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Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation
Advance Notice of Proposed Rulemaking
83 Federal Register 50872, October 10, 2018

Advocates for Highway and Auto Safety (Advocates) files these comments in response to the National Highway Traffic Safety Administration's (NHTSA) Advance Notice of Proposed Rulemaking (ANPRM) on the appropriate factors and structure for a national pilot program for the safe on-road testing and deployment of autonomous vehicles (AVs).[1] While Advocates supports the agency's efforts to gather on-road data to develop performance standards for AVs, any pilot program established by NHTSA must include sufficient safeguards to protect the public as this nascent technology is tested.

Motor Vehicle Deaths Remain Unacceptably High

According to the federal government, each year motor vehicle crashes kill tens of thousands of people and injure millions more at a cost to society of over $800 billion.[2] According to the latest statistics from NHTSA, 37,133 people were killed on our nation's roads in 2017.[3]

Advocates Has Consistently Promoted Proven Technology to Save Lives and Prevent Injuries

Advocates has always championed proven vehicle safety technology and for good reason; it is one of the most effective strategies for preventing deaths and injuries. In 2015, NHTSA estimated that between 1960 and 2012, over 600,000 lives had been saved by motor vehicle safety technologies.[4] In 1991, Advocates led the coalition that supported bipartisan legislation

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1 Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation, NHTSA, 83 FR 50872, Oct. 10, 2018, NHTSA-2018-0092; (ANPRM).

2 The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised), NHTSA, DOT HS 812 013, (May 2015 (Revised)). (NHTSA Cost of Motor Vehicle Crashes Report).

3 2017 Fatal Motor Vehicle Crashes: Overview, NHTSA, DOT HS 812 603 (Oct. 2018).

4 Lives Saved by Vehicle Safety Technologies and Associated Federal Motor Vehicle Safety Standards, 1960 to 2012, NHTSA, DOT HS 812 069 (Jan. 2015).

that included airbag technology in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.[5] As a result, by 1997, every new passenger vehicle sold in the United States was equipped with a front seat airbag and the lives saved have been significant. Over the last decade airbags saved approximately 2,500 lives annually,[6] and saved an estimated 47,648 lives since 1987, according to NHTSA.[7]

Advocates built on this success by supporting additional lifesaving technologies as standard equipment in all vehicles in other legislation and regulatory proposals. These efforts include: tire pressure monitoring systems;[8] rear outboard 3-point seat belts;[9] electronic stability control;[10] rear seat belt reminder systems;[11] rear view cameras;[12] brake transmission interlocks;[13] seat belts on motorcoaches;[14] and, electronic logging devices for commercial motor vehicles (CMVs).[15] These safety advances have saved hundreds of thousands of lives. Additionally, crash avoidance systems, such as automatic emergency braking (AEB), are critical to the development of AVs and could be saving even more lives if the technology was required as standard equipment.[16]

Autonomous Vehicles Need Sensible Safeguards

Advocates believes that AVs have the potential to make significant and lasting reductions in the number of deaths and injuries that occur each year on our nation's roads. However, deploying AVs before they can be safely operated on public roads and without commonsense government oversight and industry accountability is not only reckless and ill-advised, but it will also substantially reduce public confidence in this new technology.

Serious and fatal crashes involving vehicles with autonomous capabilities have revealed significant flaws in this still developing technology, including the ability to detect and respond to adverse weather, roadway infrastructure, emergency vehicles, bicyclists and pedestrians. On May 7, 2016, in Williston, Florida, a Tesla Model S on "Autopilot" struck and passed beneath a

5 Intermodal Surface Transportation Efficiency Act of 1991, Pub. L. 102-240 (Dec. 1991).
6 Lives Saved in 2011 by Restraint Use and Minimum-Drinking-Age Laws, NHTSA, DOT HS 811 702 (Dec. 2012); Lives saved in 2016 by Restraint Use and Minimum-Drinking-Age Laws, NHTSA, DOT HS 812 454 (Oct. 2017).
7 Traffic Safety Facts 2016, NHTSA, DOT HS 812 554 (May 2018).
8 Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, Pub. L. 106-414 (Nov. 2000).
9 Anton's Law, Pub. L. 107-318 (Dec. 2002).
10 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, Pub. L. 109-59 (Aug. 2005).
11 *Id.*
12 Cameron Gulbransen Kids Transportation Safety Act of 2007, Pub. L. 110-189 (Feb. 2008).
13 *Id.*
14 Moving Ahead for Progress in the 21st Century Act, Pub. L. 112-141 (Jan. 2012).
15 *Id.*
16 80 FR 62487 (Oct. 16, 2015).

semitrailer killing the driver.[17] On January 22, 2018, in Culver City, California, another Tesla Model S operating on "Autopilot" collided with a parked fire truck that was responding to the scene of a separate crash.[18] Remarkably, neither the Tesla driver nor any first responders were injured.[19] On March 18, 2018, in Tempe, Arizona, an Uber test vehicle operating on self-driving mode struck and killed a pedestrian walking a bicycle.[20] Then, just a few days later on March 23, 2018, in Mountain View, California, a Tesla Model X operating on "Autopilot" collided with a safety barrier resulting in the death of the driver.[21] According to the National Transportation Safety Board (NTSB) preliminary report on the crash, the vehicle was being operated under "Autopilot", had moved out of the lane of travel on its own and accelerated to 70 miles-per-hour (MPH) before colliding with the barrier.[22] The collision and subsequent intense fire closed the freeway for at least five hours.[23] On May 29, 2018, a Tesla Model S operating on "Autopilot" struck a parked police vehicle in Laguna Beach, California.[24] The NTSB has investigated or is investigating all of these crashes except the last one.

