



ADVOCATES
FOR HIGHWAY
& AUTO SAFETY

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**Removing Regulatory Barriers for Vehicles With Automated Driving Systems
Advanced Notice of Proposed Rulemaking
84 Federal Register 24433, May 28, 2019**

Advocates for Highway and Auto Safety (Advocates) files these comments in response to the National Highway Traffic Safety Administration's (NHTSA, Agency) advanced notice of proposed rulemaking (ANPRM, Notice) 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 (FMVSS) for Automated Driving System-Dedicated Vehicles (ADS-DVs) that lack traditional manual controls necessary for a human driver to maneuver the vehicle as well as the other features intended to facilitate operation of a vehicle by a human driver.¹

As the NHTSA states in the Notice, the Agency is "charged with reducing crashes and deaths and injuries resulting from crashes on the nation's roadways."² According to the same section of the United States Code (U.S.C) cited by the Agency in describing their charge, the NHSTA is to achieve the goal of "reducing crashes and deaths and injuries" by prescribing motor vehicle safety standards and carrying out safety research and development.³ According to federal law, "[e]ach standard shall be practicable, meet the need for motor vehicle safety, and be stated in objective terms."⁴ Motor vehicle safety by definition:

Means the performance of a motor vehicle or motor vehicle equipment in a way that protects the public against unreasonable risk of accidents occurring because of the design, construction, or performance of a motor vehicle, and against unreasonable risk of death or injury in an accident, and includes nonoperational safety of a motor vehicle.⁵

¹ Removing Regulatory Barriers for Vehicles With Automated Driving Systems, Advanced Notice of Proposed Rulemaking, NHTSA, 84 FR 24433, May 28, 2019, NHTSA-2019-0036. (Notice)

² Notice, p. 24435, citing 49 U.S.C. 30101.

³ 49 U.S.C. 30101.

⁴ 49 U.S.C. 30111(a).

⁵ 49 U.S.C. 30102(a)(9).

While the majority of the present Notice focuses on the mechanics of how the FMVSS can be modified to accommodate ADS-DVs, specifically the testing methods, any modification must ensure that the safety need met by the FMVSS being modified is still addressed when applied to these vehicles after the modification. As FMVSS are by their definition “minimum standard[s] for motor vehicle or motor vehicle equipment performance”⁶, any modification which lowers the level of safety would undercut the minimum performance provided to road users.

The comments which follow will address at a high level the questions posed by the NHTSA in the present notice. Advocates’ positions on many of these issues are also detailed in comments provided to the research project conducted by the Virginia Tech Transportation Institute (VTTI) cited in the current notice,⁷ comments provided in response to the 2018 Request for Comments,⁸ statements made at the public meeting,⁹ comments on the AV Pilot Program ANPRM,¹⁰ and comments submitted in response to the recent General Motors (GM) and Neuro petitions for exemption.¹¹ (*See attached.*) Those submissions and these present comments include multiple examples of how modifications of FMVSS without regard to the safety need met by the original standard could lower the level of safety established by the original language to the detriment and danger of all road users.

While autonomous vehicles (AVs) hold the promise of improving safety, reducing congestion and improving mobility, a promise is different than proof. Numerous statements made by industry representatives including Ford¹² and Uber¹³ as well as former officials at the U.S. Department of Transportation (DOT)¹⁴ have run counter to earlier claims that the widespread introduction of AVs will occur in the near future. Thus, the rush to rapidly change the existing FMVSS, given the unknowns relating to the performance of these new autonomous driving systems and the timeline for these systems to reach the market is unnecessary. Moreover, by the agency’s own account, AVs only need the FMVSS modifications due to design choices on the part of the manufacturer.¹⁵

As such, at this time the agency should focus on establishing FMVSS governing the performance of automated driving systems (ADS), as well as FMVSS requiring proven, presently available, safety technologies into all new vehicles so that a large number of crashes, injuries and fatalities

⁶ 49 U.S.C. 30103(a)(10)

⁷ Notice, p. 24435 and 24436.

⁸ Advocates for Highway and Auto Safety – Comments, Mar. 20, 2018, NHTSA-2018-0009-0086.

⁹ Statement of Peter Kurdock, Director of Regulatory Affairs, Advocates for Highway and Auto Safety, NHTSA Public Workshop, *Removing Regulatory Barriers for Vehicles With Automated Driving Systems*, Mar. 6, 2018, NHTSA-2018-0009-0048.

¹⁰ Advocates for Highway and Auto Safety – Comments, Dec. 21, 2018, NHTSA-2018-0092-0076.

¹¹ Advocates for highway and Auto Safety – Comments, May 23, 2019, NHTSA-2019-0016-0049; Advocates for Highway and Auto Safety – Comments, May 24, 2019, NHTSA-2019-0017-0026.

¹² Ford CEO says the company ‘overestimated’ self-driving cars, Khalid, A., Engadget, Apr. 10, 2019.

¹³ Uber, ahead of IPO, see some time before self-driving cars dominate the road, Galloni, A., Franklin, J., Reuters, Apr. 8, 2019.

¹⁴ Kan: Here’s what DOT got wrong on driverless cars, Snyder, T., Politico, July 25, 2019.

¹⁵ Notice, p. 24435.

can be prevented in the coming years as the development of AVs continues. These technologies include systems such as automatic emergency braking, pedestrian / bicyclist automatic emergency braking, lane departure warning, lane keeping assist, rear cross traffic alert, rear automatic emergency braking, pedestrian impact protection requirements, rear seatbelt reminders, and occupancy detection and alert systems to prevent child vehicular heatstroke. In fact, many of these current technologies, which will benefit human driven vehicle operations now, are also foundational technologies for AVs. By issuing minimum performance standards requiring these systems in all new vehicles, the NHTSA can meet its mandate to prevent crashes, injuries, and fatalities. In addition, the agency can obtain real-world, on-road data on the performance, and more importantly any shortcomings, of these systems while under the command of human drivers before determining how to modify the FMVSS to accommodate certain AVs.

Meeting the Safety Need

In the Notice, the NHTSA provides what it deems to be “regulatory barriers” using examples from two FMVSS; No. 135 – Light Vehicle Brake Systems and No. 126 – Electronic Stability Control Systems (ESC) for Light Vehicles. The following comments will address these two examples as well as additional concerns regarding proposed modifications to other FMVSS.

FMVSS No. 135; Light Vehicle Brake Systems

In the first example in the Notice, the NHTSA focuses on the language in section 5.3 of the standard which states “[t]he service brakes shall be activated by means of a foot control.”¹⁶ The Agency should be commended for recognizing that the safety need addressed by this FMVSS goes beyond simply providing braking capability, but is achieved when an alert driver “reliably use[s] the service brakes to avoid obstacles.”¹⁷ Thus, any course of action proposed with respect to this FMVSS should ensure that this safety need continues to be met in all vehicles moving forward. Specifically, if the Agency proposes to eliminate the requirement for foot operated controls in AVs, the NHTSA must establish requirements that the autonomous driving system must be able to recognize and respond (through braking) to all foreseeable hazards within the verified operational design domain (ODD). While human drivers can, and do, fail to use their brakes accordingly, it would be inexcusable for the Agency to modify the FMVSS to allow AVs to not meet a requirement to operate on par with the performance of an attentive and engaged human driver.

Other aspects of this FMVSS raise similar issues. These concerns will also be repeated in addressing numerous other FMVSS. Specifically, FMVSS 135 requires certain telltales / indicators to inform the driver of problems with the braking system. In some cases, manufacturers are proposing to meet the requirement by providing warning information to the ADS.¹⁸ However, such an approach could fail to meet the safety need met by FMVSS 135. The

¹⁶ Notice, p. 24438, citing 49 CFR 135 S5.3.1.

¹⁷ Notice, p. 24438.

¹⁸ Notice, p. 24436, citing GM’s Petition.

warning indicators inform a driver that there are issues with the performance of the braking system which could affect the safe operation of the vehicle. Specifically, the safety need of preventing a driver from operating a vehicle with faulty brakes is met by the driver bringing the vehicle to a mechanic for repairs. Should the Agency consider removing the requirements for this visible or audible telltale under the assumption that this information will be provided to the ADS, the NHTSA must establish standards for triggering that warning and set specifications for what actions the ADS should take. Specifications must be developed to ensure that ADS do not ignore the warning and take to the road endangering passengers and other road users when the brakes are in poor condition. While Advocates knows that human drivers can ignore these warnings, it would be unconscionable to allow the deployment of an AV, purportedly being developed to eliminate the human error element, which ignores these warnings.

FMVSS No. 126; Electronic stability control systems for light vehicles

In this second example, the NHTSA focuses on the use of manual controls in the testing specifications of the FMVSS to illustrate how this could be a barrier to the certification of AVs lacking traditional controls. The Agency states in the Notice that “the purpose of [the] 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.”¹⁹ The Agency’s discussion however does not address the different dynamics under which directional control could be lost in a vehicle operated by an ADS using mechanical actuators as compared to the dynamics under human operation using traditional controls. The current testing specifications were developed to confirm the operation of the ESC system under conditions meant to represent a loss of control incident of a vehicle under the control of a human driver. Specifically, the sine with dwell test used in the standard specifies a maximum turning angle and steering rate which are based, at least partially, on the performance of human drivers under emergency conditions. Any proposal to modify the standard must evaluate and control for the steering angles and steering rates of which an ADS may be capable and the resulting vehicle dynamics. Such research is necessary to ensure that any proposed modification of the standard does not allow for the increase of risk due to these new performance capabilities. It may be that the Agency must evaluate each ADS and test it at the limits of its individual capability (as limited by its technology or ODD) or that limits on steering angle and/ or steering rate are necessary to prevent the system from inducing vehicle dynamics beyond the control of ESC systems confirmed by the standard testing. Regardless of the solution identified, the safety need addressed by the standard must be maintained.

