

January 28, 2021

The Honorable Steven Cliff
Deputy Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, S.E.
Washington D.C. 20590

**Request for comment, Advanced Notice of Proposed Rulemaking
Framework for Automated Driving System Safety; Docket No. NHTSA-2020-0106**

Dear Deputy Administrator Cliff:

The Insurance Institute for Highway Safety and Highway Loss Data Institute (IIHS-HLDI) appreciate the opportunity to comment on the National Highway Traffic Safety Administration's deliberations regarding automated driving system (ADS) safety. We along with other members of the public (Chase & Osborne, 2020) remain disappointed with NHTSA's dithering about how to approach the regulation of ADS safety. As our past comments suggest, there are several things NHTSA could require of ADS-controlled vehicles that would put them on the road to becoming safer than human-driven vehicles without stifling innovation.

NHTSA's obsession with "removing regulatory hurdles" and "not stifling innovation" is inconsistent with the agency's mission "to save lives, prevent injuries, and reduce economic costs due to road traffic crashes." Automated driving technology may prove a useful tool to help accomplish that mission, but it is naïve to think that it will improve road safety without public policy that guides it to that end. ADSs are not being developed solely to improve road safety. There are other business interests behind these efforts¹. The compelling need for early safety regulation is to obligate ADS developers to favor safety over competing demands of the technology (e.g., cost, speed, style). NHTSA is surely aware of the countless instances when safety trade-offs made for cost and convenience led to needless injury and death.

ADS regulation should address known crash causes and factors

The causes and contributing factors resulting in injury and death from motor vehicle crashes are well documented (Singh, 2015). As such, NHTSA should begin crafting regulation that compels ADS developers to address these problems.

NHTSA should require that ADS technology enforce seat belt wearing in vehicles controlled by it. Despite relatively high rates of seat belt use, fewer than half of front-seat occupants and a third of rear-seat passengers older than 13 who are killed in crashes were wearing their belts (IIHS, 2020b). Moreover, NHTSA has recent evidence that ADSs do not obviate the need for proper occupant restraint use. In February 2020, the agency temporarily suspended the operations of an ADS-controlled shuttle in Columbus, Ohio, following an incident involving a passenger falling from their seat due to hard braking by the ADS. Other similar events also have been reported (Shepardson, 2020). Fortunately, these incidents did not result in serious injury, but they might have if they had been caused by crashes with other vehicles.

¹ As observed in *Driven – The Race to Create the Autonomous Car*, by Alex Davies, "Uber and Waymo executives sang sweet songs about ending road deaths, but they weren't in court fighting over who got to save more lives. They went to war because each wanted to claim a dominant share of a market predicted to be worth \$42 billion in 2025 and \$77 billion in 2035" (p 4; Simon & Schuster, 2021).

NHTSA should require ADSs to comply with traffic laws. More than 9,000 deaths — 26% of all crash fatalities — occurred in speed-related crashes, and 846 people were killed in crashes that involved red light running in 2018 (IIHS, 2020a). Without a regulatory requirement, there is nothing to prevent ADS developers from allowing their systems to engage in similar behaviors, just as automakers currently offer adaptive cruise control (ACC) features that will accommodate set speeds exceeding the legal limit because there is no regulation prohibiting them. Recent IIHS research shows that drivers tend to travel faster when using ACC than without it (Monfort et al., 2021), and some crashes involving automated speeding have resulted in needless death (NTSB, 2020a, 2020b). Regulatory requirements should prevent automakers from offering for sale ADS-controlled vehicles that do not follow traffic rules.

NHTSA has raised a question in the current notice about whether the enforcement of traffic laws and seat belt wearing should be left to local law-enforcement efforts. Unfortunately, the figures noted above indicate that law-enforcement alone cannot be expected to curtail dangerous driving behavior. If ADSs are to be successful at reducing the toll of road crashes, then they must be required to avoid and prevent the humanlike errors like speeding and red light running that cause crashes today. Furthermore, as we have previously suggested, ADSs should respond as an ideal driver would be expected to in those conditions that, under current Federal Motor Vehicle Safety Standards (FMVSS), necessitate the illumination of a warning light (e.g., low tire pressure or an airbag system malfunction) (IIHS-HLDI, 2019).