In addition to the tragic crashes that have already happened involving autonomous systems, data accumulated from the limited miles traveled also paints an alarming picture. In 2017, the latest year for which data is available, on average a person was killed in a traffic collision every 86.2 million miles traveled on U.S. roads.[25] Before the fatal crash in Arizona, Uber had reportedly logged 2 million autonomous miles as of the end of 2017 and was predicted to accrue another 1 million miles over the next 100 days.[26] Based on a simple evaluation of this data, the autonomous Uber had one fatality in three million miles; that is a fatality rate 28 times that of human drivers. This analysis highlights just how little proof there is that these systems are safe. The voluntary safety self-assessments filed with NHTSA illustrate that manufacturers are touting the "millions of miles"[27] or "five million miles"[28] driven by their test vehicles as proof of their systems' safety. However, these numbers pale in comparison to the more than three *trillion* miles traveled by human drivers on U.S. roads each year.[29]

Similar misdirection about safety performance data has been used in response to recent crashes involving AVs. After the 2016 fatal Tesla crash in Florida, the NHTSA Office of Defects and

[17] National Transportation Safety Board, *Collision Between a Car Operating With Automated Vehicle Control Systems and a Tractor-Semitrailer Truck Near Williston, Florida*, Report No.: NTSB/HAR-17/02 (Sep. 12, 2017) (NTSB Tesla Crash Report).
[18] Peter Valdes-Dapena, Tesla in Autopilot mode crashes into fire truck, CNN Tech, (Jan. 24, 2018).
[19] *Id.*
[20] Everett Rosenfield, Tempe police release video of deadly Uber accident, CNBC (Mar. 21, 2018).
[21] David Shephardson, U.S. opens probe into fatal Tesla crash, fire in California, Reuters (Mar. 27, 2018).
[22] National Transportation Safety Board, Preliminary Highway Report, HWY18FH011 (Jun. 7, 2018).
[23] *Id.*
[24] Brittny Mejia, Tesla in Autopilot mode crashes into parked Laguna Beach police cruiser, L.A. Times (May 29, 2018).
[25] 2017 Fatal Motor Vehicle Crashes: Overview, NHTSA, DOT HS 812 603 (Oct. 2018).
[26] Carzon, B., Uber's Self-Driving Cars Hit 2 Million Miles As Program Regains Momentum, Forbes (Dec. 22, 2017).
[27] General Motors, 2018 Self-Driving Safety Report.
[28] Waymo, "Waymo Safety Report: On the Road to Fully Self-Driving" (Oct. 2017).
[29] Traffic Safety Facts 2016, NHTSA, DOT HS 812 554 (May 2018).

Investigation (ODI) issued a report which included an analysis of data supplied by Tesla that showed "that the Tesla vehicles crash rate dropped by almost 40 percent after Autosteer [a feature of the Autopilot system] installation."[30] However, included in the ODI report was a critical footnote that the crash rates reported were "for all miles travelled before and after Autopilot installation and are not limited to *actual Autopilot use*" (emphasis added).[31] Despite this clear statement by NHTSA, Tesla continues to mischaracterize the ODI analysis in response to subsequent fatal crashes involving vehicles operating under the "Autopilot" system.[32] NHTSA has since clarified again that the effectiveness of the "Autopilot" system was not evaluated in its prior investigation, refuting the claims by Tesla.[33] Moreover, Tesla was removed as a party to the NTSB investigation of the second fatal crash involving one of its vehicles shortly after a March 2018 blog post once again made this same claim.[34]

These types of details matter when it comes to AVs, particularly when evaluating claims are made to support their introduction. Some members of the industry assert that waiting for AV technology to be perfect would be "the enemy of the good."[35] In some cases, they point to a report of the same title by the Rand Corporation (RAND) to bolster this argument.[36] In fact, the RAND report concluded that allowing the deployment of AVs, which have a safety performance that is just 10 percent better than that of the average human driver, would save more lives than waiting for a perfectly safe AV.[37] However, the critical underpinning of this statement, which is being widely missed in the use of this report, is that these vehicles are in fact demonstrably better, even in some minute amount, than human drivers. It is essential to note that this is a fact which has yet to be proved. The industry and regulators have yet to agree on the proper metrics for evaluating the safety performance of an AV, let alone requirements for operation which would assure that these vehicles are ten percent, one percent, or even a tenth of a percent better than the average human driver.

Federal Vehicle Safety Standards Are the Most Effective Regulatory Tool to Protect Public Safety

Advocates supports NHTSA's efforts as noted in the ANRPM to begin to gather data to establish federal safety standards for AVs.[38] Federal vehicle safety standards have been shown to protect the public and improve the safety of motor vehicles. Moreover, federal standards pave the way to build public acceptance and use of these technologies which magnifies the safety benefits.

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[30] NHTSA Office of Defects Investigation, ODI Resume: Investigation PE 16-007.
[31] *Id.*
[32] Tesla, An Update on Last Week's Accident (Mar. 30, 2018).
[33] Reuters, 'Effectiveness' of Tesla self-driving system was not assessed in probe: US traffic safety agency (May 2, 2018).
[34] Levin, A., Beene, R., Tesla Was Kicked Off Fatal Crash Probe by NTSB (April 12, 2018).
[35] David Strickland, We Can't Afford to Put Up Any More Roadblocks on Self-Driving, Morning Consult (Dec. 1, 2017).
[36] *Id.*; Kalra, N., Groves, D., The Enemy of the Good: Estimating the Cost of Waiting for Nearly Perfect Automated Vehicles, RAND Corp. (2017).
[37] *Id.*
[38] 83 F.R. 50876.

