the left front seating position could be regarded as the driver's position in a variety of standards referencing the "driver" or "driver's seating position."

The response then addressed the question of whether and how Google could certify that the SDS meets a standard developed and designed to apply to a vehicle with a human driver. NHTSA said that in order for it to interpret a standard as allowing certification of compliance by a vehicle manufacturer, NHTSA must first have a suitable test procedure or other means of verifying such compliance. That is, NHTSA said that if a FMVSS lacks a test procedure that is suitable for the Agency's use in verifying a manufacturer's certification of the compliance of some of its vehicles with a FMVSS, the manufacturer cannot validly certify the compliance of those vehicles with the standard. As NHTSA further explained in the letter,

> The critical point of NHTSA's responses for many of the requested interpretations is that defining the driver as the SDS (or the driver's position as the left front position) does not end the inquiry or determine the result. Once the SDS is deemed to be the driver for purposes of a particular standard or test, the next question is whether and how Google could certify that the SDS meets a standard developed and designed to apply to a vehicle with a human driver. Related, in order for NHTSA to interpret a standard as allowing certification of compliance by a vehicle manufacturer, NHTSA must first have a test procedure or other means of verifying such compliance.

Volpe completed its review of the FMVSS before NHTSA sent its February 4 letter to Google and thus did not consider that letter in conducting its review. The report on the results of the review was published one month later in March 2016.[13] (To read the executive summary of the report and a list of the FMVSS identified in the report, please see the appendix at the end of this document.) In that report, Volpe described the two reviews that it conducted of the FMVSS:

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[13] Kim, Anita, David Perlman, Dan Bogard, and Ryan Harrington. "Review of Federal Motor Vehicle Safety Standards (FMVSS) for Automated Vehicles," Preliminary Report – March 2016. U.S. DOT Volpe Center, Cambridge, MA. *Available at* https://rosap.ntl.bts.gov/view/dot/12260. For a specific listing of potential barriers, *see* Appendix B of that report, pp. 26 *et seq.*

a driver reference scan to identify which standards include an explicit or implicit reference to a human driver and a driving automation concepts scan to identify which standards could pose a challenge for a wide range of driving automation capabilities and concepts. The review revealed that there are few barriers for a vehicle with ADS to comply with the FMVSS, so long as the vehicle does not significantly diverge from a conventional vehicle design. Two standards, FMVSS 114 for theft protection and rollaway prevention and FMVSS 135 for light vehicle brake systems, were identified as having potential issues for vehicles with an ADS and with conventional designs.[14]

In addition, NHTSA subject matter experts have identified specific requirements and test procedure limitations. NHTSA is initiating new research on the assessment and evaluation of, and solutions to, the preliminary challenges identified in the Volpe report to the testing, compliance verification and self-certification of vehicles with ADSs. Most of these challenges are precipitated by alternative vehicle designs, such as ones lacking manual driving controls. NHTSA's initial research focuses primarily on the FMVSS compliance test procedures, but will also explore options for telltales, visual and auditory displays and controls and other innovative new vehicle design challenges that may not have been identified in the original Volpe report. NHTSA has contracted with the Virginia Tech Transportation Institute to perform this research. This is a multidisciplinary project to develop technical translations to existing FMVSS and related testing procedure approaches for emerging innovative and non-traditional vehicle

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[14] Ibid, pp. 9-10. FMVSS 114 presents several issues. One is whether, for the purposes of satisfying the requirement an automatic transmission "vehicle must be designed such that the transmission or gear selection control cannot move from the "park" position, unless the key is in the starting system," an electronic code transmitted from a smartphone application to a vehicle can be interpreted as being a key. The report notes that NHTSA has historically interpreted the electronic code transmitted by a wireless transponder directly to a vehicle as a key for the purposes of FMVSS 114. Although the report notes the existence of a technological difference in these two different methods of transmitting an electronic code to a vehicle, it does not suggest why that difference should lead to a different conclusion by the Agency.
FMVSS 135 requires that the service brakes "shall be activated by means of a foot control"