Additionally (and similar to concerns with the first example), the ESC standard requires a telltale for the driver. Again, proposals that AVs could meet this standard by providing the warning to the ADS are fraught with serious safety concerns including whether this meets the safety need of a driver having the vehicle repaired before going back out on the road with a faulty ESC system. The Agency must take into account all aspects of meeting the safety need of each FMVSS prior to adopting changes to accommodate a particular industry design.

¹⁹ Notice, p. 24439; citing 49 CFR 571.126 S2.

The NHTSA states in the current notice that “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.”²⁰ As the Agency stated previously in the Notice:

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 FMVSS. Thus, it is a manufacturer’s design...that could complicate the compliance of the vehicle to the existing FMVSSs.²¹

In light of this, while research and development of alternative solutions are welcome, stating that there is a “need” for a nearer-term solution appears overly eager. Being unable to verify compliance with standards which meet a safety need simply for the sake of design is a woefully inadequate justification for drastically revising a FMVSS that is critical to ensuring public safety on our Nation’s roads.

Other FMVSS Concerns

The following is a list of examples of concerns with proposed or possible modifications of other FMVSS. This list is by no means exhaustive but is provided to inform the Agency when evaluating or proposing alternative test procedures to ensure that the Agency considers how those changes in procedure alter the standards’ abilities to meet the safety need.

FMVSS No. 101; Controls and Displays

Before the Agency recommends the removal of any controls, indicators or displays, the potential safety needs met by the information or control offered by these systems must be considered. For example, the current notice mentions the need for an emergency stop (E-stop) function to be made available to test engineers in case “the vehicle experiences a malfunction.”²² Information provided by a number of the telltales, displays and controls covered under this standard may very well warrant a passenger wanting or needing to exercise control of an E-stop. Moreover, the present notice does not include a discussion of the need for an E-stop in any other context other than for testing purposes. This is yet another example of why Advocates is concerned that the emphasis on modifying the existing FMVSS to allow autonomously driven vehicles on the road is eclipsing the very real and essential need for even the most basic performance requirements for these vehicles, such as an E-Stop available to all passengers, including those with cross disabilities, to address malfunctions.

²⁰ Notice, p. 24439.

²¹ Notice, p. 24435.

²² Notice, p. 24443.

FMVSS No. 102; Transmission Shift Position Sequence, Starter Interlock, and Transmission Braking Effect

FMVSS 102 specifies the relative positions of shift positions (Neutral between Forward and Reverse), the orientation of those positions, starter interlock requirements and display of shift positions. As with other FMVSSs, there are foreseeable situations where passengers would benefit from knowing the current state of the transmission. For example, when preparing to exit the vehicle, passengers need to know that the vehicle is in park. There are a number of other possible situations where the specifications of this FMVSS would provide additional benefits or may need to be reconsidered and updated to address autonomously driven vehicles. The Agency should consider whether the specification of the neutral position being located between the forward and reverse gears is not only necessary for an autonomously driven vehicle but also if additional requirements govern the conditions under which these shift positions can be commanded by the ADS. For example, allowing an autonomously driven vehicle to shift into reverse and begin movement prior to occupants being seated, let alone properly restrained, could increase the risk of injury to occupants even without an impact occurring.

FMVSS No. 103; Windshield Defrosting and Defogging Systems
FMVSS No. 104; Windshield Wiping and Washing Systems

While Advocates is unaware of any specific statements regarding the incompatibility of FMVSSs 103 and 104 with the introduction of ADS, the Agency may need to examine the requirements for the clear view of cameras [or other sensors which could be obstructed] used by ADS. For those ADS seeking to rely on cameras alone or in conjunction with other sensors to ensure their safe operation, the Agency may need to establish requirements to deal not only with condensation but also many other types of fouling. Moreover, the Agency will likely need to establish self-check requirements for such systems to ensure that vehicles relying on these systems do not enter traffic unless the system can confirm that the sensors are capable of providing the performance necessary to ensure safety.

FMVSS No. 105; Hydraulic and Electric Brake Systems

The NHTSA in the Notice highlights two areas of FMVSS 105 which they consider barriers to the introduction of AVs. The first is the reference to a *Brake Power Assist Unit* as it relates to operator effort and muscular force; second is the use of manual controls for testing. Many of the concerns here are identical to those expressed with respect to the example using FMVSS 135 noted earlier in these comments. Automated driving systems should have requirements to identify and respond appropriately to all foreseeable hazards within the verified ODD. The elimination of the brake systems indicator lamp is once again misguided as the information could be of a substantial safety interest to passengers. Moreover, regulations specifying how an ADS must identify failures or degradation in the brake system and respond to prevent risk should be established.

FMVSS 108; Lamps, Reflective Devices, and Associated Equipment

In the current Notice the NHTSA cites the hazard warning operating unit, the beam switching device and the turn signal operating unit in FMVSS 108 as additional potential barriers for the introduction of AVs. In all three cases, the Agency notes that the included language requires a manual control or specifies the use of a manual control for testing. As with other telltales, indicators, displays or controls, if the Agency removes the requirement, passengers, including people with cross disabilities, must have access to an accessible manual control for turning on the hazard warning signal. Similar to the discussion about the necessity for an E-Stop, there certainly could be times when a passenger would want to signal to other drivers and road users that the vehicle is experiencing a malfunction and assistance is required. Additionally, the Agency should evaluate and establish the requirements for the operation of hazard warning signals, beam switching devices and turn signals when under the control of the automated driving system. For example, presently no FMVSS requires the use of turn signals for human driven vehicles, let alone AVs. Similarly, no FMVSS specifies when the hazard warning signals must turn on. While some of these requirements may overlap with state level laws regarding operation of the vehicle, the NHTSA should evaluate the risks associated with the failure to warn other drivers and road users through the use of hazard signals or turn signals and establish requirements for their operation when under the control of an ADS. Moreover, this need to warn or alert other road users such as pedestrian and bicyclists will not be eliminated even if the entire fleet of vehicles becomes autonomous.

Another aspect of headlamps, turn signals and other lighting which bears discussion is the effectiveness of these lights. The Insurance Institute for Highway Safety (IIHS) has evaluated numerous vehicles and found many of them lacking from a visibility standpoint.²³ Advocates continues to support an update of the lighting regulatory requirements given improvements in technology since its first promulgation. Headlamps and beam switching have been mentioned in at least one pending petition for exemption from the FMVSS for an AV.²⁴ The NHTSA should not eliminate or modify these requirements without first considering the other benefits of these devices. Headlamps not only benefit the driver but also assist other road users. Moreover, lighting requirements may need to be reconsidered, especially for those ADS which will rely partially or completely on cameras for execution of the driving task.

FMVSS No. 111; Rear Visibility

While the rear visibility standard is mentioned only in passing in the Notice, Advocates reiterates here the comments provided to the Agency on the recent GM petition. The questions surrounding the proposed modification to FMVSS 111 illustrate the dangers of revising regulations without assurance that the safety need will continue to be met.

²³ Headlights, IIHS, available at <https://www.iihs.org/topics/headlights>, last accessed Aug. 28, 2019.

²⁴ General Motors, LLC – Petition for Exemption, Jan. 11, 2018, NHTSA-2019-0016-0002.

The safety need addressed by the requirements of FMVSS 111 are not only that the driver (or ADS in this case) be provided a clear and reasonably unobstructed view to the rear but also that the driver or ADS react and not collide with or run over the objects in that view. This requirement is essential to the effectiveness of the FMVSS 111 final rule for rear visibility systems. The final rule itself quantifies the annual benefits based on the analysis presented in the final regulatory impact analysis in which it notes that:

...three conditions must be met for a technology to successfully provide a benefit to the driver.

- 1) The crash must be one which is “avoidable” with the device. In other words, the pedestrian must be within the target range for the sensor, or the viewable area of the camera or mirror (at a point in time early enough so as to enable the system and driver to react appropriately to avoid the crash).
- 2) Once the pedestrian is within the system’s range, the device must actually detect and provide the driver with information regarding the presence of the pedestrian.
- 3) The driver must both perceive this information and respond appropriately before impact with the pedestrian.²⁵

In short, systems which fail to detect pedestrians in the field of view and cause the driver to perceive this information and respond appropriately before impact (e.g. apply the service brake) would fail to meet the safety need.²⁶

Regulations must be promulgated requiring AVs to detect and respond appropriately (namely braking) to objects in or entering the area behind the vehicle. A failure to create such a rule would not meet the safety need addressed by the current regulation and could increase the risk of backover crashes with these vehicles.

Advocates concurs with the Agency’s statement in the Notice that “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 safety benefits must be considered in evaluating their continued necessity on an ADS-DV without traditional human controls.”²⁷ Modifications of existing regulatory standards cannot be limited to the letter of the regulation alone. The Agency must

²⁵ Federal Motor Vehicle Safety Standards; Rear Visibility, Final Rule, 79 FR 19178, Apr. 7, 2017, NHTSA-2010-0162, citing U.S. DOT/NHTSA – Final Regulatory Impact Analysis – Backover Crash Avoidance Technologies FMVSS N. 111, NHTSA-2010-0162-0255.