Advocates has always supported the introduction of safety technologies once its benefits have been identified and verified. For example, Advocates evaluated an abundance of research and data demonstrating that installing a rearview camera in passenger vehicles would help to prevent backover crashes and resultant deaths and injuries, often to young children and people with disabilities.[39] Advocates, together with others in the safety community especially KidsAndCars.org and the remarkable families of backover victims, then fought for a decade in total to ascertain a rearview camera requirement for all new vehicles, which recently took effect on May 1, 2018.[40] The Insurance Institute for Highway Safety (IIHS) conducted research, published in their November 17, 2016 *Status Report*, demonstrating additional benefits of rearview cameras such as reducing property damage crashes during backing, and assistance with backing maneuvers such as parking.[41] Furthermore, if a video sensor stream was required, including additional driver assistance technologies such automatic rear braking, parking guidance, and even automated parking assistance, even more advantages could be realized.

Similarly, Advocates supported equipping vehicles with anti-lock braking systems (ABS), which help a driver to maintain control of the vehicle when braking on slippery surfaces. ABS has also resulted in wide ranging benefits. In fact, ABS is the base technology for electronic stability control (ESC) which helps to prevent rollover and loss-of-control crashes and is attributed to having saved more than 7,000 lives since 2011.[42] Automatic emergency braking (AEB), which uses on-board sensors such as radar, cameras or lasers to detect an imminent crash, warns the driver and applies the brakes or increases the braking effort if the driver does not take sufficient action. The applications which are in ABS and ESC are also an underlying technology for AVs.

Examples of the success of effective standards and oversight of automated systems fly over our heads every single day. According to the U.S. Bureau of Transportation Statistics, 741 million passengers traveled on domestic flights in 2017.[43] The tragic April 2018 death of a Southwest Airlines passenger was the first U.S. commercial airline fatality since 2009.[44] Over that same span of time (2010-2017), nearly 5.4 billion passengers travelled safely through our skies. The Federal Aviation Administration (FAA) estimates that airline pilots use automated systems 90 percent of the time while flying.[45] Meanwhile, on our roads from 2010 to 2017, crashes claimed the lives of approximately 275,000 road users.[46] The federal government and the U.S. DOT in

[39] Vehicle Backover Avoidance Technology Study, Report to Congress, NHTSA (Nov. 2006).
[40] 79 F.R. 19178 (Apr. 7, 2014).
[41] Insurance Institute for Highway Safety (IIHS), Rearview cameras reduce police-reported backing crashes, Status Report, Vol. 51, No. 9 (Nov. 17, 2016).
[42] Webb, C. N., Estimating Lives Saved by Electronic Stability Control, 2011–2015. (Traffic Safety Facts Research Note. Report No. DOT HS 812 391). Washington, DC: NHTSA (Mar. 2017).
[43] U.S. Bureau of Transportation Statistics, Annual Passengers on All U.S. Schedules Airline Flights (Domestic & International) and Foreign Airline Flights to and from the United States, 2003-2017.
[44] Gardner, L., Southwest passenger dies in first U.S. airline fatality since 2009, Politico (Apr. 17, 2018).
[45] Federal Aviation Administration, Office of the Inspector General, Audit Report: Enhanced FAA Oversight Could Reduce Hazards Associated with Increased Use of Flight Deck Automation, Report Number AV-2016-013 (Jan. 7, 2016).
[46] Traffic Safety Facts 2016, NHTSA, DOT HS 812 554 (May. 2018); 2017 Fatal Motor Vehicle Crashes: Overview, NHTSA, DOT HS 812 603 (Oct. 2018).

particular already have experience in developing standards and implementing effective oversight of automated systems in transportation. While adaptation for governing AVs on roads is necessary, this is not an entirely new concept. DOT should coordinate with other departments and its own agencies, and make the best use of its past research, current regulations, and the latest technologies to set standards ensuring the safe introduction of AVs.

Any Pilot Program Involving Testing AVs on Public Roads Must Include Sufficient Safeguards to Protect the Public

Advocates supports NHTSA's efforts to gather data reflecting the on-road performance of AVs particularly in challenging environments in order to establish federal safety standards. However, because of the experimental nature of the technology and the fact that AVs have already been shown to have significant operational flaws, any pilot program established by the agency that will permit the testing of these vehicles on public roads must have substantial safeguards. Advocates' responses to the specific inquiries posited in the ANPRM are as follows:

Question 1. What potential factors should be considered in designing the structure of a pilot program that would enable the Agency to facilitate, monitor and learn from on-road research through the safe testing and eventual deployment of vehicles with high and full driving automation and associated equipment?

Any pilot program established by NHTSA should be designed, above all else, to preserve public safety. While AVs may someday save lives and prevent injuries, this potential has yet to be proven. Crashes involving AVs will further erode public confidence in the technology and jeopardize any potential benefits. Advocates supports the program's goal of providing the agency with data and information to form the basis of rulemakings to establish much needed FMVSS for AVs. In order to achieve that goal, the program should be designed to generate the data and subsequent metrics needed for thoughtful and effective regulatory actions by the agency. At a minimum, those vehicles that participate in the program should be required to meet a functional safety standard and have sufficient safeguards in place to ensure the AV does not travel outside of its operation design domain (ODD).

Question 2. If NHTSA were to create a pilot program, how long would there be a need for such a program? What number of vehicles should be involved? Should NHTSA encourage the conducting of research projects in multiple locations with different weather conditions, topographical features, traffic densities, etc.?