Importance of the operational design domain (ODD)

NHTSA is right to recognize that the ODD will influence the nature and need for specific regulatory requirements. A first step, however, would be to require that every ADS be designed to prevent its use outside its ODD. This is an especially important consideration for dual-use vehicles in which the driver may be able to choose or not to engage an onboard ADS. IIHS research shows that while drivers tend to use ACC and more automated driver assistance systems more often within the intended ODD, their use outside the ODD is not negligible and can vary dramatically among drivers (Reagan et al., 2019). Operating within its ODD is a critical component of ADS risk-mitigation strategy, therefore it should be enforced through regulation.

NHTSA should not expect that states, local authorities, or entities utilizing ADS-controlled vehicles to provide transportation services will strictly adhere to restricting ADS use within the appropriate ODD. Several states (IIHS, 2010) and local jurisdictions allow the use of neighborhood electric vehicles on roads with conditions beyond those considered in establishing FMVSS 500 (1998). Likewise, several states permit the use of off-road vehicles on public roads (IIHS, 2013), a practice that contributed to 421 on-road deaths among riders of these vehicles in 2018 (Consumer Federation of America, 2020). Clearly, there is public interest in pushing the bounds of vehicle operation beyond what is safe and to the extent this can be prevented by regulating ADS technology, it should.

NHTSA's questions about a safety framework

Next we address three of NHTSA's questions about a safety framework for ADS technology.

Question 1. Describe your conception of a Federal safety framework for ADS that encompasses the process and engineering measures described in this notice and explain your rationale for its design.

IIHS-HLDI recommend that NHTSA adopt an “all of the above” approach to guiding the development of ADS technology to address the causes and contributing factors that lead to injury and death from motor vehicle crashes. Focusing on process measures in the near term by auditing ADS developers' safety cases would provide NHTSA with an opportunity to shape ADS safety ahead of its deployment onto our nation's roads. It seems that ISO2148, ISO26262, UL4600 or some combination of the three could be used as the basis for such an effort. Specifying sooner rather than later how NHTSA will judge safety

cases can only help ADS developers address the requirements that ultimately should be imposed on them. We urge NHTSA to issue a specific proposal describing how it plans to ensure the sound development of safety cases by those entities developing ADS technology.

The engineering measures described in the notice — Model Predictive Instantaneous Safety Metric (MPriSM), Responsibility Sensitive Safety (RSS), and Safety Force Field — are derived from geometry and the equations of motion in formulations intended to govern the motion of the ego-vehicle to reduce the risk of and possibly prevent collisions with other road users. As such, they offer promise to serve as the basis for establishing regulatory expectations of ADS behavior. All three, however, require some level of standardization if they are to be used in guiding safe ADS development. A target value for the MPriSM metric is needed to operationalize its use. RSS requires establishing an agreed-upon reasonable description of other road users' possible motions. NHTSA should set through regulation the acceptable ranges of such parameters.

It is clear from the current notice and NHTSA's past publications that the agency is reluctant to issue prescriptive regulatory mandates governing ADS behavior. However, the guidance issued by NHTSA so far is too vague to help ADS developers understand what will be expected of their efforts or to provide the public with any confidence that the agency is, in fact, trying to ensure that ADSs will be safer than human drivers. To move forward from its current "hands-off" state, we recommend that NHTSA begin by formulating specific guidance based on the process and engineering measures described in the notice. As voluntary guidance, there would be little penalty if the precise formulation didn't suit all ADS developers because they wouldn't be required to follow it. The feedback about why some ADS developers ignored the voluntary guidance, and the comparison of safety performance between those that followed the guidance with those that didn't, would provide NHTSA with information helpful to developing final regulatory requirements. The agency's current lack of specificity about the safety goals for ADS technology is indefensible.

Question 6. Do you agree or disagree with the core elements (i.e., "sensing," "perception," "planning" and "control") described in this notice? Please explain why.