²⁶ 49 USC 30111 (a), Standards.

²⁷ Notice, p. 24435.

consider not only the safety need met by the standard in its promulgation, but also those additional safety benefits which have arisen over time and become essential.

FMVSS No. 114; Theft Protection and Rollaway Prevention

While the present Notice focuses on the reference to a parking brake and the requirement that the service brake be depressed, additional questions have arisen from the recent GM petition.²⁸ As noted earlier in these comments when discussing FMVSS 102, the Agency must undertake further consideration of any modifications to the present rule and the necessity to establish regulations governing when an AV can and should shift from park and undertake forward or rearward motion. For example, while the present rule was conceived to deal with the rollaway events as it occurs at the hand of a human operator, the regulation does not consider the potential for rollaway in the context of an inappropriate or non-commanded motion from an AV, with or without a malfunction. As with many of the FMVSS discussed herein, ensuring the safety need addressed by the rule is still maintained after any modifications is necessary to prevent an increase in risk associated with the introduction of AVs.

FMVSS No. 118; Power-operated Windows, Partition, and Roof Panel Systems

While not discussed in the present notice, it must be noted that while the requirements of FMVSS 118 may not pose a barrier to the introduction of AVs, consideration must be given to the changes in use presented by AVs and the presence of new and possibly increased risks associated with the use of AVs. Some of these vehicles may only transport younger passengers not subject to the supervision of an adult. As such, the NHTSA must consider if the regulations regarding automatic reversal systems to protect young occupants need to be strengthened to deal with the possible risks posed by the change in occupant population resulting from the introduction of AVs.

FMVSS No. 121; Air Brake Systems

The Agency indicates that descriptions of controls and specifications of the use of manual controls in the test procedure in FMVSS 121 are potential barriers to the introduction of AVs. The comments provided earlier with respect to FMVSSs 105 and 135 would largely apply to this FMVSS as well. The safety need of any of the brake standards are only met when the driver, or in the proposed case the ADS, can recognize and respond to foreseeable hazards within the verified ODD. Moreover, with the additional components, gauges, and warning signals associated with air brake systems, the Agency needs to establish the boundaries for operation outside of which the AV cannot operate in order to avoid an increase in needless risk to the public. For example, such boundaries could include limits on pressure ranges, anti-lock braking system (ABS) malfunctions, and brake adjustment and condition. Establishing the safe ranges for operation will be

²⁸ GM Petition, p. 27.

necessary to ensure that an AV in an unsafe condition cannot travel on public roads until repaired.

FMVSS No. 124; Accelerator Control Systems

While not mentioned in the present notice, FMVSS 124 was included in the recent GM Petition.²⁹ FMVSS 124 governs the return to idle of the throttle under a removal of actuating force or in event of severance or disconnection of the control system. The Agency must consider the need for more stringent and modified requirements to specifically apply to AVs. As noted elsewhere in these comments, as AVs are introduced the population of occupants carried in the vehicle, let alone the presence of a licensed individual, may change. It will be even more important to prevent a stuck throttle or other possible source of unintended acceleration when the driving of the vehicle is handed over to the ADS and passengers are further removed from the act of control of the vehicle. This situation also applies to the earlier discussion about the need for a regulation requiring an emergency stop function, not just for test engineers, but for all occupants to enable them to command a stop should a dangerous malfunction occur.

FMVSS No. 125; Warning Devices

FMVSS 125 governs the design and performance of warning devices used to alert traffic of the presence of a stopped vehicle. The safety need of this FMVSS is only met when drivers or other occupants are able to deploy these devices in the appropriate situations. As noted throughout these comments, the introduction of AVs may lead to substantial changes in the occupant population. In situations where an occupant may not be present in the vehicle or may be unable to access and place the warning device, the safety need addressed by FMVSS 125 may not be met. The Agency must establish what warning systems will be necessary to ensure the safety of occupants of AVs, including people with cross disabilities, should they experience a malfunction or other breakdown and end up stopped on the side of the road, let alone in the path of traffic.

FMVSS No. 136; Electronic Stability Control Systems for Heavy Vehicles

As noted earlier in discussing FMVSS 126, the Agency must address the possibility that machine control of steering, braking and acceleration could induce dynamics to the vehicle which could cause loss of control. Such a situation may not be addressed by the test maneuver required by FMVSS 136 which is based on human steering capability.

FMVSS No. 138; Tire Pressure Monitoring Systems

FMVSS 138 presents another example of how the underlying safety need of the regulation may not be met by the proposed modifications. The benefits of a tire pressure

²⁹*Id.*

monitoring system are that an informed driver will take a vehicle for service to ensure that the tires are safe and properly inflated before continuing to drive a vehicle. Proposals that would allow the AVs to meet this standard by simply informing the ADS that tire pressures are low fails to meet the safety need of the current regulation. Any revision to FMVSS 138 should require that the AV cease operations and immediately be serviced to ensure the tires are in proper working condition.

A second aspect of FMVSS 138 (which likely applies to all the other FMVSSs discussed in these comments) is that in many cases, the FMVSS only applies to limited cross sections of the vehicle fleet. As AVs covering the spectrum of possible vehicles (including trucks, busses, and passenger cars) have been considered and discussed by the U.S. DOT, the Agency must consider if regulations like FMVSS 138 need to be applied to AVs of all kinds.

Possible Approaches To Revising Crash Avoidance Test Procedures

The NHTSA envisions four options for revising test procedures to verify compliance with regulations including:

1. Conducting the test under the AV's normal operation;
2. The AV would have a test mode pre-programmed;
3. The AV could be put into test mode and controlled by an external controller;
4. Simulation;
5. Technical documentation;
6. Use of a surrogate vehicle with human controls.

The current testing regime whereby the Agency purchases a vehicle from a dealer lot and conducts testing to confirm compliance with the FMVSS is essential to ensuring public safety and should continue. However, the introduction of AVs may require consideration of other additional compliance verification methods. The NHTSA should establish functional safety standards, safety of the intended function standards, as well as additional standards to require safe operation within the ODD, limitation of operations to only a specified ODD, appropriate responses to all foreseeable hazards, and fail safe and fail operational modes to deal with malfunctions of various types. The Agency must develop regulations for automated driving systems which address scenarios and situations which could increase risk in ways not considered in traditional vehicles and not addressed by existing rules.

The following are Advocates' comments on each of the proposed compliance testing options proposed by the Agency.

Normal Automated Vehicle Operation

The normal operation option most closely mimics that presently undertaken by the NHTSA when evaluating compliance with the FMVSS. In this option, the Agency would purchase a vehicle from a dealer lot and conduct compliance verification testing. As the Agency states in the notice, this may be complicated by the limitations of the ODD of the ADS which may not include maneuvers specified in the tests or the locations or scenarios depicted in the testing grounds. Furthermore, the vehicle itself may not include the controls necessary for conducting the test. However, for example, not having a brake pedal to enable testing should not absolve the vehicle from the requirements under the FMVSS. In order to meet the safety need, the Agency should specify additional requirements for AVs rather than modifying regulations or issuing exemptions on the basis of conflicts with testing protocols.

Test Mode With Pre-Programmed Execution (TMPE)

In this alternative testing regime, manufacturers would program a test mode into the AV which would allow the test engineer to either run pre-programmed tests, or to run those tests with some control over parameters. This scenario presents significant concerns especially given the recent scandal and recall of Volkswagen vehicles after software designs to circumvent emissions standards was discovered.³⁰ Recent studies of belt positioning in US New Car Assessment Program testing in which manufacturer selection of an elevated D-ring position resulted in lower than expected injury estimates is another example of how manufacturer control over testing protocol specifications could end in misleading results.³¹ The opportunities for manufacturers to optimize performance and evade the compliance tests under this option are very real. As such, this option should not be considered.

Test Mode With External Control

Similar to the previous option, this testing option would require vehicles to be manufactured with a test mode. However, the test mode would be one in which an external controller could be used to control actions which would traditionally be completed by a human driver. As the NHTSA states in the notice, such capability would likely be necessary for small local movements such as in dealer lots or for maintenance and as such would be a capability already available. The Agency cautions that allowing this kind of access could raise cybersecurity concerns. Presently there are no regulatory requirements for cybersecurity. Introducing compliance testing options which could increase cybersecurity concerns in the absence of regulatory requirements could also increase risk for passengers and those sharing the roads with AVs. In the absence of strong cybersecurity requirements and standards to ensure that manufacturers cannot

³⁰ Volkswagen: The Scandal Explained, Hotten, R., BBC News, Dec. 10, 2015.

³¹ Application of Multiple Rib Gages to Improve Chest Injury measurements, Digges, K; Dalmotas, D., Prasad, P., 26th ESV, Paper Number 19-0266.

manipulate the test mode, even with a remote controller, this testing option is similarly suspect.

Simulation

Under this option, simulation based compliance verification software or hardware-in-the-loop evaluations would be used to verify compliance as opposed to traditional physical testing. The NHTSA rightfully identifies that accuracy of the simulation would be critical to determining the validity of any results using this method.³² As the Agency further correctly notes, while simulation may play a role in the process of certification, that physical testing would likely still, as it has in the past, be a better arbiter of performance and ensuring that systems modeled in a simulation perform as expected on the road.³³ As with concerns regarding pre-programmed test methods, allowing certification using simulation alone could present a situation in which manufacturers present idealized performance which does not reflect the performance of a production vehicle. As such, unless the Agency envisions having the time, funding and expertise necessary to confirm the validity of a simulation to the level necessary to provide confidence on par with on-road testing, simulation alone is not an appropriate avenue to confirm compliance.