The pilot program will likely need to be established for a significant period of time considering the unknown timeline for the development of AV technology. The program should also cover a wide range of operating conditions that will account for different weather, topographical features and traffic situations as AVs have already demonstrated difficulty operating in these various environments. The scope of the program should also be expanded to include level 2 AVs and above as some Level 2 AVs are already being sold to the public and have been involved in fatal crashes.

Question 3. What specific difficulties should be addressed in designing a national vehicle pilot program for vehicles with high and full driving automation either through the exemption request process relevant for FMVSS or more broadly related to other areas of NHTSA and/or other authorities?

Advocates concurs with the statement in the third edition of the AV guidelines released earlier this fall that the U.S. DOT "envision[s] an environment in which automated vehicles operate alongside conventional, manually-driven vehicles and other road users."[47] Under this mixed fleet model, AVs will surely continue to be involved in crashes. Therefore, it is critical that AVs are not exempt from meeting crashworthiness or occupant protection standards. These safety standards have been established through years of research and have saved countless lives. For example, removing the steering wheel should not eliminate the requirement to protect the occupant from injury using safety systems such as airbags. Alternatively, proposed designs which would have occupants facing rearward should not be permitted until testing and data prove that these configurations do not expose occupants to undue risk. Prohibiting such exemptions will in no way inhibit the development of AV technology but will ensure that passengers of AVs are properly protected in a crash.

Question 4. How can existing statutory provisions and regulations be more effectively used in implementing such a pilot program?

The current vehicle limits contained in 49 U.S.C. 30113 must be maintained to minimize exposure of the public to unnecessary risk. NHTSA should not use the pilot program and the current exemption provisions as a substitute for developing safety standards for AVs through the traditional regulatory process. In addition, the current requirements for the consideration of an application for exemption including public notice and comment as well as the contents of the application must be maintained.

Question 5. Are there any additional elements of regulatory relief (e.g., exceptions, exemptions, or other potential measures) that might be needed to facilitate the efforts to participate in the pilot program and conduct on-road research and testing involving these vehicles, especially those that lack controls for human drivers and thus may not comply with all existing FMVSS?

The pilot program should be constrained to only permit the limited testing of AVs in order to obtain data to develop safety standards for this nascent technology. Therefore, utilizing the exemption process contained in 49 U.S.C. 30113 is not necessary to achieve this goal. Longstanding federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads.[48] Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes.

[47] AV 3.0 p. v.
[48] Fixing America's Surface Transportation Act, Pub. L. 114-94, Sec. 24404 (2015).

Question 6. What vehicle design elements might replace existing required safety equipment and/or otherwise enhance vehicle safety under reasonably anticipated operating conditions?

Regardless of the design element, NHTSA must ensure that the public, as passengers in the AV or as other road users, are not endangered by the proposed replacement for the required safety equipment. The current level of safety and occupant protection provided by the replaced safety equipment must be maintained. Furthermore, the safety need addressed by any regulation from which relief is sought must also not be diluted. Industry efforts to constrain discussions of alternative regulatory language only to the letter of the regulation and ignoring the intent and safety need of the standard (which are a critical part of regulatory development) have the potential to significantly undermine safety. For instance, exemptions from the rearview camera requirements should ensure that any alternative system meets the safety need of not backing into or over other vehicles, pedestrians, or bicyclists. While the present FMVSS only discusses presenting the image of the area behind a vehicle to a driver, the safety need of the rule is only met when the driver appropriately stops the vehicle. Therefore, an AV should be required to detect and respond appropriately to persons and objects behind the vehicle.

Question 7. What types of performance measures should be considered to ensure safety while allowing for innovation of emerging technology in vehicles with high and full driving automation participating in a pilot program?

Until AVs are proven to have eliminated crashes, occupant protection performance measures must be maintained. The pilot program is an opportunity for the NHTSA to address the variability of the ODD. The agency will need to establish a standard means of defining the ODD, identify what potentials for risk exist within that domain, and develop sensible requirements for the AV. For example, a low speed bus operating on a closed loop (no other traffic) but in the vicinity of pedestrians would need to be tested for the types of objects it would encounter and for its performance at its operating speeds. This testing regime would be quite different than a vehicle proposed to operate on highways in mixed traffic at high speeds. In the end, the performance measures should be such that the agency can confirm that AVs will address the foreseeable hazards which exist within a given AV's ODD. Further, NHTSA should require that AVs have established and proven fall back scenarios for when the vehicles travel outside the ODD or unanticipated hazards.

As NHTSA notes in this section, there are significant concerns with human-machine interface for certain AVs. As such, the agency should include level 2 and 3 vehicles in the scope of the program in order to develop much needed FMVSS for driver engagement with these systems. The crashes that have occurred in these types of vehicles already indicate the failure of some manufacturers to address this critical and deadly safety issue.

Question 8. How should the Operational Design Domains of individual vehicle models be defined and reinforced and how should Federal, State and local authorities work together to ensure that they are observed?

In order to protect public safety, no AV should be allowed to operate outside of conditions under which it is foreseeably expected to perform safely (i.e. within its ODD). Permitting an AV to operate outside of its ODD poses an unnecessary grave risk to all those involved in the program as well as the public. Regardless of the manner in which the ODD is specified, the requirement for every AV should be that it will only operate within the boundaries of safe operation and should be required to have a designed process for limiting or eliminating misuse. In addition, the agency should require that protocols are in place if the vehicle malfunctions and travels outside the ODD. The Tesla crash in Florida illustrated the dangers than can occur when a system is used outside of its ODD. In that case, the Autopilot System which was designed for use on limited access roads was operated on roads with cross traffic resulting in a collision with a tractor trailer after the Autopilot system failed to recognize the trailer.[49] These types of problems are readily predictable, are defined by the manufacturers, and should be a critical element of sensible design.

