

Anthony Gentile

NHTSA-2020-0106 Comment

Preamble

It is no secret that companies are spending billions of dollars on driverless car development.¹ Several states already allow driverless cars to be tested on public roads.² On top of this, at least one woman has already been killed by a self-driving car, even with a driver on board.³ Given that the driverless car market is bound to expand over the next few years and that roadways are more deadly for pedestrians than in recent history⁴, it is imperative that the NHTSA Framework for Automated Driving System Safety due all that it can to ensure that emerging ADS technology is safe for pedestrians, cyclists, and drivers alike. This comment will answer the relevant questions asked at the end of 49 CFR Part 571, V., "Questions and Requests."

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

A. ADS Must Be Safe For All Members of Society

My conception for a Federal safety framework for ADS is premised on a few key ideas.

¹ Amir Efrati, *Money Pit: Self-Driving Cars' \$16 Billion Cash Burn*, THE INFORMATION (Feb. 5, 2020), <https://www.theinformation.com/articles/money-pit-self-driving-cars-16-billion-cash-burn>.

² Jack Karsten and Darrell West, *The state of self-driving car laws across the U.S.*, Brookings (May 1, 2018), <https://www.brookings.edu/blog/techtank/2018/05/01/the-state-of-self-driving-car-laws-across-the-u-s/>.

³ Daisuke Wakabayashi, *Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam*, THE NEW YORK TIMES (Mar. 19, 2018), <https://www.nytimes.com/2018/03/19/technology/uber-driverless-fatality.html>.

⁴ Colin Beresford, *Pedestrian Deaths in 2019 Were Highest in 30 Years, Report Says*, Car and Driver (Feb. 27, 2020), <https://www.caranddriver.com/news/a31136893/pedestrian-deaths-increase-2019>.

First, that ADS must be safe for all members of society. This includes people with disabilities, people of all races, genders, ages, and locations, and people who use all modes of transportation. It is vital that ADS technology is tested for safety for all of these groups because each are affected differently than the others. Currently, a black man is "about twice as likely to be killed while walking (or wheeling) as white men and four times more likely to be killed than the general population."⁵ On top of race, age and income also play a part in the likelihood of being killed by a vehicle as a pedestrian. Pedestrians over the age of sixty-five are "about 35 percent more likely to be killed while walking than people in their twenties".⁶ In terms of income, in 2014, "census tracts with high poverty rates have about twice as many pedestrian deaths as those with low poverty."⁷ These demographic disparities are symptoms of current societal, systemic problems. If ignored, it is likely that ADS systems will either continue or worsen these problems.

i. ADS Must Avoid Algorithmic Bias

ADS systems are susceptible to the problem of algorithmic bias. This bias can be found in systems like the automatic setting of bail and sentencing limits, where flawed historical data that relies on racial bias is foundational to the algorithm⁸, the software used on Twitter to crop photos⁹, and even software created by Google classifying photos of black people as gorillas.¹⁰

⁵ Angie Schmitt, *RIGHT OF WAY* 34 (2020).

⁶ *Id.* at 40.

⁷ *Id.* at 43.

⁸ Nicol Turner Lee et al., *Algorithmic bias detection and mitigation: Best practices and policies to reduce consumer harms*, BROOKINGS (May 22, 2019), <https://www.brookings.edu/research/algorithmic-bias-detection-and-mitigation-best-practices-and-policies-to-reduce-consumer-harms/>.

⁹ Jason Slotkin, *Twitter Announces Changes To Image Cropping Amid Bias Concern*, NPR (Oct. 2, 2020), <https://www.npr.org/sections/live-updates-protests-for-racial-justice/2020/10/02/919638417/twitter-announces-changes-to-image-cropping-amid-bias-concern>.

¹⁰ Kevin Todd, *The Problem of Algorithmic Bias in Autonomous Vehicles*, JOURNAL OF LAW AND MOBILITY BLOG (Mar. 12, 2019), <https://futurist.law.umich.edu/the-problem-of-algorithmic-bias-in-autonomous-vehicles/>.