Technical Documentation for System Design and/or Performance Approach

In this option, manufacturers would provide the NHTSA with vehicle-specific technical design and/or build documentation which would be used for assessment of compliance. Once again, the Agency correctly states that it “believes it is important to buy and test new vehicles as produced and sold.”³⁴ Any compliance verification method that would effectively require the Agency to take a manufacturer at their word that the vehicle would perform as specified in the documentation is fatally flawed and woefully insufficient to protect public safety. Years of defects and recalls have illustrated how even well thought out design can run afoul of compliance, sometimes with deadly and tragic results. While documentation would serve to inform the Agency and may be able to supplement a compliance verification process, Advocates does not support the use of documentation alone.

Use of Surrogate Vehicle With Human Controls

In this method, compliance would be verified through testing of a surrogate vehicle, identical to the AV, equipped with traditional controls to enable testing. Such an option presents significant concerns that it could lead to oversight of risks introduced by the operation of the vehicle by the ADS as opposed to a human driver. As noted in the comments on the example of ESC testing under FMVSS 126, the control of steering, braking and acceleration by actuators controlled by

³² Notice, p. 24444.

³³ *Id.*

³⁴ Notice, p. 24446.

the ADS may introduce vehicle dynamics and loss of control scenarios not contemplated in the original rulemaking and not addressed by the tests conducted using a human driver or based on human driver limitations.

Conclusion

Advocates has serious and significant concerns, as relayed in the comments above related to individual FMVSS, that the safety need addressed by a given FMVSS may no longer be met by modification of existing regulatory language. Instead, the agency should be currently developing regulations specifically to address complications which may arise as a direct result of ceding control of the vehicle over to an ADS. Similarly, rushing to permit any compliance alternatives which do not confirm the level of safety performance identified by traditional evaluations methods and established regulatory requirements and test protocols simply for the convenience of vehicle design choices is misguided and ill-advised and will likely result in a considerable and needless threat to public safety. While an alternative or modified compliance verification may be needed for AVs, NHTSA correctly asserts that physical testing is necessary to ensure compliance and identify defects not captured in simulation or technical documentation. While the new methods or even a combination of methods may be the necessary approach, any compliance verification scheme must ensure that an AV complies with regulations and continues to meet the safety need while achieving a level of confidence in the results on par with that provided by current physical testing of human driven vehicles.



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FOR HIGHWAY
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DOT Docket No. NHTSA-2019-0016

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**General Motors, LLC – Receipt of Petition for Temporary Exemption
From Various Requirements of the Safety Standards
for an All-Electric Vehicle With an Automated Driving System
Notice of receipt of petition for temporary exemption; request for public comment
84 Federal Register 10182, March 19, 2019**

Advocates for Highway and Auto Safety (Advocates) files these comments in response to the National Highway Traffic Safety Administration's (NHTSA, Agency) notice of receipt of a petition for temporary exemption (Petition) and request for public comment from General Motors, LLC (GM).¹ Advocates opposes the granting of the petition as it fails to meet the statutory requirements for petitions for exemption from the Federal Motor Vehicle Safety Standards (FMVSS). Granting this petition would enable GM to place vehicles which fail to meet the safety needs addressed by the FMVSS into commerce and onto U.S. roads.

Evaluating Safety in a Petition for Exemption Under the Safety Act

A motor vehicle safety standard is by definition “a minimum standard for motor vehicle or motor vehicle equipment performance.”² These standards must be “practicable, meet the need for motor vehicle safety, and be stated in objective terms.”³ In light of these guiding principles, consideration of any exemption from a FMVSS should be examined closely and evaluated with the understanding that these standards specify only the minimum level of protection required for the motoring public. Any exemption which does not ensure that the safety need met by an FMVSS is addressed exposes the public to unreasonable risks of crashes, injuries or death.

The requirements for applications for exemption are specified clearly in the U.S. Code (USC) and the corresponding Code of Federal Regulations (CFR). In the case of the present petition, GM is applying for exemption under two different bases, that “the exemption would make easier

¹ General Motors, LLC – Receipt of Petition for Temporary Exemption From Various Requirements of the Safety Standards for an All-Electric Vehicle With an Automated Driving System, NHTSA, 84 FR 10182, March, 19, 2019, NHTSA-2019-0016. (Notice)

² 49 USC 30102 (a)(10), Definitions.

³ 49 USC 30111 (a), Standards.

the development or field evaluation of a new motor vehicle safety feature providing a safety level at least equal to the safety level of the standard”⁴, and/or that “the exemption would make the development or field evaluation of a low-emission motor vehicle easier and would not unreasonably lower the safety level of that vehicle”.⁵ In either case, the USC enumerates the contents of the application. Under the basis of developing or evaluating a new safety feature, the application must include “a record of the research, development, and testing establishing the innovative nature of the safety feature and a detailed analysis establishing that the safety level of the feature at least equals the safety level of the standard.”⁶ Under the exemption basis of developing or evaluating a low-emission vehicle, the application must include “a record of the research, development, and testing establishing . . . that the safety level of the vehicle is not lowered unreasonably by exemption from the standards.”⁷

Likewise, the enabling regulations specify what information is required in applications for exemption under the different bases. For exemptions on the basis that the exemption would “make easier the development or field evaluation of a new motor vehicle or safety impact protection features providing a safety or impact protection level at least equal to that of the standard”⁸, the application must include:

- (1) A description of the safety or impact protection features, and research, development, and testing documentation establishing the innovational nature of such features.
- (2) An analysis establishing that the level of safety or impact protection of the feature is equivalent to or exceeds the level of safety or impact protection established in the standard from which exemption is sought, including –
 - (i) A detailed description of how a vehicle equipped with the safety or impact protection feature differs from one that complies with the standard;
 - (ii) If applicant is presently manufacturing a vehicle conforming to the standard, the results of tests conducted to substantiate certification to the standard; and
 - (iii) The results of tests conducted on the safety or impact protection feature that demonstrates performance which meets or exceeds the requirements of the standard.⁹

Similarly, if the exemption is on the basis “that the exemption would make the development or field evaluation of a low-emission vehicle easier and would not unreasonably lower the safety or impact protection level of that vehicle”¹⁰ the application must include:

- (2) Research, development, and testing documentation establishing that a temporary exemption would not unreasonably degrade the safety or impact protection of the vehicle, including –

⁴ 49 USC 30113 (b)(3)(B)(ii).

⁵ 49 USC 30113 (b)(3)(B)(iii).

⁶ 49 USC 30113 (c)(2).

⁷ 49 USC 30113 (c)(3).

⁸ 49 CFR 555.6 (b).

⁹ 49 CFR 555.6 (b)(1-2).

¹⁰ 49 CFR 555.6 (c).

- (i) A detailed description of how the motor vehicle equipped with the low emission engine would, if exempted, differ from one that complies with the standard;
- (ii) If the applicant is presently manufacturing a vehicle conforming to the standard, the results of tests conducted to substantiate certification to the standard;
- (iii) The results of any tests conducted on the vehicle that demonstrate its failure to meet the standard, expressed as comparative performance levels; and
- (iv) Reasons why the failure to meet the standard does not unreasonably degrade the safety or impact protection of the vehicle.¹¹

Both the USC and the underlying CFR regulations specify strict requirements for documentation and analysis of the proposed exemptions, regardless of the basis on which the exemption is predicated. The petition submitted by GM fails to meet these requirements.

GM devotes several pages attempting to define how the NHTSA should evaluate their petition. However, the USC and the CFR clearly define how petitions for exemption should be considered and specifies that applications must be detailed and contain documentation supporting claims that an equivalent level of safety has been achieved or the safety levels have not been unreasonably lowered. This includes documentation of research, analysis and testing far beyond simple assertions not based in fact.

Despite GM's insistence in the application, defect investigations and remedies available to the Agency are in no way comparative to strong government oversight and regulation which are necessary to prevent dangerous and deadly defects from being allowed on U.S. roads. For example, the 2014 GM ignition switch recall involved more than 2 million vehicles with model years ranging as far back as 2003. The length and expanse of this recall demonstrates how ineffective the recall process is at addressing unreasonably risky products in a timely fashion, let alone before serious injuries and fatalities have been sustained.¹² Similar examples may be found in the Takata airbag fiasco and many other previous safety recalls. While NHTSA's recall authority certainly is important, it is no substitute for strong effective regulations that establish a minimum level of safety required of vehicles on our roads.

The arguments put forth by GM opposing the promulgation of standards for automated driving systems (ADS) are gratuitous and without merit. First, as this is a petition for exemption from existing safety standards, it is the inappropriate venue to discuss the promulgation of new standards. If GM is in fact only seeking an exemption, and the vehicle "meets the safety purposes and objectives of all applicable FMVSS",¹³ then a discussion of new standards in the petition is not needed. Second, GM reiterates the argument that in the absence of a standard, "the Safety Act's requirement that manufacturers avoid putting a motor vehicle into commerce that creates an unreasonable risk to motor vehicle safety (and the corollary obligation to remedy safety-related defects) maintains motor vehicle safety."¹⁴ As previously noted, if this aspect of

¹¹ 49 CFR 555.6 (c) (1-2).