The agency needs to establish a standard means of specifying the ODD and defining the risks which must be addressed within a given ODD. The agency needs to at least define the operating criteria which it deems important to operational safety and which it can categorize for the development of standards and confirmatory tests. For example, if a manufacturer claims that its vehicle only operates on sunny days, then it should be evaluated at all angles of the sun. If the manufacturer states that the AV only operates when the sun is more than 20 degrees above the horizon, then it should be tested under such conditions and tested to ensure it does not operate when outside of those conditions.

Question 9. What type and amount of data should participants be expected to share with NHTSA and/or with the public for the safe testing of vehicles with high and full driving automation and how frequently should the sharing occur?

Transparency and the sharing of robust data is critical to any pilot program conducted by the agency for the testing of AVs, as the pilot program will be permitting experiments of nascent technology on public roads. At a minimum, participants should be required to report on all safety critical events involving their vehicles. This requirement must include all police reports, statements from all those involved (beyond a narrative from the manufacturer) and any other available data on the collision. Moreover, participants must be required, at a minimum, to ensure that vehicles are equipped to record all data elements currently required by event data recorders (EDRs). In addition, vehicles should also be required to record all details on the vehicle control decision process which led to the occurrence. Unlike current collisions involving human drivers, where EDR data can only reflect vehicle operations, there should be a permanent record of the decision making process for AVs. This data should be available in a standardized format and made accessible in such a way that the public or an investigative body does not need to rely on the participating company for access to and interpretation of the information as has been recommended by the NTSB as a result of its investigation of the Tesla crash in Florida.[50]

[49] NTSB, Collision Between a Car Operating With Automated Vehicle Control Systems and a Tractor-Semitrailer Truck Near Williston, Florida, May 7, 2016, Accident Report HAR-17/02 (Sep. 12, 2017).
[50] *Id.*

Question 10. In the design of a pilot program, how should NHTSA address the following issues—

a. confidential business information?

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.

d. data retention and reporting?

Regular and timely public reports on the progress, changes, concerns, data (including crashes) and risks involving the AVs in the program are critical to ensuring that participants are held accountable and that the public is kept informed. In addition, anonymized data should also be provided to the public. NHTSA should establish a public website with basic safety information about AVs for consumers and for use in safety research. This online database would be similar to the safercar.gov website that the agency maintains to inform the public about safety recalls applicable to their vehicle. This would enable consumers to enter their VIN to obtain critical information about their AV such as the level of automation, any exemptions granted by NHTSA from the FMVSS, and the ODD which includes limitations and capabilities of each autonomous driving system with which a vehicle is equipped. Such a database will be critical for consumers who purchase AVs, whether first-hand or as a pre-owned vehicle, and will also allow NHTSA and other research groups to perform independent evaluation of the comparative safety performance of AV systems.

Question 11. In the design of a pilot program, what role should be played by—

i. Failure risk analysis and reduction during design process (functional safety)?

Functional safety is an ongoing process and should continue throughout the program. The agency will be uniquely situated to be a central repository for data on performance and, perhaps most importantly, unique crash cases. The agency should maintain a list of scenarios which have been identified during the program which have posed challenges for AVs and share this list with the public as well as with manufacturers to ensure that proper productive evaluations can be done to help prevent similar crashes. Considering the variation in conditions to be experienced on the road, it is unlikely that a single company will have their AVs experience every edge case possible. Instituting this process would provide manufacturers with critical information to better their products as well as protect public safety, similar to the reporting system under the Federal Aviation Administration (FAA) known as the Aviation Safety Information Analysis and Sharing (ASIAS) System.

ii. Objective performance criteria, testable scenarios and test procedures for evaluating crash avoidance performance of vehicles with high and full driving automation?

Standardizing variability in testing is critical to establishing performance criteria, testable scenarios and test procedures. For example, the agency could standardize a variety of pedestrian dummies and vary their operation during test scenarios. Similar variability will need to be developed for other vehicles, bicycles and scooters. Again, depending on the ODD definition, the number and variation of tests to be considered could vary.

iii. Third party evaluation?

It is NHTSA's duty to ensure the safe design and deployment of all AVs on our nation's roads including those participating in the pilot program.

iv. Occupant/non-occupant protection from injury in the event of a crash (crashworthiness)?

Occupant protection requirements must be maintained to ensure safety. Decades of research have resulted in improved vehicle safety and should not be ignored in order to facilitate novel seating configurations or other alternative designs which are unrelated to ensuring the safe performance of AVs. For the foreseeable future, AVs will share the road with human drivers and crashes involving AVs will surely occur.

Ensuring the safe interaction of AVs with vulnerable road users is also critical. Advocates has urged that the New Car Assessment Program (NCAP) include vulnerable road user protection requirements similar to those evaluated in other NCAP programs around the world.[51] AVs may be uniquely positioned to further improve the survivability of vulnerable road users involved in collisions due to the increased monitoring of the road environment by an AV. This unique operational aspect could be used to trigger countermeasures specific to such road users such as an active hood.

v. Assuring safety of software updates?

The agency must establish a means of verifying the validity and performance of any proposed software updates. In fact, a recent update issued by Tesla left vehicles' owners without the use of AEB.[52] As such, the agency must develop a protocol for verifying that updates will not degrade safety. In addition, there must be sufficient cybersecurity protection standards in place to protect against hacking.

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[51] Advocates for Highway and Auto Safety, Comments to DOT Docket No. NHTSA-2015-0006 (Apr. 22, 2015).
[52] Patrick Olsen, Over-the-Air Update Left Tesla Model 3 Without Key Safety Features, Consumer Reports (Sep. 13, 2018).

vi. Consumer education?