Unsurprisingly, there is already evidence that detection systems used in autonomous vehicles are more error prone for pedestrians with dark skin.¹¹ Bias testing in software should be recommended throughout the design process to reduce the risk that the end result of development does not have the aforementioned problems. Further, public disclosures about the number of collisions by a certain ADS technology by the manufacture broken down by race, mobility ability, etc. may encourage companies to work more rigorously to address and update technology in use by the public or in the development of new technology. Category based collision reporting is an important tool that should be used outside of ADS-equipped vehicles as well. This way, the Agency and manufacturers can gather useful data that may inform new policy or technology changes.

ii. Non-Driver Safety Testing

Outside of strict algorithmic bias, the Framework should also include provisions for testing the capability of the ADS system to detect and handle the presence of slow moving pedestrians, pedestrians in wheelchairs or with any other movement-aiding device, and cyclists. Traffic systems are not designed with slower moving pedestrians in mind.¹² This means, for instance, that slow moving pedestrians often find themselves in the middle of an intersection after the do not walk signal has been given.¹³ ADS technology must be able to detect the presence of a slow moving pedestrian that is moving irregularly compared to an average pedestrian that might be the basis for detection within the ADS. This requirement would help to protect elderly pedestrians, pedestrians with disabilities, and any other pedestrians that happen to be moving more slowly than the baseline. Similarly, ADS technology must be tested for safety in

¹¹ *Id.*

¹² *Right of Way*, 41.

¹³ *Id.*

detecting and handling mobility devices. On top of moving more slowly than an average pedestrian, pedestrians using mobility devices will have a different shape and movement than pedestrians not using mobility devices. The Framework must ensure that these pedestrians are as safe as everyone else. Finally, the Framework must ensure the safety of cyclists. Given the history of bias in technology and the societal and systemic bias in our country, the Framework must include provisions that protect the most vulnerable in our population.

The safety of pedestrian and other non-vehicle traffic should be addressed through both engineering measures and process measures. Engineering measures would include the actual testing of the technology to ensure that it is safe for all skin colors, mobility abilities, non-vehicle transportation modes, etc. The exact process measures involved in the Framework may be more complicated.

B. ADS Testing Results Should Be Public

Second, that manufactures and implementers of ADS technology will be public about the results of safety tests and evaluations, and any problems or errors that arise from the technology while it is in use. In the same way that companies use positive crash test ratings to draw in customers¹⁴, companies will be incentivized to strive for high scores on ADS safety tests as well. Similarly, by requiring that companies disclose problems with their ADS technology that is in use by the general public, companies will be incentivized to continually monitor and update their technology as to not incur ill will by potential customers. Not only will this encourage good

¹⁴ Veerender Kaul et al., *Consumer Attitudes and Perceptions about Safety and Their Preferences and Willingness to Pay for Safety*, SAE INTERNATIONAL, (Oct. 19, 2010) ("Analysis of respondent's feedback clearly indicates that U.S. consumers consider safety features that protect occupants in a collision and features that enhance braking or steering such as ABS, TCS, ESC, airbags, BSD as important features when it comes to new vehicle purchase.").

behavior from companies through commercial pressures, but it could act as a source of data for other companies engaged in development of similar ADS technology.

A recent study conducted on how U.K. companies have reacted to new, mandatory, greenhouse gas emissions disclosures provides an excellent example of this behavior. The author of the study found that companies that are more concerned with their public reputations lowered their greenhouse gas emissions by a larger amount than those that were less concerned with their public reputation.¹⁵ Additionally, the author found that mandated reporting caused firms to change their behaviors to keep up with their competitors and prepare for further regulations.¹⁶ These types of behaviors would be very beneficial to consumers of ADS technology, non-driver passengers of vehicles, and non-motorists on and around the road. Car manufactures certainly care about their brand image and reputation. Like in the above example, disclosures about the safety of a given ADS technology would likely induce competition amongst manufacturers to achieve high scores. Plus, like the U.K. firms, mandatory disclosures could inform manufacturers of expectations of current regulations and help them prepare for new regulations.

C. ADS Framework Implementation Should be Rolled Out in Pieces

Finally, that the Framework will be implemented and updated piece by piece proactively instead of all at once. This will stop the framework from holding back already useful systems as it waits to certify all systems. By implementing the framework piece by piece, the NHTSA can get ahead of emerging technologies and ensure that they are safe before they hit the market, instead of allowing the ADS market to decide for itself after unleashing dangerous new technology on the public. For example, there is evidence that an adoption of automatic

¹⁵ Jody Grewal, *Real Effects of Disclosure Regulation on Voluntary Disclosers*, JOURNAL OF ACCOUNTING AND ECONOMICS, 30-31 (Feb. 2021), <https://doi.org/10.1016/j.jacceco.2021.101390>.

¹⁶ *Id.*

emergency braking, lane departure warning, blind spot warning and pedestrian detection could reduce collision casualties by 11,800 lives.¹⁷ These technologies have already been tested through public use (whether or not that was the right way to go about it is not terribly relevant at this point) and their mandatory adoption should not have to wait for the entire framework to be developed. To handle future situations like this, the Framework could be split into tiers based on how autonomous and impactful the actions taken by the system are. For instance, there is a clear difference between alerting a driver of an object in a blind spot with a light and sound and the car parking or changing lanes without any input of the driver.

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?