¹² NHTSA Campaign Number 14V047000, Ignition Switch May Turn Off.

¹³ Petition, p. 3.

¹⁴ Petition, p. 18

the Safety Act were alone effective, then the American public would not have been faced with the over 600 million vehicles that have been subject to a safety recall since 1997 nor would there be a need for FMVSS.¹⁵

Finally, GM states that the introduction of new technologies follows a pattern in which “after robust testing and validation, manufacturers introduce new vehicle technologies into commerce”.¹⁶ If GM has followed this “familiar paradigm”¹⁷ then there should be more than adequate documentation and an analysis accompanying the petition illustrating the robust testing and validation GM has undertaken to ensure they are not introducing dangerous vehicles onto American roads. However, a cursory review of the petition and the lack of additional documentation in the present docket demonstrate that this is not the case.

Basis For Exemption

GM notes in their Petition¹⁸ that they are applying on two independent bases, first that the exemption will make the development or field evaluation of a low-emission motor vehicle easier and would not unreasonably lower the safety level of that vehicle, and second, that the exemption would make easier the development or field evaluation of a new motor vehicle safety feature providing a safety level at least equal to the safety level of the standard.¹⁹

GM’s attempt to justify the exemption under the basis of making easier the development and field evaluation of a low emission vehicle is meritless. The Petition notes that the proposed vehicle would largely be based on an existing vehicle, the Bolt, which is already an all-electric vehicle. GM further notes that they have been testing these vehicles since June of 2016 in multiple locations and now have more of 50 of them on the road. Despite this admission, GM is now claiming that exemptions from a multitude of safety standards are necessary. The Petition contains no supporting data from these nearly three years of research to support any claim that safety exemptions are needed to support the development or field evaluation of the propulsion systems of these vehicles. The GM vehicle is not new in terms of propulsion or other technology related to emissions. Therefore, granting these exemptions on this basis is not warranted.

FMVSS Specific Responses

The following are Advocates’ comments on GM’s description of the exemption being sought for each specific FMVSS. GM mentions select portions of each FMVSS which its proposed vehicle would not comply with, at times claiming that the regulations would not apply to their vehicle. The NHTSA should review these claims to clarify that all FMVSS are applicable to these vehicles and that exemptions are thus required. Again, the statutory and regulatory requirements

¹⁵ NHTSA, All Recalls by Year (Jan. 18, 2018).

¹⁶ Petition, p. 18.

¹⁷ Petition, p. 18.

¹⁸ General Motors, LLC – Petition for Exemption, January 11, 2018, NHTSA-2019-0016-0002. (GM Petition).

¹⁹ Petition, p. 5-6.

specify that the manufacturer must provide documentation and analysis of their systems performance to illustrate compliance or comparative non-compliance with the requirements.

FMVSS 101: Control and Displays

The Petition indicates that the proposed vehicle “will not be equipped with most of the human-operated controls in the tables and will not have a human driver, so the location, visibility, symbols, color and illumination requirements for controls, telltales, and indicators meant for a human driver, as written, do not apply.”²⁰ This puzzling statement begs the question as to why GM would require an exemption from a standard that the company claims does not apply to its vehicle. As noted in other sections below, GM has not provided analysis of which telltales might provide insight to passengers and what affect that could have on their safety. Moreover, while GM has stated what the response of the ADS should be in reaction to the conditions triggering the different telltales, no test or evaluation data has been provided to prove that the vehicle will in fact take the steps described.

For example, in response to a brake system malfunction, GM states that the ADS would enter “Response State 3”²¹ which means the ADS would “[g]radually slow the vehicle to a stop while steering to a safe location at the side of the road. Engage ‘park.’ Activate hazard flashers.”²² However, no testing or evaluation has been provided showing that on a test vehicle, when a brake system malfunction is introduced, the vehicle will actually execute this maneuver. Moreover, no analysis has been provided to show the specifics of the maneuver indicated by “Response State 3” would be performed safely. If, as GM noted, this system is being introduced only after “robust testing and validation” then such testing, documentation, and analysis surely must be available for review. The NHTSA should evaluate the information conveyed to passengers as well as drivers by the telltales to determine whether exemptions from requiring their display could reduce safety by leaving passengers uninformed as to the operational status of the vehicle. While the FMVSS speak of informing drivers, the safety need is met by the driver taking an action in response to the warning (pulling the vehicle over, stopping, etc.). In the case of an ADS, it could be beneficial that in the absence of a driver to relay this information to the passengers that the information should be conveyed to the passengers. Moreover, in each case, GM has provided only claims (with no testing or verification) that the ADS is being provided the correct signals to trigger the response states claimed. Again, petitions for exemption are required to have documentation, testing, and analysis to confirm the performance of the proposed exempt systems to ensure that levels of safety are equivalent and are still providing overall protection against unreasonable risks.

FMVSS 111: Rearview Visibility

²⁰ Petition, p. 23-24.

²¹ Petition, p. AII-18.

²² Petition, p. AII-12.

GM claims that the rear facing sensor suite “which provides information to the ADS from its unobstructed sensor view to the rear of the vehicle”²³ meets the safety purpose of the mirror and rear camera display requirements of FMVSS 111. The safety need addressed by the requirements of FMVSS 111 are not only that the driver (or ADS in this case) be provided a clear and reasonably unobstructed view to the rear but also that the driver or ADS react and not collide with or run over the objects in that view. This requirement is essential to the effectiveness of the FMVSS 111 final rule for rear visibility systems. The final rule itself quantifies the annual benefits based on the analysis presented in the final regulatory impact analysis in which it notes that:

...three conditions must be met for a technology to successfully provide a benefit to the driver.

- 1) The crash must be one which is “avoidable” with the device. In other words, the pedestrian must be within the target range for the sensor, or the viewable area of the camera or mirror (at a point in time early enough so as to enable the system and driver to react appropriately to avoid the crash).
- 2) Once the pedestrian is within the system’s range, the device must actually detect and provide the driver with information regarding the presence of the pedestrian.
- 3) The driver must both perceive this information and respond appropriately before impact with the pedestrian.²⁴

In short, systems which fail to detect pedestrians in the field of view and cause the driver to perceive this information and respond appropriately before impact (e.g. apply the service brake) would fail to meet the safety need.²⁵ GM should be required to provide proof that their ADS will not only be provided sensor information regarding objects in the path of travel behind the vehicles, but should also prove that it can avoid the collisions in the same manner and with an equivalent or better effectiveness than those systems required by FMVSS 111.

FMVSS 114 Theft Protection and Rollaway Prevention

GM claims that the descriptions provided in an appendix to the petition illustrate that the system will comply with the requirements of FMVSS 114. However, descriptions and claims are far from an equivalent of documentation of testing and analysis.

FMVSS 124 Accelerator Control Systems

²³ Petition, p. 26

²⁴ Federal Motor Vehicle Safety Standards; Rear Visibility, Final Rule, 79 FR 19178, Apr. 7, 2017, NHTSA-2010-0162, citing U.S. DOT/NHTSA – Final Regulatory Impact Analysis – Backover Crash Avoidance Technologies FMVSS N. 111, NHTSA-2010-0162-0255.

²⁵ 49 USC 30111 (a), Standards.

GM claims that the descriptions provided in an appendix to the petition illustrate that the system will comply with the requirements of FMVSS 124. However, descriptions are far from an equivalent of documentation of testing and analysis. While GM does mention that the system has validity checks, and fail-safe operational power and communication, evidence of the robust testing and validation of a traditional development paradigm, as described by GM elsewhere in the petition should be provided.

FMVSS 126 Electronic Stability Control (ESC) Systems

GM claims that the vehicle will be equipped with an ESC system that is “functionally similar to that on the Chevrolet Bolt EV” and that they “will run tests to ascertain the full functionality of the ESC system for the ZEAV [zero-emission autonomous vehicle] before the first deployment of the vehicles”.²⁶ In the appendix, GM notes that the “steering controllers have safe rate limits”.²⁷ Also in the appendix, GM notes that in order to test the ESC of the proposed vehicles, a test ZAEV with human control will be used to perform the test.²⁸ However, the petition fails to include a description of the “safe rate limits” and the impacts this could have on the effectiveness of ESC when the vehicle is being driven by the ADS and the steering maneuvers are executed by actuators as opposed to a human. FMVSS 126 specifies that the limit of the steering amplitude in the final run of the sine with dwell test is 300 degrees.²⁹ This limit is based on the testing of human driver capabilities.³⁰ Without verification, the ADS, through its actuators, could induce vehicle dynamics beyond the capability of human drivers and not considered in the development of the ESC final rule. Moreover, it is disconcerting that GM notes that they “will run tests...before the first deployment of the vehicle” implying that testing has not been conducted, or speculatively any tests have not been comprehensive enough to instill confidence, and the safe performance of the ESC system under ADS control has not been evaluated or tested.

FMVSS 135 Light Vehicle Brake Systems

GM claims that the description of the ADS and braking system meets the requirements of FMVSS 135. However, as noted in other sections, a description is far short of providing testing, documentation, and analysis. GM states that “the ZEAV will undergo brake testing as described in Appendix II to demonstrate that it meets the performance requirements before GM initiates deployment of the vehicle”. Such a statement implies that this testing has not be a part of the “robust testing and validation” paradigm described by GM elsewhere in the petition.