IIHS-HLDI agree that the core elements of perception, planning, and control as defined in the notice comprise a reasonable organization for regulatory efforts governing ADS safety. We raise two questions about the value of including sensing as a separate element. Firstly, the main concerns about sensing are its ability to support perception. As such, if perception requirements are adequately defined then sensing will be compelled to support those needs without NHTSA needing to specify details about sensing performance. Our second concern is that prescribing required sensing or defining sensing performance would not be strictly technology agnostic, as NHTSA wishes it to be. ADS developers should be free to choose the sensing technology that best supports their application's perception needs. If NHTSA decides to retain sensing as the object of future regulation, we suggest that the resulting regulations should take the "if equipped" basis.

Question 2. In consideration of optimum use of NHTSA's resources, on which aspects of a manufacturer's comprehensive demonstration of the safety of its ADS should the Agency place a priority and focus its monitoring and safety oversight efforts and why?

IIHS-HLDI suggest that NHTSA place a priority and focus on the monitoring and developing guidance for the perception and planning aspects of ADS design. These aspects, as defined in the notice, most closely map to the categories of human errors identified in an IIHS analysis of the National Motor Vehicle Crash Causation Survey (NMVCCS) (Mueller, Cicchino, & Zuby, 2020). If ADS-controlled vehicles are to improve upon the safety of human-driven vehicles, then they must be designed to avoid these errors.

More than 60% of crashes in the NMVCCS sample involved errors that IIHS researchers categorized as “sensing and perceiving,” which fits pretty closely with NHTSA’s description of the “perception” element. It will be critical that an ADS be capable of identifying other road users and miscellaneous objects that are in or near its intended path. Likely, the requirements for perception will vary somewhat based on an individual ADS’s ODD. As such, NHTSA should consider defining some likely ODD categories and then specify the perception requirements accordingly. The specific types of road users and objects that need to be perceived and their relative criticality could be specified relative to an ADS’s ODD, for example. ADS-controlled vehicles operating within urban environments would need to be highly perceptive to the presence of pedestrians, while those operating only in freeway environments would be less likely to encounter them². The distance at which road users and other objects need to be perceived would vary not only based on the ADS’s host vehicle speed but also on the expected speeds of other road users and objects within its ODD. Other aspects of perception performance that could be regulated would include field of view and resilience when subjected to atmospheric and electro-magnetic interference.

Another nearly 60% of crashes in the NMVCCS sample involved errors that IIHS researchers categorized as “planning and deciding” or “prediction” errors, which match NHTSA’s definition of “planning” reasonably well. The most common “planning and deciding” errors were speeding, illegal maneuvers, following too closely, and other aggressive driving. Thus, our suggestion that NHTSA require that ADSs heed traffic laws would help address these errors. Similarly, regulations defining acceptable assumptions about other road users’ movements could be used as the basis for judging whether ADS prediction algorithms are sufficiently cautious.

Question about NHTSA's research

Question 14. What additional research would best support the creation of a safety framework? In what sequence should the additional research be conducted and why? What tools are necessary to perform such research?

Research is needed to better understand how the application of MPrISM, RSS, and Safety Force Field would relate to actual crash risk/severity in a fleet of vehicles designed to adhere to these principles. Implementation of MPrISM in regulating ADS behavior would require an understanding of which value or range of values for the defined metric represent driving behavior that is safer than the typical human driver. RSS depends on the validity of assumptions about other road user behavior. At one extreme, these measures would result in ADSs unable to maneuver in regular traffic; while at the other extreme, these measures would allow more aggressive behavior in ADSs than typical human drivers exhibit. Initial research might involve a naturalistic driving study in which subjects drove vehicles instrumented to measure the distances and trajectories of other road users and objects so that NHTSA could develop a baseline understanding of driving behavior relative to these proposed engineering measures.

Conclusion

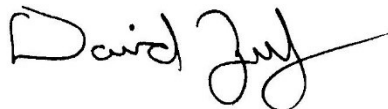
It is disappointing that 11 years after the advent of the Google Self-driving Car Project and more than 4 years since NHTSA published its first Federal Automated Vehicle Policy, the agency has yet to propose any specific guidance or regulation that would establish the goals for ADS safety. Instead, NHTSA continues to promote the fallacious notion that the mere substitution of ADS technology for human drivers will lead to fewer injuries and deaths from motor vehicle crashes. This leaves ADS developers uncertain about whether their creations will be judged acceptably safe and the public skeptical of the promised safety improvements.

