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U.S. Department of Transportation
Docket Management Facility
1200 New Jersey Avenue, SE
West Building, Ground Floor, Room W12-140
Washington, DC 20590-0001

RE: Removing Regulatory Barriers for Vehicles with Automated Driving Systems [Docket No. NHTSA-2019-0036]

The American Association of Motor Vehicle Administrators (AAMVA) welcomes the opportunity to provide comment on the National Highway Traffic Safety Administration's (NHTSA) Advance Notice of Proposed Rulemaking on vehicles with automated diving systems. Specifically, NHTSA is seeking comment on FMVSS-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. While AAMVA ultimately defers to NHTSA expertise in establishing the testing standard and how manufacturers must conform to that standard, AAMVA has previously commented that in the absence of ability to conform to standards, supplemental documentation and attestations to an equitable level of safety may provide a bit of flexibility during the period of FMVSS reevaluation.

General Comments

As cited in previous petitions against the testing standard, AAMVA requests clarity from NHTSA on whether or not granting an exemption (even temporary) would absolve OEMs from adhering to state (or local) vehicle testing requirements or operational constraints. The granting of a federal exemption from FMVSS that effectively removes a driver may mean different things to different parties. The more up-front clarity provided to consideration of exemptions and how they relate to operational constraints and testing versus deployment, the better.

AAMVA has also previously commented that the removal of driver controls are expected due to the removal of the driver from the designated driver position in the vehicle. This makes sense in that controls may not be applicable or available for a non-existent operator. Until now, all vehicles have required a human driver. If NHTSA is to seriously

consider the removal of a human driver for reliance on the ADS, then NHTSA must consider what it means for the vehicles to be operated, monitored, and maintained "by proxy."

In the context of the removal of the driver and the relatively short period of time some of these technologies have been subject to evaluation, supportive data regarding safety equivalency will become more and more essential. While non-engineers will not be able to sufficiently describe the details surrounding how something works, objective and transparent data submitted on FMVSS exempted equipment should be able to support that it is working. In the absence of supporting data proving a technology's performance, manufacturers should provide documented statements attesting that the vehicle meets the standard.

NHTSA Examples

The ANPRM cites that NHTSA has determined that most of the potential regulatory barriers to certification of ADS-DVs without traditional manual controls in the 100-series 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.

A. Example #1 (FMVSS No. 135): Manual Control Required
   NHTSA cites this type of barrier as a barrier to compliance verification of an ADS-DV when a safety standard directly requires a manual control be provided in the vehicle. For example, NHTSA cites FMVSS No. 135 – "Light vehicle brake systems." This standard requires a vehicle be equipped with a manual control and requires that this manual control be used to test compliance. Specifically, "all light vehicles must be equipped with service brakes that "shall be activated by means of a foot control."

NHTSA cites four potential approaches to remedying requirements for manual controls, including:

1) 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.

   AAMVA supports this approach.

2) 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 by law.

While NHTSA should consider modification or removal for the requirement, AAMVA recommends NHTSA approach the question of determining "necessity" for motor vehicle safety carefully. NHTSA may need to consider the interaction of how removal of one control may impact the vehicle's safety rating as a whole. Further, NHTSA will need to consider whether the removal of applicable standards could affect the safety of the vehicle both while it is being operated, while it is not being operated, and when it is inoperable. Given mechanical functions of the vehicle have traditionally had human-operated controls, first responders have been able to interact with and manipulate a vehicle in circumstances beyond normal operation. The ability for first responders to continue to interact with, and potentially control a vehicle under emergency circumstances should continue to be a consideration for NHTSA.

3) 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.

AAMVA cites the above comments in scenario 2 posited above. AAMVA also advises caution on the differentiation of what is necessary for traditional versus ADS-DVs in terms of standardization. There remain questions regarding how the classification of ADS-DVs will work. There is also the potential for fluid crossover between traditional vehicles and ADS-DVs through over-the-air updates or aftermarket modifications to the vehicle. This could complicate the ability of FMCSA to apply a set of standards to one vehicle in one year, and remove the requirement on the same vehicle the following year. It could also make inspection of the vehicle for safety purposes more difficult. NHTSA will have to very carefully provide guidance on how applicability of the standards intersects with enforcement of the standards, unless it is only applicable to testing against the standard. NHTSA will also have to consider how the removal of the manual controls impacts the ability for states to test against the standard, or identify whether the vehicle is classified as an ADS-DV. Finally, the authority to make vehicle designations, and determine who is appropriately suited to make ADS-DV classifications on any given vehicle will play a large role in the equity of those vehicle classifications.