The public has consistently expressed deep skepticism about AVs.[53] Public acceptance will be critical to the potential future safety benefits that will result from the mass deployment of AVs. Therefore, the agency must be as transparent as possible in conducting the pilot program. At a minimum, NHTSA should inform consumers of testing on public roads, the capabilities and limitations of the AVs being tested and any and all safety critical events.

Question 12. Are there any additional critical areas to consider in the design of a safe pilot program for the testing and deployment of vehicles with high and full driving automation?

The agency must expend considerable time and effort to ensure that all the vehicles involved in the pilot program have sufficient cybersecurity protections in place. While the agency has not yet established cybersecurity requirements for AVs, if this program is to increase the number of viable hacking targets on public roads, a minimum level of cybersecurity must be required of all participants. In addition, the agency should require that all vehicles in the pilot program have sufficient safeguards in place to protect the electronics systems in the vehicles and can properly detect and respond to other road users. The data gathered from AVs subject to these requirements participating in the program should be used to develop and issue performance standards for all AVs.

Question 13. Which of the following matters should NHTSA consider requiring parties that wish to participate in the pilot program to address in their applications?

a. ''Safety case'' for vehicles to be used in the pilot program (e.g., system safety analysis (including functional safety analysis), demonstration of safety capability based on objective performance criteria, testable scenarios and test procedures, adherence to NHTSA's existing voluntary guidance, including the submission of a voluntary safety self-assessment, and third party review of those materials).

This information should not just be part of the application to participate in the program but the "safety case" of each AV in the pilot program should be monitored continuously by the agency. Each manufacturer should be required to establish an Internal Review Board (IRB) to provide essential oversight of the vehicle testing. Functional safety is an ongoing process of analysis, review, and improvement. Analyses should be updated on a consistent basis with available data to ensure that the systems are meeting targets for performance and safety. This information should be part of the regular public reporting provided to the agency.

> *i. What methodology should the Agency use in assessing whether an exempted ADS vehicle would offer a level of safety equivalent to that of a nonexempted vehicle? For example,*

[53] Advocates for Highway and Auto Safety, Public Opinion Polls Show Deep Skepticism About Autonomous Vehicles, available at: http://saferoads.org/wp-content/uploads/2018/11/AV-Public-Opinion-Polls-10-29-18-1.pdf

> *what methodology should the Agency use in assessing whether an ADS vehicle steers and brakes at least as effectively, appropriately and timely as an average human driver?*

The agency needs to establish the initial criteria by which it will judge AV designs, and in the absence of on-road data, other objective criteria are necessary. In cases of exemptions from FMVSS, the agency must assure that not only is an equivalent level of safety maintained but also that the safety need addressed by the FMVSS is met. Establishing the performance level equivalent to that of the "average human driver" is not sufficient to ensure public safety. AVs, if they are to meet the promised goals of its proponents, must be subject to a higher standard. In addition, the agency should request reports on any and all developmental testing which could support claims of safe performance by a manufacturer (including simulations and closed course testing). Moreover, in the near term until sufficient data is collected to demonstrate proficiency, operating conditions should be limited in order to reduce risk to the public.

b. Description of research goals, methods, objectives, and expected results.

These components of the application should meet the standards for any scientific experimentation. Hypotheses, methods for analysis, scope of work and means of controlling risk including how problems will be addressed should all be part of any application.

c. Test design (e.g., route complexity, weather and related road surface conditions, illumination and institutional review board assessment).

Each application must include a risk assessment(s) and any analyses necessary to limit the conditions under which the vehicle will be operating. This should include clear evidence of how all of the foreseeable risks are addressed in the design of the experiment as well as within the ODD. The application should also clearly indicate how the AVs will mitigate risk when faced with situations not considered to be foreseeable.

d. Considerations for other road users (e.g., impacts on vulnerable road users and proximity of such persons to the vehicle).

Again, the applicants should be required to identify any and all risks associated with the proposed testing and the means of eliminating or mitigating that risk. If a vehicle is to operate and never interact with pedestrians, bicyclists or other venerable road users, then there should be clear indications of how these interactions will be prevented. If the AV will interact with such road users, there must be clear evidence of how they will be accounted for and avoided.

e. Reporting of data, e.g., reporting of crashes/incidents to NHTSA within 24 hours of their occurrence.

As noted above, participants in the program must report all crashes involving AVs. In addition, the following information should be included for all such events: statements of all persons involved in the incident, police reports, EDR data, and any additional data which reflects the decision process on the part of the ADS (automated driving system). Moreover, all relevant information and data must be provided in adequate time and in a transparent manner to ensure that delays in submission do not contribute to the loss of critical information.[54]

f. Recognition that participation does not negate the Agency's investigative or enforcement authority, e.g., independent of any exemptions that the Agency might issue to program participants and independent of any terms that the Agency might establish on those exemptions, the Agency could conduct defect investigations and order recalls of any defective vehicles involved in the pilot program. Further, the Agency could investigate the causes of crashes of vehicles involved in the program.

Participation in the pilot program should in no way negate any of the agency's current enforcement authorities. In fact, NHTSA needs enhanced authorities to properly regulate AVs. To protect the public against potentially catastrophic vehicle safety defects in AVs and traditional vehicles, NHTSA must have imminent hazard authority. This important tool would allow the agency to expedite the grounding of vehicles that have potential problems which could result in crashes, deaths and injuries. Moreover, NHTSA should have the legal ability to levy criminal penalties to deter automakers from deliberately hiding problems that could imperil safety. Other federal agencies including the Securities and Exchange Commission and Food and Drug Administration have such authority.

g. Adherence to recognized practices for standardizing the gathering and reporting of certain types of data in order to make possible the combining of data from different sources and the making of statistically stronger findings.