² The likelihood of encountering pedestrians may be a reasonable basis for justifying different levels of reliability in different ODD, but should not be used to justify ignoring pedestrian-detection requirements altogether. Fifteen percent of pedestrians killed in 2018 died on interstates and freeways.

Deputy Administrator Steven Cliff
January 28, 2021
Page 5

As the forgoing comments suggest, there are concrete requirements NHTSA could impose on ADSs without concern about interfering with the innovation needed to bring ADS technology to fruition. Moreover, the use of voluntary guidance allows NHTSA to propose specific aims for ADS safety without imposing strict regulatory hurdles. We urge NHTSA to develop specific proposals to ensure that ADS technology fulfills its safety promise.

Sincerely,



David Zuby
Executive Vice President and Chief Research Officer
Insurance Institute for Highway Safety &
Highway Loss Data Institute

References

- Chase, C., & Osborne, B. (2020, May 3). Without regulation, self-driving cars could be a hazard. The Washington Post. Retrieved from <https://www.washingtonpost.com/>
- Consumer Federation of America. (2020). *2018 all-vehicles fatalities report*. Retrieved from <https://consumerfed.org/wp-content/uploads/2020/02/2018-December-OHV-Deaths-Report-Generator-ALL-2020.pdf>
- Federal Motor Vehicle Safety Standard No. 500; Low-speed vehicles, 63 Fed. Reg. 33194 (June 17, 1998) (to be codified at 49 C.F.R. pt. 571.500).
- Insurance Institute for Highway Safety. (2010, May 20). Low-speed vehicles and minitrucks shouldn't share busy public roads with regular traffic. *Status Report*, 45(5), 1–3, 6–7.
- Insurance Institute for Highway Safety. (2013, December 19). Many fatal all-terrain vehicle crashes take place on public roads. *Status Report*, 48(9), 6–7.
- Insurance Institute for Highway Safety-Highway Loss Data Institute. (2019, May 20). Comment submitted to Docket No. NHTSA-2019-0016: General Motors, LLC, petition for temporary exemption from various requirements of the safety standards for an all-electric vehicle with automated driving system.
- Insurance Institute for Highway Safety. (2020a). Red light running [web page]. Retrieved from <https://www.iihs.org/topics/red-light-running>
- Insurance Institute for Highway Safety. (2020b). Seat belts [web page]. Retrieved from <https://www.iihs.org/topics/seat-belts>
- Insurance Institute for Highway Safety. (2020c). Speed [web page]. Retrieved from <https://www.iihs.org/topics/speed>
- Monfort, S., Reagan, I. J., Cicchino, J. B., Hu, W., Gershin, P., Mehler, B., & Reimer, B. (2021). *Speeding behavior while using adaptive cruise control and lane centering*. Arlington, VA: Insurance Institute for Highway Safety.

References (continued)

- Mueller, A. S., Cicchino, J. B., & Zuby, D. S. (2020). What humanlike errors do autonomous vehicles need to avoid to maximize safety? *Journal of Safety Research*, 75, 310–318. doi:10.1016/j.jsr.2020.10.005
- National Transportation Safety Board. (2020a, January 22). *Collision between car operating with partial driving automation and truck-tractor semitrailer, Delray Beach, Florida, March 1, 2019* (Report No. NTSB/HAB-20/01). Washington, DC.
- National Transportation Safety Board. (2020b, February 25). *Collision between a sport utility vehicle operating with partial driving automation and a crash attenuator, Mountain View, California, March 23, 2018* (Report No. NTSB/HAR-20/01). Washington, DC.
- Reagan, I. J., Hu, W., Cicchino, J. B., Seppelt, B., Fridman, L., & Glazer, M. (2019). Measuring adult drivers' use of Level 1 and 2 driving automation by roadway functional class. *Proceedings of the Human Factors and Ergonomics Society 2019 Annual Meeting*, 2093–2097. doi:10.1177/1071181319631225
- Shepardson, D. (2020, February 25). U.S. agency slams brakes on self-driving EasyMile shuttles after passenger injury. Retrieved from <https://www.reuters.com/article/us-autos-selfdriving-idUSKBN20J2N6>
- Singh, S. (2015, February). *Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey* (Traffic Safety Facts Crash Stats. Report No. DOT HS 812 115). Washington, DC: National Highway Traffic Safety Administration.