4) 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.

AAMVA reiterates its comments in approach 3 above. Close collaboration between NHTSA and vehicle manufacturers will be required in order to identify the areas where ADS-DVs perform the same function as traditional vehicles but without the manual controls. AAMVA urges NHTSA to collect documentation on how the same mechanical functions might be accomplished, or where not permissible due to proprietary reasons, requesting that the manufacturer simply attest to the fact that the vehicle meets the safety standards in an alternative fashion and authorize the appropriate authorities to verify vehicle performance against the standard (where applicable).

B. Example #2 (FMVSS No. 126): Existing Test Procedures That Cannot be Executed Absent Traditional Manual Controls

NHTSA identifies the second type of barrier as one in which 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. The example NHTSA provides is Electronic Stability Control (FMVSS No. 126).

AAMVA agrees that with the NHTSA statement that the "FMVSS, therefore, is about the performance of the ESC system, not any traditional manual control." Given that the standard was written to incorporate a life-saving performance technology that can best be monitored and controlled by a system itself, it makes sense that the manual control aspects of the system serve as a methodology for compliance testing rather than overall safety performance. Further, NHTSA is correct in stating that the wheel-mounted construct that serves as a steering machine to gauge inputs at specific magnitudes, rates and timing is specific to the preconception that all vehicles would have a steering wheel. However, this demonstrates the interconnectivity of the FMVSS working as a system of safety standards. The removal of one standard will have a domino effect on potential impacts to other standards. NHTSA should weigh the impacts of how removal of one regulatory barrier may impact additional safety standards, and consider whether a uniquely applicable set of standards may more efficiently serve ADS-DVs. If the standard is written such that the standard is only applicable to compliance testing methodology, AAMVA defers to NHTSA as the appropriate oversight authority to ensure vehicle design features align appropriately with what is considered safe operation. AAMVA does, however, request NHTSA preserve the ability of state authorities to enforce their own laws in post-production operational safety requirements of all vehicles.

VI. Possible Approaches to Revising Crash Avoidance Test Procedures

A. Normal ADS-DV Operation

This approach for self-certification 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. Vehicle performance would be observed and assessed during the period of normal on-road vehicle operation.

In this section, NHTSA cites that this approach could be used for such tests as tire pressure monitoring systems whereby the ADS rather than the driver perform the functions of the test reliant on a driver. NHTSA cites the shortcomings of the approach as not being ODD-specific in the application of the test. NHTSA states that "the primary drawback of the 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) of the ADS." AAMVA defers to NHTSA expertise on how best to test the vehicles with respect to their intended design, but cautions against fabricating the test to fit the vehicle rather than the other way around. If a vehicle is unable to perform compliance tests applicable to the standard due to limitations on intended vehicle use (ODD); exceptions to a vehicle's ability to perform the test infringes on the ability to monitor, enforce, and restrict that use in accordance with the compliance test findings of NHTSA.

Questions specific to this testing method:

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?

AAMVA defers to manufacturers on prospective passenger/operator commands. However, passenger safety must be taken into account beyond the performance of the vehicle. Environmental factors for observing and mitigating safety risks as a passenger may coincide with or supersede expectations on vehicle performance. Passenger interaction with the vehicle may require the ability to monitor performance and make decisions relative to passenger safety that have nothing to do with the on-road performance of the vehicle. Passengers may also need to assess the vehicle's safety condition prior to, during, and after vehicle operations. Further, passengers may need to interrupt or stop commands to ensure their safety. While the interface with the passenger will need to be described, a reasonable ability to override certain vehicle functions may also need to be explored.

13) Are there specific challenges that will be encountered with this kind of approach for vehicle compliance verification?

See the above comments. There are also technical and taxonomy challenges in assigning testing methodology based on ODD capabilities. Once an individual vehicle classification determines the ability to test, the conditions of the test impact the operational capacity of the vehicle and its verified performance results. That kind of differentiation may unnecessarily complicate the ability to know whether any individual

vehicle satisfies the conditions of the test and is certified by NHTSA to operate unilaterally under any circumstances.