designs. The project is being conducted by a core team comprising FMVSS experts; industry team members General Motors and Nissan; testing facilities Dynamic Research, Inc., and MGA Research Corporation; and research institutions Booz Allen Hamilton and the Southwest Research Institute in concert with stakeholder and peer review groups. The research will review and identify alternative new vehicle designs, develop candidate alternative approaches, and establish an evaluation process as well as associated tools in close collaboration with critical stakeholders. This research project started at the beginning of FY2018 and is expected to develop robust alternative approaches within the next 12 months to demonstrate compliance with many of the identified FMVSS whose existing test procedures present challenges. The results of this research will be made public after the completion of the project.

V. Requests for Comment

To help guide NHTSA's research to address testing and self-certification issues, we seek comments on the topics below. The Agency urges that, where possible, comments be supported by data and analysis to increase their usefulness. Please clearly indicate the source of such data.

A. Barriers to testing, certification and compliance verification

1. What are the different categories of barriers that the FMVSS potentially create to the testing, certification and compliance verification of a new ADS vehicle lacking manual driving controls? Examples of barrier categories include the following:

a. test procedures that cannot be conducted for vehicles with ADSs and with innovative interior designs; and

b. performance requirements that may serve a reduced safety purpose or even no safety purpose at all for a vehicle with ADS and thus potentially impose more cost and more restrictions on design than are warranted.

As noted earlier in this document, the first of the above categories is the primary focus of this document. However, the Agency seeks comments on both categories of barriers. If you believe that there are still other barrier categories, please identify them.

2. NHTSA requests comments on the statement made in NHTSA's February 2016 letter of interpretation to Google, that if a FMVSS lacks a test procedure that is suitable for the Agency's use in verifying a manufacturer's certification of compliance with a provision in that FMVSS, the manufacturer cannot validly certify the compliance of its vehicles with that provision. Do commenters agree that each of the standards identified in the letter as needing to be amended before manufacturers can certify compliance with it must be amended in order to permit certification? Why or why not? If there are other solutions, please describe them.

3. Do you agree (or disagree) that the FMVSS provisions identified in the Volpe report or Google letter as posing barriers to testing and certification are, in fact, barriers? Please explain why.

4. Do commenters think there are FMVSS provisions that pose barriers to testing and certification of innovative new vehicle designs, but were *not* covered in the Volpe report or Google letter? If so, what are they, how do they pose barriers, and how do you believe NHTSA should consider addressing them?

5. Are there ways to solve the problems that may be posed by any of these FMVSS provisions without conducting additional research? If so, what are they and why do you believe that no further research is necessary? For example, can some apparent problems be solved through interpretation? If so, which ones?

6. Similarly, are there ways to solve the problems that may be posed by any of these FMVSS provisions without rulemaking? For example, can some apparent problems be solved through interpretation without either additional research or through rulemaking? If so, which ones?

7. In contrast, if a commenter believes that legislation might be necessary to enable NHTSA to remove a barrier identified by the commenter, please explain why and please identify the specific existing law that the commenter thinks should be changed and describe how it should be changed. If there are associated regulations that the commenter believes should be changed, please identify the specific CFR citation and explain why they need to be changed.

8. Many FMVSS contain test procedures that are based on the assumed presence of a human driver, and will therefore likely need to be amended to accommodate vehicles that cannot be driven by humans. Other FMVSS test procedures may seem, based on a plain reading of their language, to accommodate vehicles that cannot be driven by humans, but it may nevertheless be unclear how NHTSA (or a manufacturer attempting to self-certify to the test) would instruct the vehicle to perform the test as written.

   a. Do commenters believe that these procedures should apply to a vehicle that cannot be driven by a human? If so, why? If there are data to support this positon, please provide it.

   b. If not, can NHTSA test in some other manner? Please identify the alternative manner and explain why it would be appropriate.