Agency should focus its monitoring and safety oversight efforts on the finished product testing stage of the manufacturing process. Ideally, the agency would also be able to devote resources to the oversight and monitoring of the development stage of emerging ADS technology but as resources are limited, finished product testing should take priority. Focusing on the finished product testing stage incentivizes manufacturers to develop efficient processes to manufacture ADS technology that will ultimately pass the rigors of finished product testing oversight and monitoring by the Agency. Manufacturers will still be bound by other laws and regulation for development and production of technology generally. Thus, if those manufactures can innovate the best way to create safe ADS technology legally, there should be no need for monitoring or oversight by the Agency in that process. At the end of the day, the finished

¹⁷ Safer Vehicles and Highways, CENTER FOR STUDY OF RESPONSIVE LAW, 6 (Jan 2021), <https://nader.org/wp-content/uploads/2021/01/AutoSafetyReport2021.pdf>.

product safety is going to be what saves lives for the general public so that should be the primary focus.

Question #3: How would your conception of such a framework ensure that manufacturers assess and assure each core element of safety effectively?

In order to ensure that manufactures asses and assure each core element of safety, the Framework must provide testing guidelines and data reporting requirements. Appropriate testing guidelines would provide manufactures information on what needs to be tested and what test results are considered acceptable. At a bare minimum, useful testing guidelines would require that manufacturers test technology in variable environments that can simulate different weather events, light levels, stationary objects, other vehicles, and the varied types and behaviors of pedestrians as described in the response to question 1, above.

At a more granular level, safety testing should be broken into very specific categories so the safety of the driver, other drivers, and non-drivers is assessed and assured. Creating testing requirements will require a determination of an acceptable amount of risk for different situations. Once a baseline level of risk is determined, the acceptable level should be adjusted for factors like potential injury severity or property damage. For instance, the acceptable level of risk of ADS failure that leads to hitting an elderly pedestrian at high speeds, where death is very likely, should be lower than the risk of ADS failure that leads to a 5 mph rear ending of another vehicle.

In addition to specific testing guidelines, data reporting requirements must be implemented to assure the public that manufacturers are meeting or exceeding testing requirements. The Framework would require that manufacturers report a standard form of data, that can easily be compared against other manufacturers, that proves compliance with the testing

guidelines. The Framework may need to require video or other non-text requirements for data as well. This data would then be collected and shared with the public to allow consumers to choose the best option for them. Given the complex nature of testing ADS technology, the Framework should provide a comprehensive system that makes data from different manufacturers (who may have different obstacle courses, simulations, etc.) comparable. The National Transportation Safety Board shares this view, specifically for automated pedestrian safety technology.¹⁸

Question #6: Do you agree or disagree with the core elements (i.e., “sensing,” “perception,” “planning” and “control”) described in this document?

I agree with the core elements described in this document but would recommend that the language for sensing and perception be updated to place more emphasis on pedestrians and cyclists. As mentioned in my responses to several other questions, pedestrians and cyclists are being killed by motorists at an alarming rate. ADS technology is uniquely positioned to help both drivers and non-drivers alike. By developing systems like crash avoidance, emergency braking, blind spot warnings, etc. the road can be safer for both pedestrians and drivers. However, if the Framework only focuses on driver safety, the costs associated with vehicle collisions will never be eliminated. By adding more emphasis on pedestrian and cyclist safety in the 'sensing' and 'perception' elements of the Framework, the Agency can push future ADS technology to make the roads safer for everyone as well as reduce the costs of collisions on society.

Question #7: Can you suggest any other core element(s) that NHTSA should consider in developing a safety framework for ADS? Please provide the basis of your suggestion.

I suggest that "failure" should be added as a core element. As a complete system, an ADS

¹⁸ NAT'L TRANSPORTATION SAFETY BOARD, NTSB/SIR-18/03, Pedestrian Safety 27 (2018).

equipped vehicle must be able to handle the situation where the technology fails. The safety of an ADS equipped vehicle must include the safety of the vehicle without ADS technology. A vehicle that is incapable of being safe without the aid of ADS technology is not really safe at all given that no technology can be 100% reliable. Thus, in order to promote a truly safe environment, the handling of technological failure should be emphasized just as much as the other core elements.

Even in seemingly small cases, failure can be a major determinant of safety. For instance, a driver who is used to driving with blind spot assistance technology may act unsafely when that technology fails without adequately warning or making the driver aware that it has failed. Not hearing the familiar beep or seeing the familiar flashing lights, the driver may collide with a nearby car in his or her blind spot while changing lanes. As ADS technology gets more advanced or takes over more control of the car, the ability for the technology to fail gracefully in a safe manner becomes more and more important.