Standardization is always critical to developing a meaningful dataset and performing insightful analyses. The agency should establish these requirements not only for the benefit of the database, but also should consider how such standardization could enable sharing of important information on the failures of individual systems in order to inform all parties. Under such a sharing regime, intellectual property could be preserved while allowing other manufacturers to understand the situation encountered and improve their operations of their vehicles, similar to the methods used in the FAA's ASIAS System.

h. For which types of data would standardization be necessary in order to make such findings and why?

At a minimum vehicle crash data, ADS decision data, crash environment data and operational data should all be standardized for the reasons noted above.

Question 14. What types of terms and conditions should NHTSA consider attaching to exemptions to enhance public safety and facilitate the Agency's monitoring and learning from the testing and deployment, while preserving the freedom to innovate, including terms and

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[54] NTSB, Letter to Schoharie County District Attorney (Dec. 14, 2018).

conditions for each of the subjects listed in question 13? What other subjects should be considered, and why?

The pilot program should be constrained to only permit the limited testing of AVs in order to obtain data to develop safety standards for this nascent technology. Utilizing the exemption process contained in 49 USC 30113 is not necessary to achieve this goal. Again, long standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads. Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes. Moreover, the establishment of minimum performance standards fosters innovation by creating a level playing field for all those testing and deploying AVs.

Question 15. What value would there be in NHTSA's obtaining one or more of the following potential categories of data from the participants in the pilot program? Are there other categories of data that should be considered? How should these categories of data be defined?

a. Statistics on use (e.g., for each functional class of roads, the number of miles, speed, hours of operation, climate/weather and related road surface conditions).

For many of the reasons stated above, there is great value in obtaining such data as it will be essential for the agency to properly assess the on-road performance of the AVs participating in the program.

b. Statistics and other information on outcome (e.g., type, number and cause of crashes or near misses, injuries, fatalities, disengagements, and transitions to fallback mechanisms, if appropriate).

Details on the conditions surrounding these disengagements or transitions to fallbacks are essential for a thorough evaluation of the performance of the AV. Without such information the agency cannot possibly conduct a thorough and complete analysis of the on-road performance of AVs participating in the program. Without sufficient protocols in place to ensure that all essential data is provided to NHTSA, the program's goals cannot be achieved. While disengagements may be the sign of an overly cautious test driver, they could just as well be indicative of a faulty system. A standardized requirement for reporting why and how the disengagements or transitions occurred would enable a more accurate analysis as opposed to an aggregated number of disengagements.

c. Vehicle/scene/injury/roadway/ traffic data and description for each crash or near miss (e.g., system status, pre-crash information, injury outcomes).

For many of the reasons stated above, obtaining such data is essential for the agency to properly assess the on-road performance of the AVs participating in the program. As noted above, without this essential information the agency cannot possibly conduct a proper analysis of the on-road performance of AVs participating in the program. Unless the agency is able to capture this essential data, the program's goals will not be achieved.

d. Sensor data from each crash or near miss (e.g., raw sensor data, perception system output, and control action).

Manufacturers should be required to maintain the raw data associated with any crash or other safety critical event for review. The agency should establish a standard means of reporting information necessary to properly evaluate the importance of the event and determine if a review of the raw data is warranted.

e. Mobility performance impacts of vehicles with high and full driving automation, including string stability of multiple consecutive ADS vehicles and the effects of ADS on vehicle spacing, which could ultimately impact flow safety, and public acceptance.

The safety impacts of multiple consecutive AVs traveling together are considerable. For example, the spacing between AVs, especially automated commercial motor vehicles, in a so-called "platoon" could have wide-ranging implications. If these large vehicles travel too closely together, their combined weight load could place severe stress on a bridge. In addition, lengthy platoons that consist of many AVs could be difficult to pass and affect merging and exiting from roadways. The agency must fully evaluate these issues before permitting such operations to occur as part of the program.

f. Difficult scenarios (e.g., scenarios in which the system gave control back to an operator or transitioned to its safe state by, for example, disabling itself to a slow speed or stopped position).

For many of the reasons stated above, there is great value in obtaining such data as it will be essential for the agency to properly assess the on-road performance of the AVs participating in the program.

g. Software updates (e.g., reasons for updates, extent to which updates are made to each vehicle for which the updates are intended, effects of updates).

For many of the reasons stated above, there is great value in obtaining such data as it will be essential for the agency to properly assess the on-road performance of the AVs participating in the program.

h. Metrics that the manufacturer is tracking to identify and respond to progress (e.g., miles without a crash and software updates that increase the operating domain).

For many of the reasons stated above, there is great value in obtaining such data as it will be essential for the agency to properly assess the on-road performance of the AVs participating in the program.

j. Metrics or information concerning the durability of the ADS equipment and calibration, and need for maintenance of the ADS.

The agency should collect this data as it likely will be beneficial to understanding how the maintenance of AVs should be handled and the risk which could be posed to consumers by equipment that is not properly maintained or calibrated.

k. Data from ''control groups'' that could serve as a useful baseline against which to compare the outcomes of the vehicle participating in the pilot program.

The agency should design the program to collect this type of data to help examine the safety benefits of these systems comparatively.

m. 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 it and the ability of the Agency to absorb and use it effectively?

The agency should establish requirements for the maintenance of data for a specified period of time for all data. The program should require reporting of specific information and metrics which would allow the agency to identify specific circumstances in which a more in depth review of the data would be necessary.

n. How would submission of a safety assurance letter help to promote public safety and build public confidence and acceptance?