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”; “sift from park to drive and accelerate to 25 mph”; “drive up onto a car hauler truck trailer”; etc.? Explain projected challenges for ADS-DVs without traditional manual controls to complete discrete driving commands and tasks.

One of the challenges would be the standardization of common commands. Vehicles would need to be able to respond uniformly to these types of commands, across manufacturers – especially given shared vehicle deployment plans. Developing a complete listing of what a vehicle must be able to perform via passenger command will also be difficult. The method of accomplishing the same result across a multi-vehicle platform will be difficult. Recognition of commands in various languages and cultures could also impede the ability to provide responsive voice activated commands. One of the benefits of the long-standing FMVSS structure is that the manual controls of the vehicles are widely recognized across language and cultural barriers. In emergency situations, people know where to find the brake, the accelerator, the steering wheel. Reliance on voice commands could pose additional non-standardized recognition and response challenges in safety-critical situations.

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?

See previous comments. NHTSA will rely on state enforcement partners to ensure intension aligns appropriately with documented conditions applicable to each vehicle. There are numerous challenges here, including the classification of the vehicle’s functionality, documentation of its described ODD, description of its intended use. All of these are essential communication points that must be shared between federal and state authorities. NHTSA should require documentation from manufacturers describing any limitations on vehicle performance and any departures from current standards. NHTSA should also require attestation from manufacturers during the design phase that vehicles would conform with all aspects of road safety. Any departure of the vehicles from those described and documented limits should trigger the appropriate enforcement authorities at the federal and state level.

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.

AAMVA endorses NHTSA's consideration of an "E-stop" option on the vehicle to maximize the safety of testing and other environmental circumstances.

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?

AAMVA defers this question to NHTSA and the manufacturers. However, precautions should be made that while engineers are given access to interfacing with the compliance test library menu, they are not given access to manipulation of any data associated with the test itself.

17) Would the FMVSS need to specify the libraries available to NHTSA to test the vehicle?

AAMVA defers to NHTSA expertise on this, but given the difficulty in changing or modifying FMVSSs generally, it may make sense to avoid (or limit where possible) any specific references to testing that may be subject to change.

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).

If the vehicle is level 3 or below, AAMVA presumes that there would be traditional manually-operated controls during testing. For levels 4 and higher, AAMVA again defers to NHTSA on what appropriate testing methodology looks like and the appropriate way to pre-program information on the test without compromising the integrity of the test or the ability of the vehicle to function appropriately on command.

19) Can an ADS-DV be expected to perform within tight-tolerance levels using the regular on-board sensors?

AAMVA defers to the manufacturers and NHTSA on performance evaluation. However, the vehicle should be able to perform as expected, and under the same safety tolerance levels prescribed to non-ADS-DV vehicles.

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?

AAMVA defers to NHTSA on acceptable tolerances for variations in testing locations and their impact on performance testing. AAMVA expects that the majority of testing

locations have similar enough characteristics to provide latitude on achieving similar results.

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?

Individual manufacturers are likely most equipped to handle the specifics of applying and disengaging geofencing. Precautions should be made in ensuring any software design that allows manipulation of geofenced restrictions is applicable only to test vehicles that are actively involved in the testing process. Given that this may differentiate the test vehicle from the comparable vehicles being used for deployment, NHTSA should ensure that the software doesn't extend beyond short-term geofencing flexibility.

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?

AAMVA defers to NHTSA on cybersecurity and security concerns related to vehicle system access relative to testing.

23. Are there other considerations NHTSA should be aware of when contemplating the viability of programmed execution-based vehicle compliance verification?

AAMVA reiterates previous comments regarding the extent to which pre-programming may alter the intent of the test. NHTSA is most knowledgeable about how FMVSS testing is performed, but if the test includes any elements of uncontrolled or unexpected vehicle response to external stimulus, NHTSA should ensure the pre-programmed response doesn't interfere with the ability to test for an appropriate vehicle response.

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?

AAMVA defers to automaker expectations on how to reflect updated TMPE content and the frequency with which it is updated. NHTSA may have to have the ability to designate, assign, and record results as applicable to each TMPE.

C. Test Mode with External Control

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?