9. What research would be necessary to determine how to instruct a vehicle with ADS but without manual means of control to follow a driving test procedure? Is it possible to

develop a single approach to inputting these "instructions" in a manner applicable to all vehicle designs and all FMVSS, or will the approach need to vary, and if so, why and how? If commenters believe there is a risk of gaming,[15] what would that risk be and how could it be reduced or prevented?

10. In lieu of the approaches suggested in questions 8 and 9, is there an alternative means of demonstrating equivalent level of safety that is reliable, objective and practicable?

11. For FMVSS that include test procedures that assume a human driver is seated in a certain seating position (for example, procedures that assess whether a rearview mirror provides an image in the correct location), should NHTSA simply amend the FMVSS to require, for instance, that "driver's seat" requirements apply to any front seating position? If so, please explain why. If not, what research would need to be conducted to determine how NHTSA should amend those requirements?

12. A variety of FMVSS require safety-related dashboard telltales and other displays, if provided, to be visible to a human driver and controls to be within reach of that driver. Generally speaking, is there a safety need for the telltales and other displays in Table 1 and 2 of FMVSS 101 to be visible to any of the occupants in vehicles without manual driving controls?[16] Commenters are requested to provide their own list of the telltales and other displays they believe are most relevant to meeting any potential safety need in those vehicles. For each item on that list, please answer the following questions:

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[15] For example, if vehicles with ADSs were tested by instructing them to follow a fixed path through a maze of streets simulating a series of adjacent urban or suburban blocks and if, along that path, the vehicles encountered surrogate vehicles, cyclists and pedestrians at fixed time intervals and in fixed locations, it might be possible for the vehicles to avoid any collisions if the vehicles were programmed to stop in those locations at the scheduled time intervals in lieu of the vehicles' actually relying on their sensors to detect the surrogates and on their algorithms to manage braking and steering in such a way as to avoid any collisions.

[16] Examples of such displays are the malfunction displays for systems like Antilock Braking System (ABS), Electronic Stability Control (ESC), Tire Pressure Monitoring System (TPMS), air bags, etc.

a. Should the telltale or other display be required to be visible to one or more vehicle occupants in vehicles without manual driving controls?

b. If there is a need for continued visibility, to the occupant(s) of which seating position(s) should the telltale or other display be visible?

c. Does the answer to the question about the continued need for a telltale or other display to be visible to the occupant of a vehicle without manual driving controls change if a manufacturer equips the vehicle with a device like an "emergency stop button"? Why or why not?

d. Would the informational safety needs of the occupants of vehicles with ADSs differ according to whether the vehicle has a full set of manual driving controls, just an emergency stop button or no controls whatsoever?

e. Conversely, if a vehicle is designed such that it can be driven only by an ADS, does the ADS need to be provided with some or all of the same information currently required to be provided for a human driver? For example, does the ADS need to know if the tires are underinflated? Why or why not?

f. If commenters believe that it would enhance safety if a vehicle's ADS were required to receive information similar to some or all of that currently required to be provided to human drivers by telltales and other displays, what research needs to be conducted to develop the kinds of objective and practicable performance requirements or test procedures that would enable manufacturers and the Agency to evaluate whether that information was provided to and understood by the ADS?

13. If NHTSA is going to conduct research to determine whether there is any safety need for the occupants of fully-self-driving vehicles to continue to have any access to any of

the nondriving controls (e.g., controls for windshield washer/wiper system, turn signals and lights) in a vehicle without manual driving controls, what should that research include and how should NHTSA conduct it?

a. If there is a safety need for the occupants of fully-self-driving vehicles to have access to any of the existing vehicle non-driving controls, please identify those controls and explain the safety need

b. Do commenters believe that research should be conducted to determine whether any additional controls (such as an emergency stop button) might be necessary for safety or public acceptance if manual driving controls are removed from fully-self-driving vehicles? Why or why not, and what is the basis for your belief?

c. If NHTSA is going to conduct research to determine whether there is any safety need for the occupants of fully-self-driving vehicles to continue to be able to control exterior lighting like turn signals and headlamp beam switching devices, what should that research include and how should NHTSA conduct it? Separately, if NHTSA is going to conduct research on what exterior lighting continues to be needed for safety when a human is not driving, what should that research include and how should NHTSA conduct it?