FMVSS 138 Tire Pressure Monitoring Systems

²⁶ Petition, p. 27.

²⁷ Petition, AII-10.

²⁸ Petition, AII-15.

²⁹ Standard No. 126; Electronic stability control systems for light vehicles, 49 CFR 571.126.

³⁰ Federal Motor Vehicle Safety Standards; Electronic Stability Control Systems; Controls and Displays; Final Rule, 72 CFR 17236, Apr. 6, 2007, NHTSA-2007-27662.

GM claims that its description of the ADS response to a low tire pressure monitor signal satisfies the requirements of FMVSS 138. Yet, GM has provided no documentation proving that the vehicle correctly signals the ADS when the tire pressure is low or that the maneuver described in order to remedy the situation will be executed safely.

FMVSS 208 Occupant Crash Protection

GM claims that the requirements of FMVSS 208 will be met by mirroring the right front passenger's seat protection requirements in the former driver's seat position. In previous sections describing FMVSSs 203, 204, and 207, GM specifically notes "[t]o verify occupant protection, GM began its crash testing with computer simulation tests of the ZEAV with its integrated ADS computer, sensor, and control components. GM has followed these computer simulation tests of the integrated ZEAV, which will establish performance of the entire vehicle, including the ADS and all of its components."³¹ However, there is no information or documentation of these tests or their results provided in the petition. In other sections of petition GM notes that "computer simulation crash tests and subsequent physical crash tests of the integrated ZEAV are planned to validate occupant impact protection in all seating positions, including verifying that the left front seating position safety equipment provides occupant protection comparable to that of the right front passenger".³² This statement again implies that the research, testing and analysis, which is a requirement of the application process, has yet to be conducted.

With respect to seatbelts, GM notes that "[t]he ADS will convey appropriate reminders and warnings to all vehicle occupants to fasten their seatbelts prior to initiating a ride."³³ In the appendix, GM notes that the vehicle:

"will not shift the transmission out of 'Park' unless all of the following conditions are met: The service brake is applied; all vehicle doors are closed; all occupants are buckled or they have dismissed the seat belt warnings using buttons on the in-vehicle tablets; an occupant has activated the "Start Ride" button"³⁴

While requiring all occupants to be properly restrained is not a part of the FMVSS, it raises the question of how GM's vehicle will comply with state laws, some of which require the "driver" of the vehicle to ensure that all or certain occupants are properly restrained.³⁵ Advocates believes that it would be unconscionable for a vehicle employing technologies as advanced as ADS, requiring so many exemptions from FMVSSs, to ever travel without ensuring that all occupants are properly restrained.

FMVSS 214 Side Impact Protection

³¹ Petition, p. 30

³² Petition, p. 30.

³³ Petition, P. 30.

³⁴ Petition, p. AII-14.

³⁵ See MD Transp Code 22-412; Utah Code Title 41 Chapter 6A Part 18; California Vehicle Code Sec. 27315.

As with other FMVSS exemptions, GM notes that they have “started computer simulation crash testing and will perform relevant physical crash tests of the vehicle with its integrated ADS computer, sensor, and control components to verify that occupant protection for the left front seating position is comparable to that for the right front seat passenger.”³⁶ Again, this claim falls far short of the documentation, testing, and analysis which are required by statute and regulation.

Summary of FMVSS Specific Responses

Despite claims by GM that their vehicle meets the safety purposes of the FMVSS from which they seek exemption, this burden has not been met. In many cases, GM has failed to meet the statutory requirements to document the research, development, and testing proving that the proposed system would provide an equivalent level of safety or not unreasonably lower the level of safety addressed by the FMVSS. While GM argues that “robust testing and validation” is part of the “familiar paradigm” before manufacturers introduce new vehicle technologies into commerce, the present petition does not support such claims. In some instances GM clearly indicates that testing has not taken place while in others they mention testing but have provided no documentation for review. As such, GM has failed to meet the statutory and regulatory requirements for a petition of exemption.

Public Interest

GM alleges granting the petition is in the public interest because “[t]he safety advances discussed [in the petition] have the potential to save many lives and reduce motor vehicle crashes and injuries, providing tremendous benefit to the public.”³⁷ However, yet again, GM fails to provide any proof or documentation to support this claim. While removing the human driver may eliminate human driving errors that cause crashes, it does not mean that errors in coding, design, or sensors will not occur. For example, despite the findings of the National Transportation Safety Board (NTSB) that in a 2016 fatal crash of a Tesla, the design of the system contributed to the driver’s overreliance, allowed the vehicle to be operated outside of its operational design domain (ODD), and failed to monitor driver engagement,³⁸ the NTSB is now investigating a nearly identical fatal crash three years later.³⁹

Automated driving systems have been involved in several other crashes also being investigated by the NTSB including a fatal collision with a roadside barrier, and at least one collision with a stopped emergency response vehicle. The fatal crash of an Uber vehicle in 2018 in Tempe, Arizona appears to be a combination of human errors, despite the vehicle being driven by the ADS. In that case, testing officials chose to disable the vehicle’s automatic emergency braking (AEB) system, disable the ADS’s ability to brake and provided no alerts to the operator when

³⁶ Petition, p. 32.

³⁷ Petition, 35.

³⁸ Collision Between a Car Operating With Automated Vehicle Control Systems and a Tractor-Semitrailer Truck Near Williston, Florida, May 7, 2016, NTSB, Accident Report NTSB/HAR-17/02, Sep. 12, 2017.

³⁹ Preliminary Report Highway HWY19FH008, NTSB.

either system identified an object in the path. In addition, the vehicle had only one operator instead of two, requiring the operator to drive the vehicle and monitor the ADS system performance. As such, the driver was forced to look away from the road. These human choices combined with the distracted driving on the part of the operator all likely contributed to the fatal crash of this ADS driven vehicle.

GM also cites the work of Dr. Nidi Kalra and Dr. David Groves of the RAND Corporation, claiming that “[e]very day of delay in getting autonomous vehicles safely on American roads is a day in which we are losing lives that could be saved.”⁴⁰ However, GM appears to have missed a very important part of that research. The benefits of early introduction of AVs noted by Kalra and Groves were predicated on having a vehicle which has some measureable / provable level of safety compared to the average human driver. To date, no ADS manufacturer or developer has produced any evidence that their vehicles is 90 percent, ten percent or even one percent better than the average human driver, let alone as good as the safest human drivers. GM notes elsewhere in the petition that the proposed vehicles will demonstrate a statistical improvement to overall vehicle safety, yet they provide no indication of which measures will be used or what will be considered a statistical improvement. Without demonstrable proof these are nothing more than fanciful claims and cannot be the basis for granting the petition.

Operational Design Domain

Noticeably absent from the petition is any specific definition of the operational design domain (ODD) of the proposed vehicles. While GM mentions that the vehicles will be “weather restricted”⁴¹ and that the “planned deployment aligns” with certain criteria (urban environments, low speeds, etc.), there is no specific definition of where the vehicle will be operated and what will be its limiting conditions. As noted throughout this document, statutory and regulatory language requires research, documentation and testing to prove that the level of safety will be maintained or not unreasonably lowered if the exemption is granted. NHTSA cannot approve an application for an ADS with no specifically defined ODD in which to verify the claims made by GM. Moreover, GM should not be permitted to expand the ODD of the vehicle without filing an additional petition for exemption which must include the necessary documentation and testing to prove that the vehicle will meet the safety requirements in the expanded ODD.

Request for Comments and Information from the NHTSA

The following are responses to specific questions posed by the NHTSA at the end of the notice and not addressed by previous comments.

4. In lieu of either of the two bases relied upon by GM, would it be more appropriate to consider GM’s petition under 49 U.S.C. 30113(b)(3)(B)(iv) (authority to grant exemptions from FMVSS

⁴⁰ Petition, p. 3, citing Nidi Kalra and David G. Groves, *The Enemy of Good, Estimating the Cost of Waiting for Nearly Perfect Automated Vehicles*, Rand Corp. (2017).

⁴¹ Petition, p. 21

for vehicles with an overall safety level at least equal to the overall safety level of nonexempt vehicles low emission vehicles)? If so, why?

GM has specified that they do not intend to sell the proposed vehicles and as such this alternative basis is not appropriate. Likewise, GM claims a number of safety benefits from maintaining control of the vehicles which would be moot if the vehicles were sold and no longer within their control, which would require the NHTSA to reevaluate the petition and consider the impacts of such a different situation.

11. 49 CFR 555.6(b)(iii) requires the petitioner to submit “results of tests conducted on the safety or impact protection features that demonstrates performance which meets or exceeds the requirements of the standard” from which temporary exemption is sought. In the case of a petition submitted for a vehicle that has not yet been produced, and therefore, cannot be tested in order to compare its performance to that of existing vehicles, how should the agency evaluate the safety level of the vehicle? On what preliminary analyses, assumptions, and methodologies should the agency rely to assess whether such performance has been persuasively demonstrated? How would the answers to those questions change if a petitioner could demonstrate that the safety features and systems on the vehicle to be exempted are comparable in performance to those in a non-exempted vehicle and that the addition of the ADS to the vehicle to be exempted did not adversely affect the performance of those safety features and systems?