AAMVA defers to manufacturers on the ability to design a common/universal interface and translator for external control of a vehicle.

26. What is the most viable method for securely interfacing an external controller with the ADS-DV (e.g. wireless or physical access)?

AAMVA defers to manufacturers to determine the best connectivity method for securely interfacing an external controller.

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?

AAMVA defers to vehicle design experts on security for compliance testing.

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?

AAMVA defers to manufacturers on feasibility of suspension of geofenced restrictions on vehicles. AAMVA points NHTSA to its comments to question 21.

29. Are there other considerations NHTSA should be aware of when contemplating the viability of using an external controller-based vehicle certification?

The only other consideration may be whether external controls significantly affect the testing results as compared to the vehicle operating independently without external controls – and whether that effect can be quantified. Further, it should be contemplated whether the external control testing method may overlap with TMPE, and how that may impact reliable testing. External controls should not be used in replacement of testing where the vehicle's sensor array play a critical role in determining the performance results of the test.

D. Simulation

30. How can simulations be used to assess FMVSS compliance?

AAMVA agrees with NHTSA that a key part of NHTSA's enforcement responsibilities includes buying and testing actual production vehicles. Because NHTSA may not ever have absolute access to the true characteristics of a virtual car, NHTSA's ability to

purchase and test physical models of the vehicle serve an essential purpose – to test real vehicles under real circumstances. The simulation of a vehicle's response under simulated conditions do not give a true sense of the safety performance of the vehicle. There are too many variables between mathematical expectations and real world, mechanical performance to make simulated models reliable. Simulations may play an important role in demonstrating general function and design development, but may play a limited role in testing.

31. Are there objective, practicable ways for the agency to validate simulation models to ensure their accuracy and repeatability?

AAMVA defers to NHTSA in the development of simulated testing methodology.

32. Is it feasible to perform hardware-in-the-loop simulations to conduct FMVSS compliance verification testing for current FMVSS?

AAMVA defers to NHTSA in the development of simulated testing methodology.

33. Is it feasible to perform software-in-the-loop simulations to conduct FMVSS compliance verification?

AAMVA defers to NHTSA in the development of simulated testing methodology.

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

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 FMVSS?

AAMVA reads the question as redundant in answering itself. As NHTSA states, "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." Further, reliance as an oversight authority would therefore be transferred completely to those responsible for the design of the vehicle, creating a lapse in appropriate independent party evaluation.

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?

If NHTSA were to accept technical documentation, it would have to require an associated attestation from the manufacturer that the documentation was applicable to the specific vehicle and circumstances described, that it represents that true and accurate results of the performance functions, and that the manufacturer submits the

documentation understanding appropriate penalties may be applicable for submitting false supporting documentation.

36. Exactly what kind of documentation could be submitted for each kind of FMVSS requirement?

AAMVA defers to the judgment of NHTSA on what is acceptable given its response to question 34.

F. Use of Surrogate Vehicle with Human Controls

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?

The first question would depend on which FMVSS is being demonstrated. Should the vehicle require sensor technologies and factor in response times that are not applicable to a surrogate, the validity of the testing method may be disputed. Further, application of a single surrogate vehicle would have to satisfy all of the applicable testing as a single vehicle should be able to perform a suite of tests prior to being deemed in compliance. Differing surrogate vehicles performing different tests presents numerous challenges that dilute the purpose of safety standards. AAMVA defers best approaches to testing methodology to NHTSA, but cautions that any differences between testing model and vehicle deployment be evaluated very carefully.

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?

AAMVA defers to NHTSA in the development of testing methodology and correlation of surrogate vehicle results to evidence of performance compliance.

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?

AAMVA is not sure that they can be, depending on the expectations of performance and the applicability of the FMVSS to each independent vehicle. Ultimately, it will be the applicability of the FMVSS as a whole to a single vehicle that will yield the most insight into its compliance with the standard. Modifications to the vehicle being tested to allow it to accomplish the requirements of the test invalidate the testing model. As with

previous comments, AAMVA defers to NHTSA in the development of testing methodology and correlation of surrogate vehicle results to evidence of performance standard compliance.

AAMVA thanks NHTSA for the opportunity to comment on this groundbreaking technology. We look forward to continuing the conversation, and realizing how new technologies can be accommodated in evaluating performance-based objectives.

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