14. If NHTSA is going to conduct research to determine whether there is a safety need for the occupants of vehicles with ADSs but without manual driving controls to be able to see to the side and behind those vehicles using mirrors or cameras, what should that research include and how should NHTSA conduct it? Separately, if NHTSA is going to conduct research to determine how NHTSA would test the ability of a vehicle's ADS' to

"see" around and behind the vehicle as well as (or better than) a human driver would, what should that research include and how should NHTSA conduct it?

15. Do the FMVSS create testing and certification issues for vehicles with ADSs other than those discussed above? If so, which FMVSS do so and why do you believe they present such issues? For example, FMVSS No. 108, "Lamps, reflective devices, and associated equipment," could potentially pose obstacles to certifying the compliance of a vehicle that uses exterior lighting and messaging, through words or symbols, to communicate to nearby pedestrians, cyclists and motorists, such as at a 4-way stop intersection, the vehicle's awareness of their presence and the vehicle's willingness to cede priority of movement to any of those people. If research is needed to eliminate the barriers in an appropriate way, please describe the research and explain why it is needed. Are there other lighting issues that should be considered? For example, what lighting will be needed to ensure the proper functioning of the different types of vehicle sensors, especially cameras whose functions include reading traffic control signs?

16. If occupants of vehicles with ADSs, especially those without manual driving controls, are less likely to sit in what is now called the driver's seating position or are less likely to sit in seats that are facing forward, how should these factors affect existing requirements for crashworthiness safety features?

17. If vehicles with ADSs have emergency controls that can be accessed through unconventional means, such as a smart phone or multi-purpose display and have unconventional interiors, how should the Agency address those controls?

18. Are there any specific regulatory barriers related to small businesses that NHTSA should consider, specifically those that may help facilitate small business participation in this emerging technology?

B. Research needed to address those barriers and NHTSA's role in conducting it

19. For issues about FMVSS barriers that NHTSA needs research to resolve, do commenters believe that there are specific items that would be better addressed through research by outside stakeholders, such as industry or research organizations, instead of by NHTSA itself?

a. Which issues is industry better equipped to undertake on its own, and why? Which issues are research organizations or other stakeholders better equipped to undertake on their own, and why?

b. What research is needed to determine which types of safety performance metrics[17] should be used to evaluate a particular safety capability and to develop a test procedure for evaluating how well a vehicle performs in terms of those metrics?

c. Which questions is NHTSA better equipped to undertake and why? For example, would NHTSA, as the regulator, be the more appropriate party to conduct research needed to determine what performance threshold to require vehicles to meet with respect to that metric? Why or why not?

d. What research have industry, research organizations, and other stakeholders done related to barriers to testing and certification? What research are they

[17] The purpose of formulating safety performance metrics for motor vehicles is to facilitate the quantitative assessment of their capabilities. An example of a crash avoidance performance metric is the ability of a vehicle with ADS to sense and avoid colliding with a surrogate pedestrian crossing a street on a test course.

planning to do? With respect to research planned, but not yet completed, please identify the research and state the starting and end dates for that research.

e. How can NHTSA, industry, states, research organizations, and other stakeholders work together to ensure that, if the research on these issues were eventually to lead to rulemaking, it is done with the rigor and thoroughness that NHTSA would need to meet its statutory obligations, regardless of who performs it (e.g., done in a manner that enables the Agency to ensure that the FMVSS continue to be objective and practicable and continue to meet the need for safety)?

20. For the issues identified above or by commenters, which merit the most attention? How should the agency prioritize its research and any follow-on rulemakings to remove the barriers to testing and certification?