Question #10: Which safety standards would be considered the most effective as improving safety and consumer confidence and should therefore be given priority over other possible standards? What about other administrative mechanisms available to NHTSA?

The inclusion of ADS technology in the NCAP and the IIHS's rating system could boost the safety and consumer confidence of ADS technology. The NTSB recommends that automated pedestrian safety systems be included in the NCAP and IIHS's rating system.¹⁹ According to the report, inclusion in these standards could advance and promote ADS to consumers.²⁰ The report gives the examples of electronic stability control and roof strength standards for this

¹⁹ *Id.*

²⁰ *Id.*

phenomenon.²¹ The benefits of this route come from the fact that these organizations and systems are already in place. Adding new testing categories to these systems would be less costly than creating entirely new ones. Plus, consumers already recognize and appreciate the ratings given by these groups. Consumers who value these ratings would push manufacturers to compete for high ratings. Finally, using these systems would provide a comparable data set. Instead of having different manufacturers conduct tests, which would differ in one way or another, each test done by the respective group would be comparable to one another.

To reach the goal of the Framework to promote the safety of ADS technology for all pedestrians and non-drivers, ADS technology testing included in the NCAP and IIHS's rating system should differentiate pedestrians by age, gender, and physical ability. This would assure that new technology does not only work for a certain group of people. This idea is supported by the Center for Study of Responsive Law in its report *Safer Vehicles and Highways*.²² In a 2010 report by SAE International, the data shows that U.S. drivers allocate most of their car buying budget for safety on technology that protects themselves, with pedestrian safety as a second.²³ The access to more information about pedestrian safety and new technology aimed at promoting it may change the attitudes of American car buyers.

In terms of other administrative mechanisms, reporting requirements may achieve similar results as the inclusion in NCAP and the IIHS's ratings. If the Agency was able to either convince or require the leading manufacturers to disclose testing procedures, safety data, mechanisms, etc. then consumers would be informed in a similar way to the NCAP and IIHS's

²¹ *Id.*

²² *Safer Vehicles and Highways*, CENTER FOR STUDY OF RESPONSIVE LAW, 8.

²³ *Consumer Attitudes and Perceptions about Safety and Their Preferences and Willingness to Pay for Safety*, SAE INTERNATIONAL, 5 (Oct. 19, 2010).

ratings. However, this data may be view as biased or untruthful because it is coming from the manufacturers, who may have an incentive to either bend the truth or only do tests that make them look good. These issues may be alleviated if the Agency were to mandate reporting requirements that were comprehensive.

Question #12: What types and quanta of evidence would be necessary for reliable demonstrations of the level of performance achieved for the core elements of ADS safety performance?

A. Sensing

The types of evidence and quanta of evidence needed for reliable demonstrations of the level of performance achieved for the core elements of ADS safety performance vary for the various elements. For sensing, evidence of visual recognition of a wide variety of objects in a wide variety of environments would be necessary. As mentioned before, there is evidence that current sensing technology fails at a higher rate for black people than others. To combat this, evidence of successful visual capture of pedestrians of all colors, builds, ages, genders, mobility levels, etc. in various weather conditions would be necessary to satisfy the sensing element. In terms of quanta for this element, the exact figure would need to be established by the Agency after researching the costs and benefits of this kind of testing.

B. Perception

The type of evidence for perception would be similar to sensing. After the system receives the visual information, it would need to be able to differentiate the information into different categories. The system would have to correctly establish what the information represented. This also implicates pedestrians because it would be necessary to ensure that the system did not incorrectly categorize a person in a wheelchair with a bicycle or scooter for

instance. In terms of quanta for this type of evidence, the amount is virtually unlimited as one could feed the perception system image data that has already been "sensed" and make the perception system perceive it, which would basically be trivial to do at least thousands, if not hundreds of thousands, of times per second.

C. Planning

The planning element would take the perceived data and attempt to plan the best route based on that information. The type of evidence here would be successful, or unsuccessful, routes based on the perceived information. Whether or not the route was successful could be determined based on the number of objects hit, time to the destination, or a combination of the two. Like the perceiving system, this type of data could be fed to the system directly, making this type of testing relatively easier and the quanta of data whatever the Agency wanted.

D. Control

Evidence of the control element could be gathered by implementing the routes created by the planning system. Correct implementations of the routes would be compared against incorrect implementations. This type of test could be done at first in a simulation but would ultimately need to be done in real conditions to test the physical properties of the system. This type of testing is probably the most costly and the quanta of evidence would need to be decided by the Agency.

Conclusion:

Overall, I believe the steps taken by NHTSA are headed in the right direction. However, the entire proposal seems to ignore the pedestrian death crisis that we are experiencing as a nation. Going forward I would recommend that the Agency add more about pedestrian safety to most of the ideas in the proposal.