As GM notes in their petition, “robust testing and validation” before introduction into commerce is a part of the “familiar paradigm” of the introduction of new vehicle technologies. As such, GM or any other manufacturer must be able to provide documentation of research and testing to illustrate compliance or comparative non-compliance with existing FMVSS to be given an exemption. Manufacturers perform research and testing on vehicle designs prior to production with traditional vehicles and the present case should be no different. In those unique cases where testing could absolutely not be performed for a valid reason, the burden is on the manufacturer to produce significant documentation justifying the assumptions and results proposed.

20. In the absence of real-world demonstration of quality of the decision-making by the ZEAV’s ADS, if the petition were to be granted, what terms and conditions, if any, should the agency place on the exemption, and any similar future requests, to protect public safety, facilitate agency efforts to monitor the operations of exempted vehicles, and maximize the learning opportunities presented by the on-road experience of the exempted vehicles during the exemption period and thereafter?

Advocates supports the Agency’s use of the exemption process to increase their understanding of AV operations through the monitoring of operations of exempted vehicles. Requiring data sharing would likewise contribute to this process. At all times however, the public must be protected from unreasonable risks through thorough review of petitions, oversight of vehicle deployment, and verification of compliance with the limitations of the exemption.

22. Please comment on the potential utility of NHTSA's placing terms and conditions on an exemption requiring the submission of the following categories of data...

Advocates supports establishing terms and conditions in the exemption process for the sharing of data with the Agency. As much as possible, the Agency should seek to make this data public and available for review by the public and researchers.

24. If the agency were to require the reporting of data, for what period should the agency require it to be reported—the two-year exemption period or the ZEAVs' entire normal service life?

Data should be reported for the life of the vehicle. While the exemption allows the introduction into commerce for the two years of the period, it does not prohibit the continued use of those vehicles and as such should be subject to reporting and any other requirements.

25. Given estimates that vehicles with high and full driving automation would generate terabytes of data per vehicle per day, how should the need for data be appropriately balanced with the burden on manufacturers of providing and maintaining it and with the ability of the agency to absorb and use it effectively?

The NHTSA should establish data retention requirements for vehicles subject to the exemption and establish requirements for access by NHTSA and any other appropriate agencies, such as NTSB.

26. If supporting information (including analysis, methodology, data, and computer simulation results involving proprietary systems or specialized computer programs) is submitted by a petitioner under a request for confidential treatment and relied upon by the agency in its determination whether to grant or deny a petition, how can the public be provided with an evaluation and a justification for the determination that are transparent, readily understandable and persuasive?

All information submitted to the agency should be made publicly available unless NHTSA determines that it constitutes confidential business information. Determinations by NHTSA regarding whether such information is in fact confidential should start with the premise that information submitted to the agency should be made public.

27. Are there any mechanisms that may help further mitigate the underlying safety risks, if any, presented by this petition? For example, what additional safety and engineering redundancies, if any, should NHTSA consider requiring as a condition to granting the exemption?

While the GM petition and the exemption process generally addresses compliance with existing requirements, the possible failures of the ADS or its components presents a dangerous unknown. While GM mentions system redundancy, among other methods, of

ensuring a fail-safe or fail-operational system, the agency should confirm that these systems exist and will perform as described. The recent Boeing crashes and surrounding controversy are indicative of the catastrophic results that can come from the misclassification of a hazard relating to the failure of a component, or the failure to inform operators about the performance of a system and how to disable same. Advocates has always been supportive of proven safety technology. While the safety benefits of AVs may be realized one day, the occurrence of additional preventable crashes in AVs as they are introduced will undoubtedly have a detrimental impact on consumer acceptance of the technology and potential lives saved and crashes prevented.

Conclusion

Advocates opposes the granting of GM's petition for exemption from a number of the FMVSS as noted in the petition. GM has failed to meet the statutory and regulatory requirements for a petition for exemption and as such the petition must be denied. In a number of cases, GM's constrained interpretation of the FMVSS and failure to account for the safety need met by the regulation would leave the public exposed to unreasonable risk of crashes, injuries and deaths. In light of this petition and the issues raised by it, Advocates once again calls upon the NHTSA to develop FMVSS that apply to automated driving systems to ensure public safety.



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ADVOCATES
FOR HIGHWAY
& AUTO SAFETY

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**Nuro, Inc.; Receipt of Petition for Temporary Exemption
for an Electric Vehicle With an Automated Driving System
Notice of receipt of petition for temporary exemption; request for public comment
84 Federal Register 10172, March 19, 2019**

Advocates for Highway and Auto Safety (Advocates) files these comments in response to the National Highway Traffic Safety Administration's (NHTSA, Agency) notice of receipt of petition for temporary exemption (Petition) and request for public comment from Nuro, Inc. (Nuro).¹ Advocates opposes the granting of the petition as it fails to meet the statutory requirements for petitions for exemption from the Federal Motor Vehicle Safety Standards (FMVSS). Granting this petition would enable Nuro to place vehicles which fail to meet the safety needs addressed by the FMVSS into commerce and onto U.S. roads.

Requirements for Petition for Exemption

Motor vehicle safety standards are by definition “a minimum standard for motor vehicle or motor vehicle equipment performance.”² These standards must be “practicable, meet the need for motor vehicle safety, and be stated in objective terms.”³ In light of these guiding principles, consideration of any exemption from a FMVSS should be examined closely and evaluated with the understanding that these standards require only the minimum level of protection required for the motoring public. Any exemption which does not ensure that the safety need met by an FMVSS is addressed would expose the public to unreasonable risks of crashes, injuries, or death.

The requirements for applications for exemption are specified clearly in the U.S. Code (USC) and the corresponding Code of Federal Regulations (CFR). In the case of the present petition, Nuro is applying for exemption under the basis that “the exemption would make the development or field evaluation of a low-emission motor vehicle easier and would not

¹ Nuro, Inc.; Receipt of Petition for Temporary Exemption for an Electric Vehicle With an Automated Driving System, NHTSA, 84 FR 10172, March, 19, 2019, NHTSA-2019-0017. (Notice)

² 49 USC 30102 (a)(10), Definitions.

³ 49 USC 30111 (a), Standards

unreasonably lower the safety level of that vehicle”.⁴ The USC enumerates the contents of the application. Under the exemption basis of developing or evaluating a low-emission vehicle, the application must include “a record of the research, development, and testing establishing...that the safety level of the vehicle is not lowered unreasonably by exemption from the standards.”⁵

Likewise, the enabling regulations specify what information is required in applications for exemption under the different bases. For exemptions on the basis “that the exemption would make the development or field evaluation of a low-emission vehicle easier and would not unreasonably lower the safety or impact protection level of that vehicle”⁶ the application must include:

- (2) Research, development, and testing documentation establishing that a temporary exemption would not unreasonably degrade the safety or impact protection of the vehicle, including –
 - (i) A detailed description of how the motor vehicle equipped with the low emission engine would, if exempted, differ from one that complies with the standard;
 - (ii) If the applicant is presently manufacturing a vehicle conforming to the standard, the results of tests conducted to substantiate certification to the standard;
 - (iii) The results of any tests conducted on the vehicle that demonstrate its failure to meet the standard, expressed as comparative performance levels; and
 - (iv) Reasons why the failure to meet the standard does not unreasonably degrade the safety or impact protection of the vehicle.⁷

The USC and the CFR clearly define how petitions for exemption should be considered and the statutory and regulatory language which establishes the need to protect the public from unreasonable risk of crashes, injuries, and death. The statutory and regulatory language specifies that applications must be detailed and contain documentation supporting claims that an equivalent level of safety has been achieved or the safety levels have not been unreasonably lowered. This includes documentation of research, analysis and testing. In short, actual proof to support the claims made in the application. The petition submitted by Nuro fails to meet these requirements.

Basis For Exemption

Nuro states in their petition for exemption⁸ that they are applying on the basis that the exemption will make the development or field evaluation of a low-emission motor vehicle easier and would not unreasonably lower the safety level of that vehicle.⁹

⁴ 49 USC 30113 (b)(3)(B)(iii).

⁵ 49 USC 30113 (c)(3)

⁶ 49 CFR 555.6 (c).

⁷ 49 CFR 555.6 (c) (1-2).

⁸ Nuro Inc. – Petition for Exemption, October 19, 2018, NHTSA-2019-0017-0002. (Petition).

⁹ Petition, p. 1.

Nuro's choice to apply for the exemption under the basis of making easier the development and field evaluation of a low emission vehicle raises substantial issues as to whether the application is invalid on its face. The NHTSA notes specifically that a question exists as to whether the Petition is in line with the "original purpose of 30113(b)(3)(B)(iii), which was to encourage the development of vehicles with low-emission propulsion technologies."¹⁰ The NHTSA also includes in the notice an extensive footnote summarizing the history of the statutes giving rise to this exemption basis and notes that "the purpose of the basis was to encourage the development of new vehicle propulsion technologies."¹¹ Advocates agrees with NHTSA's analysis and notes that Nuro has not provided enough detail to identify the proposed vehicle's propulsion system as a new low-emission vehicle propulsion technology. This question is significant as the basis under which the application is made establishes the safety level requirements for vehicles exempted. Exemptions requested under other bases require proof that the vehicle or feature provides a safety level at least equal to the safety level of the standard or nonexempt vehicle.¹²

FMVSS Specific Responses

The following are Advocates' comments on Nuro's description of the exemption being sought by the specific FMVSS.