21. Correcting barriers associated with the track testing of motor vehicles will be particularly challenging. Examples of such barriers follow:

a. As noted above, FMVSS No. 126 specifies the use of an automated steering machine that depends on a vehicle's steering wheel to steer vehicles when they are tested for compliance. NHTSA will need to determine how to amend the standard to enable the agency to conduct stability control testing in vehicles that lack a steering wheel. Further, if NHTSA is going to conduct research to consider how to change the "sine with dwell" test procedure for FMVSS No. 126, so that steering wheel angle need not be measured at the steering wheel in determining compliance with the standard, what should that research include and how should NHTSA conduct it?

b. If NHTSA is going to conduct research to develop a performance test to verify how a vehicle is activating its service brakes, what should that research include and how should NHTSA conduct it? If NHTSA is going to conduct research to determine whether there continues to be a safety need to maintain a human-operable service brake, what should that research include and how should NHTSA conduct it?

22. Are there industry standards, existing or in development, that may be suitable for incorporation by reference by NHTSA in accordance with the standards provisions of the National Technology Transfer and Advancement Act of 1995 and Office of Management and Budget Circular A-119, "Federal Participation in the Development and Use of Voluntary Consensus Standards and Conformity Assessment Activities?"

VI. Public Participation

How do I prepare and submit comments?

Your comments must be written and in English. To ensure that your comments are filed in the correct docket, please include the docket number of this document in your comments.

Your comments must not be more than 15 pages long (49 CFR 553.21). NHTSA established this limit to encourage you to write your primary comments in a concise fashion. However, you may attach necessary additional documents to your 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 above under **ADDRESSES**. Please note, if you are submitting comments electronically as a PDF (Adobe)

file, we ask that the documents submitted be scanned using an Optical Character Recognition (OCR) process, thus allowing NHTSA to search and copy certain portions of your submissions.

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 you claim to be confidential business information, to the Office of the Chief Counsel, NHTSA, at the address given above under **FOR FURTHER INFORMATION CONTACT.**

In addition, you may 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 send 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 NHTSA consider late comments?

NHTSA will consider all comments received before the close of business on the comment closing date indicated above under **DATES.** To the extent possible, NHTSA will also consider comments received after that date.

How can I read the comments submitted by other people?

You may read the comments received at the address given above under **ADDRESSES.** 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 notice, at http://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.

Authority: 49 U.S.C. 30101 *et seq.*, 49 U.S.C. 30182.

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Heidi King

Deputy Administrator

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Appendix

1. Executive Summary of the Volpe Report

Review of Federal Motor Vehicle Safety Standards (FMVSS) for Automated Vehicles Identifying potential barriers and challenges for the certification of automated vehicles using existing FMVSS

Preliminary Report – March 2016

Anita Kim, David Perlman, Dan Bogard and Ryan Harrington
Technology Innovation and Policy Division

"• Current Federal Motor Vehicle Safety Standards (FMVSS) do not explicitly address automated vehicle technology and often assume the presence of a human driver. As a result, existing language may create certification challenges for manufacturers of automated vehicles that choose to pursue certain vehicle concepts.

• The purpose of this work is to identify instances where the existing FMVSS may pose challenges to the introduction of automated vehicles. It identifies standards requiring further review - both to ensure that existing regulations do not unduly stifle innovation and to help ensure that automated vehicles perform their functions safely.

• The review highlighted standards in the FMVSS that may create certification challenges for automated vehicle concepts with particular characteristics, including situations in which those characteristics could introduce ambiguity into the interpretation of existing standards. The review team's approach was meant to be as inclusive as possible, with the intent to identify standards that would require further review or discussion.

• This is a preliminary report summarizing the review of FMVSS and includes a discussion on approach, findings, and analysis. As a preliminary review, the contents of this report reflect the results of an initial analysis and may be modified based on stakeholder input and future discussion.