The safety assurance letters submitted to the agency to date are little more than slick marketing brochures that do not provide useful information to properly assess the performance of the technology let alone assure safe operation on our nation's roads. Numerous public opinion polls show strong public skepticism and reticence about AVs.[55] Those doubts are warranted based on the recent crashes as well as the past conduct of some automakers. Public confidence in AVs will be achieved through transparency and the safe and thoughtful development of AVs instead of a rush to market.

o. For all of the above categories of information, how should the Agency handle any concerns about confidential business information and privacy?

Please see comments above.

Question 16. How should the Agency analyze safety in deciding whether to grant such exemptions under each of the separate bases for exemptions in section 30113? Can the

[55] Advocates for Highway and Auto Safety, Public Opinion Polls Show Deep Skepticism About Autonomous Vehicles, available at: http://saferoads.org/wp-content/uploads/2018/11/AV-Public-Opinion-Polls-10-29-18-1.pdf

exemption process be used to facilitate safe and effective ADS development in an appropriate manner?

The pilot program should be constrained to only permit the limited testing of AVs in order to obtain data to develop safety standards for this nascent technology. Therefore, utilizing the exemption process contained in 49 USC 30113 is not necessary to achieve this goal. Long-standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads. Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes.

Advocates strongly opposes increasing the number of exempt vehicles beyond the current statutory limit of 2,500 contained in 49 U.S.C. 30113. This cap was established to minimize potential risks when systems that do not meet the FMVSS are introduced into the market.

Question 17. Could a single pilot program make use of multiple statutory sources of exemptions or would different pilot programs be needed, one program for each source of exemption?

Advocates does not believe that multiple pilot programs are needed to gather data to establish safety standards for AVs. Long-standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads. Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes.

Question 19. How could the exemption process in section 30113 be used to facilitate a pilot program? For vehicles with high and full driving automation that lack means of manual control, how should NHTSA consider their participation, including their continued participation, in the pilot program in determining whether a vehicle would meet the statutory criteria for an exemption under section 30113?

The pilot program should be constrained to only permit the limited testing of AVs in order to obtain data to develop safety standards for this nascent technology. In no way should experimental AVs participating in the program be sold to the public. Therefore, utilizing the exemption process contained in 49 USC 30113 is not necessary to achieve this goal. Long-standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads. Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes.

Question 20. What role could exemptions under section 30114 play in the pilot program? Could participation in the pilot program assist a manufacturer in qualifying for an exemption under section 30114? Could participation be considered part of the terms the Secretary determines are necessary to be granted an exemption under section 30114 for vehicles that are engaged in ‘‘research, investigations, demonstrations, training, competitive racing events, show, or display’’?

The pilot program should be constrained to only permit the limited testing of AVs in order to obtain data to develop safety standards for this nascent technology. In no way should experimental AVs participating in the program be sold to the public. Therefore, utilizing the exemption process contained in 49 USC 30114 is not necessary to achieve this goal. Long-standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads.[56] Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes.

Question 21. What role could a pilot program play in determining when to grant an exemption from the ''make inoperative'' prohibition under section 30122 for certain ''dual mode'' vehicles? Relatedly, what tools does NHTSA have to incentivize vehicles with high and full driving automation that have means of manual control and thus do not need an exemption to participate in the pilot program?

The pilot program should be constrained to only permit the limited testing of AVs in order to obtain data to develop safety standards for this nascent technology. In no way should experimental AVs participating in the program be sold to the public. Therefore, utilizing the exemption process contained in 49 USC 30122 is not necessary to achieve this goal. Long-standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads.[57] Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes.

Question 22. If there are any obstacles other than the FMVSS to the testing and development of vehicles with high and full driving automation, please explain what those are and what could be done to relieve or lessen their burdens. To the extent any tension exists between a Federal pilot program and State or local law, how can NHTSA better partner with State and local authorities to advance our common interests in the safe and effective testing and deployment of ADS technology?

Long-standing FMVSS which were developed based on years of research and which have saved countless lives in no way are an obstacle to the safe testing AVs. As noted above, long-standing federal law was recently amended to allow for vehicles that are not in compliance with FMVSS to be tested on public roads.[58] Therefore, manufacturers can already deploy AVs that are not required to comply with FMVSS on public roads for testing purposes. In addition, there are well established processes in place that include focused requirements and limits. Moreover, the establishment of minimum performance standards fosters innovation by creating a level playing field for all those testing and deploying AVs.

[56] Fixing America's Surface Transportation Act, Pub. L. 114-94, Sec. 24404 (2015).
[57] *Id.*
[58] *Id.*

Conclusion

Advocates supports NHTSA's efforts to obtain on-road performance data for AVs in order to establish federal safety standards for this experimental technology. However, any pilot program established by the agency must include the safeguards noted above as this technology has already been shown through several fatal and serious crashes to have substantial operational shortcomings. Over fifty years ago, Congress passed the National Traffic and Motor Vehicle Safety Act of 1966[59] because of concerns about the death and injury toll on our highways. The law required the federal government to establish FMVSS to protect the public against "unreasonable risk of accidents occurring as a result of the design, construction or performance of motor vehicles, and against unreasonable risk of death or injury in an accident." In addition, NHTSA's mission is to "save lives, prevent injuries and reduce economic costs due to road traffic crashes, through education, research, safety standards and enforcement activity."[60] While cars have changed dramatically and will continue to do so in the future, the underlying premise of this prescient law and NHTSA's safety mission has not.

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[59] Pub.L. 89–563 (1966).
[60] NHTSA, NHTSA's Core Values, Commitment to Serving the Public, NHTSA's Mission.