FMVSS 500 S5(b)(8) [FMVSS 205 Glazing Materials]

The Petition indicates that the proposed vehicle would not require a compliant windshield as the vehicle does not have a driver. In support of this exemption, the Petition states that:

With respect to a windshield conforming to glazing standards in 49 CFR 571.205, Nuro seeks an exemption from this low-speed vehicle mandate on the basis that (1) R2X possesses no operational (driver or passenger) need for a forward windshield to provide the front visibility, passenger ejection, or passenger impact safety benefits intended with this mandate; (2) the inclusion of a compliant windshield (e.g. glass) would introduce avoidable risk in the event of a collision if instead R2X is able to (3) introduce a new and superior safety system designed to minimize the force of any impact, the testing of which would be in the public interest. If exempted, R2X would differ from a vehicle that complies with the standard because it would not have a windshield conforming to glazing standards and would have a new and superior front-end safety system, including rounded contouring, softer materials, and a "crumple zone."¹³

Nuro further states that the vehicle would "have a new and superior front-end system, including rounded contouring, softer materials, and a 'crumple zone'".¹⁴ The statute requires "a record of the research, development, and testing establishing...that the safety level of the vehicle is not

¹⁰ Notice, 84 FR 10181.

¹¹ Notice, 84 FR 10176, footnote 21.

¹² 49 USC 30113(b)(3)(B).

¹³ Petition, p. 10

¹⁴ Petition, p. 10

lowered unreasonably by exemption from the standards”¹⁵ be included in the application. Nuro has not provided any such evidence. This is a serious defect in the application as research has indicated that pedestrians have a 25% risk of severe injury and 10% risk of death when impacted by a vehicle at 23 mph,¹⁶ well within the operational range of the proposed vehicle so Nuro must demonstrate their vehicle design does not increase risk to pedestrians as opposed to traditional vehicles. Given that no specific FMVSS presently exists to ensure that automated driving systems (ADS) do not strike pedestrians and other vulnerable road users, it is incumbent on the NHTSA to ensure that the safety benefits claimed by Nuro are supported by documented research and testing.

FMVSS 500 S6.2 [FMVSS 111: Rearview Visibility]

Nuro claims that the proposed vehicle “has a comprehensive sensing system capable of providing a ‘clear and reasonably unobstructed view’ to the rear of the vehicle.”¹⁷ Nuro further states that “[t]he vehicle also will not reverse if the autonomy system or remote operator detects a person, animal, or object behind the vehicle.”¹⁸ While it is commendable that Nuro recognizes that the driver reaction, in this case applying the brakes and avoiding the collision, is part of meeting the safety need of the FMVSS, the statute and regulations require documentation of research and testing to demonstrate the safety level of the vehicle.

Operational Design Domain

Noticeably absent from the petition is any specific definition of the operational design domain (ODD) of the proposed vehicles. While Nuro mentions that the vehicle is designed for “neighborhood driving” and “pre-mapped surface streets”,¹⁹ no specific definition of where the vehicle will be operated and to what conditions it would be limited is provided. Again, statutory and regulatory language requires research, documentation and testing to prove that the level of safety will be maintained or not unreasonably lowered. NHTSA cannot approve an application for an ADS with no specifically defined ODD in which to verify the claims made by Nuro. Moreover, Nuro cannot be allowed to expand the ODD of the vehicle without filing an additional petition for another exemption which must include the necessary documentation and testing to prove that the vehicle will meet the safety requirements in the expanded ODD.

Advocates opposes the granting of Nuro’s petition for exemption. As discussed, Nuro has failed to meet the statutory and regulatory requirements for petition for exemption and as such the petition must be denied.

¹⁵ 49 USC 30113 (c)(3)

¹⁶ Impact Speed and a Pedestrian’s Risk of Severe Injury or Death, AAA Foundation for Traffic Safety, Sep. 2011.

¹⁷ Petition, p. 12.

¹⁸ Petition, p. 12.

¹⁹ Petition, p. 8.

Request for Comments and Information from the NHTSA

The following are responses to specific questions posed by the NHTSA at the end of the notice and not addressed by previous comments.

4. Independent of the agency's disposition of this petition, NHTSA seeks comment on whether, and if so how, the agency should also consider creating a new vehicle classification category for light and/or low-speed passengerless ADS vehicles like the R2X to which a subset of FMVSS requirements would apply.

Advocates is concerned that manufacturers may see the creation of a light / low-speed passenger-less vehicle as a means of testing ADSs without having to meet all of the FMVSS. In addition, when developing these vehicles manufacturers must consider the overall impact that the operation of these vehicles could have on safety. Regardless of these vehicle not transporting human passengers, they present safety concerns. For example, another vehicle striking an errant low speed ADS driven vehicle weighing up to 3,000 pounds, even at speeds in a "neighborhood environment", could still result in significant risks to other road users.

5. Nuro contends that an exemption is necessary [sic] facilitate the development of and [sic] LEV [low emission vehicle] because it has "exhausted the safety gains that can accrue" from its current testing. Does the petition provide sufficient information to enable the agency to determine whether exempting the vehicle would make the development or field evaluation of a low-emission motor vehicle easier? If not, what additional information should the agency seek prior to rendering its final determination and why?

Advocates is concerned with the implication that the proposed exemptions are being sought for the expansion of testing. This implies that Nuro is unable to prove the safety level of the vehicle under the proposed exemptions and is preparing to use the public as unwitting participants in their experiments. The exemptions being sought are not for testing but are for sale and introduction into commerce and thus their evaluation should be given careful consideration due to the potential impact on public safety. Manufacturers and developers seeking to test unproven vehicles on public roads should be subject to an institutional review board process to ensure that combinations of decisions, such as those made resulting in the Uber crash in Tempe, Arizona that occurred in March 2018, do not result in unreasonable risk to the public.

33. If NHTSA were to grant Nuro's petition, what would be the potential utility of NHTSA's placing terms requiring the submission of the following categories of data?

The NHTSA should establish terms and conditions in the exemption process for the sharing of data with the agency. As much as possible, the agency should seek to make this data public and available for review by the public and researchers. If rapid improvement on on-road safety is the true intent of the introduction of these vehicles,

there is no better means of increasing that process than through the dissemination of data and transparency.

35. If the agency were to require the reporting of data, for what period should the agency require it to be reported—the two-year exemption period, the R2X's entire normal service life, or a time period in between?

Data should be reported for the life of the vehicle. While the exemption allows the production of vehicles for introduction into commerce for the two years, it does not prohibit the continued use of those vehicles and as such should be subject to reporting and any other requirements.

36. Given estimates that vehicles with high and full driving automation would generate terabytes of data per vehicle per day, how should the need for data be appropriately balanced with the burden on manufacturers of providing and maintaining it and with the ability of the agency to absorb and use it effectively?

The NHTSA should establish data retention requirements for vehicles subject to the exemption and establish requirements for access by NHTSA and any other appropriate agencies, such as NTSB.

37. If supporting information (including analysis, methodology, data, and computer simulation results involving proprietary systems or specialized computer programs) is submitted by a petitioner under a request for confidential treatment and relied upon by the agency in its determination whether to grant or deny a petition, how can the public be provided with an evaluation and a justification for the determination that are transparent, readily understandable and persuasive?

All information submitted to the Agency should be made publicly available unless NHTSA determines that it constitutes confidential business information. Determinations by NHTSA regarding whether such information is in fact confidential should start with the premise that information submitted to the agency should be made public.

38. Are there any mechanisms that may help further mitigate the underlying safety risks, if any, presented by this petition? For example, what additional safety and engineering redundancies, if any, should NHTSA consider requiring as a condition to granting the exemption?

While the Nuro petition and the exemption process generally address compliance with existing requirements, the possible failures of the ADS or its components presents an unknown. While Nuro mentions system redundancy, among other methods, of ensuring a fail-safe or fail-operational system, the Agency should confirm that these systems exist and will perform as described. Overall safety of ADS will be improved by the establishment of a functional safety standard to help ensure all systems perform as intended. Recent Boeing crashes and surrounding controversy are indicative of the

catastrophic results that can come from the misclassification of a hazard relating to the failure of a component, or the failure to inform operators about the performance of a system and how to disable it. In the end, if failures during the development of AVs endanger the public and cause injuries or loss of life, and the public turns against the technology, the safety benefits of the technology could be lost for years. The Agency should keep this in mind and establish requirements for redundancy as necessary to avoid the introduction of unreasonable risk and the preservation of public safety.

39. In the absence of information demonstrating the safe real-world operation of the Nuro vehicle, would it be prudent for NHTSA to place terms on the exemption to protect public safety? If so, what terms would be appropriate? In addition, what terms, if any, should the agency consider placing on an exemption to facilitate agency efforts to monitor the operations of exempted vehicles, and maximize the learning opportunities presented by the on-road experience of the exempted vehicles during the exemption period and thereafter?

Advocates supports the Agency's use of the exemption process to increase their understanding of AV operations through the monitoring of operations of exempted vehicles. Requiring data sharing would likewise contribute to this process. At all times however, the public must be protected from unreasonable risks through thorough review of petitions, oversight of vehicle deployment, and verification of compliance with the limitations of the exemption.

Conclusion

Advocates opposes the granting of Nuro's petition for exemption. As discussed, Nuro has failed to meet the statutory and regulatory requirements for petition for exemption and as such the petition must be denied. In light of this petition and the issues raised by it, Advocates once again calls upon the NHTSA to develop FMVSS that apply to automated driving systems to ensure public safety.



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