• The Volpe team conducted two reviews of the FMVSS: a driver reference scan to identify which standards include an explicit or implicit reference to a human driver and an automated vehicle concepts scan to identify which standards could pose a challenge for a wide range of automated vehicle capabilities and concepts.

o The driver reference scan revealed references in numerous standards to a driver (defined in §571.3 as "...the occupant of the motor vehicle seated immediately behind the steering control system"), a driver's seating position, or controls and displays that must be visible to or operable by a driver, or actuated by a driver's hands or feet.

o In order to conduct the automated vehicle concepts scan, the Volpe team developed 13 different automated vehicle concepts, ranging from limited levels of automation (and near-term applications) to highly-automated, driverless concepts with innovative vehicle designs. The idea was to evaluate the FMVSS against these different automated vehicle concepts.

• In summary, the review revealed that there are few barriers for automated vehicles to comply with FMVSS, as long as the vehicle does not significantly diverge from a conventional

vehicle design. Two standards: theft protection and rollaway prevention (§571.114) and light vehicle brake systems (§571.135) were identified as having potential issues for automated vehicles with conventional designs.

• Automated vehicles that begin to push the boundaries of conventional design (e.g., alternative cabin layouts, omission of manual controls) would be constrained by the current FMVSS or may conflict with policy objectives of the FMVSS. Many standards, as currently written, are based on assumptions of conventional vehicle designs and thus pose challenges for certain design concepts, particularly for 'driverless' concepts where occupants have no way of driving the vehicle (e.g., §571.101, controls and displays, §571.111, rear visibility, §571.208, occupant crash protection represent a few examples).

• Subsequent to the Volpe Center's review of the FMVSS, but prior to the publication of this report, NHTSA released interpretations to BMW of North America and Google, Inc. in response to questions regarding how to interpret certain FMVSS requirements in the context of automated vehicles. As a result, the review does not reflect this subsequent development. The full text of these interpretations are available in NHTSA's repository of interpretation files at the website: isearch.nhtsa.gov."

2. List of Standards Identified in the Volpe Report

In the report, the Volpe Center reported 32 of 63 FMVSS's that may present certification challenges for certain types of automated vehicles because they contain performance specifications, test procedures, or equipment requirements that present potential barriers to the certification of one or more AV concepts:

1. Conventional Vehicles (with driver controls) with highly-automated features (2 standards identified)
    - key must be in position before moving out of park position, and park position interlock with the service brake (571.114)
    - foot-actuated service brake control, brake system warning indicator, and warning device for lining replacements (571.135)
2. Fully-self-driving vehicles (no driver controls or novel design) (32 standards identified, some examples listed below)
    - controls and displays visible to the driver (571.101),

- transmission shift position sequence and interlock (571.102),
- windshield defrosting and defogging (571.103)
- windshield wipers (571.104),
- foot-actuated service brake control, brake system warning indicator, and warning device for lining replacements (571.105)
- turn signal, flasher, headlamp beam switch, and upper beam indicator (571.108),
- tire/rim retention requirement for driver (571.110)
- requirements for rear visibility for the driver (571.111),
- key must be in position before moving out of park position, and park position interlock with the service brake (571.114),
- powered windows and roof panels (571.118)
- foot-actuated service brake control, low-pressure brake system warning indicator, and brake adjustment indicators (571.121)
- motorcycle brake systems (571.122)
- accelerator pedal must return to neutral when released by the driver (571.124)
- a steering wheel (a requirement for completing tests) and certain controls and displays, (571.126),
- foot-actuated service brake control, brake system warning indicator, and warning device for lining replacements (571.135),
- TPMS telltale for low tire pressure to warn driver (571.138)
- occupant protection in interior impact (571.201)
- door locks and door retention components (571.206)
- a designated seating position for the driver (571.207),

- occupant protection and warning system for non-buckled seat belt (571.208),
- seat belt anchorages (571.210)
- side impact protection (571.214)
- windshield zone intrusion (571.219)
- child restraint anchorage systems (571.225)
- readiness monitor for ejection mitigation countermeasures visible to the driver (571.226)
- flammability of interior materials (571.302)
- interior trunk release (571.401)
- other equipment may pose barriers to certification.