October 16, 2018

Docket Management Facility
U.S. Department of Transportation
Room W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590-0001

Re: Docket ID No. NHTSA-2018-0092; 83 FR 50872; RIN 2127-AL99; Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation

Dear Deputy Administrator King:

These comments are submitted in response to the NHTSA Advanced Notice of Proposed Rulemaking (ANPRM), Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation, NHSTA-2018-0092; 83 FR 50872; RIN 2127-AL99, published in the Federal Register on October 10, 2018. The NHTSA "seeks comments on potential factors that should be considered in designing a pilot program for the safe on-road testing and deployment of vehicles with high and full driving automation." I submit these comments under the NHTSA request for "comments from road users, including vehicle drivers and passengers, cyclists, and pedestrians."

The ANPRM focuses on whether the NHTSA can facilitate research to develop and establish standards for vehicles with high and full driving automation to operate safely on our nation's roads. Because the ANPRM states that high and full driving automation vehicles "may or may not be designed to allow a human occupant to assume control," I will presume a lack of intervention capability. The ANPRM states that "on-the-road testing and evaluation of Automated Driving Systems (ADS) vehicles will be critical to the successful development and integration of these vehicles into the roads and highways throughout the country." Although the ANPRM labels safety "a primary concern," I consider safety the overarching concern for the pilot program.

The National Transportation and Highway Safety Act of 1966 states that companies "may not manufacture . . . any motor vehicle . . . after the date of an applicable safety standard . . . unless the vehicle or equipment complies with the standard and is covered by a certification issued under section 30115 of this title." 49 USC § 30112(a)(1). The Federal Motor Vehicle Safety Standards would require exemptions to allow testing of high or full driving automation vehicles on the nation's roads. 49 CFR §§ 571, 555. The following comments are offered in response to the safety concern of ANPRM question 12: "Are there any additional areas to consider in the design of a safe pilot program for the testing and deployment of vehicles with high and full driving automation?"

Comment: The NHTSA should require any ADS vehicle operating at automation level 4 or 5 to be equipped with an automatic external alarm system to warn drivers, passengers, cyclists, and pedestrians whenever the automated systems experience ambiguity, perform avoidance maneuvers, or operate in degraded modes.

The ANPRM lists the functions of high and full driving automation as object detection, interpretation, data retention and processing, communication, and decision-making. The ANPRM stated intent is to develop automated systems that exceed humans' capabilities of detection, interpretation, communication, and reaction. This is possibly an achievable goal, particularly because some humans' capabilities are deficient or impaired while operating motor vehicles. But during the pilot program, any breakdown in ADS vehicle safety may stop development in its tracks.

ADS vehicles employ systems of optical, radar, and Lidar sensors to detect and analyze objects, including road markings and signage, vehicles, and other obstacles. *Special Report*: *Autonomous Vehicles,* The Economist, March 3, 2018. Software algorithms fuse sensor information with data bases to identify, predict, decide, and act. *Id.* One company has achieved an average rate of only 0.2 human interventions per 1000 miles of test driving, and two additional companies have achieved rates of less than six interventions per 1000 miles. *Id.* Lidar technology uses light to create a three-dimensional image of features and obstacles, but the system is limited in snowy conditions. *Id.* Computer system integrity is prone to cyber-security vulnerability. *Id.* Software algorithms must solve complex decisional situations, to include ethical dilemmas faced in multiple hazard avoidance maneuvers. *Id.*

Experts predict that state of the art technology will allow high and full automation vehicles to perform much better than human drivers on average. *Id.* Software protocols that ensure compliance with motor vehicle safety laws will ensure that ADS vehicles perform predictably in most hazardous encounters. *Id.* For example, ADS vehicles will be programmed to go to the nearest shoulder of the road, rather than crossing lanes, if a stop is necessary. *Id.* But unforeseen situations may cause ADS software to command unpredictable maneuvers. *Id.* In many hazardous scenarios, ADS software will react more quickly than humans to command abrupt stops. *Id.* Unpredictable maneuvers and partial system failures will create hazards for drivers, cyclists, and pedestrians in the ADS vehicles' paths. *Id.*

The United States has lost 650,000 lives in automobile accidents since 2000. *Id.* Testing of high and full automation vehicles should facilitate a marked improvement in automobile safety. The average ADS vehicle has the potential to perform much more safely than the current average vehicle. But just as emergency vehicles employ sirens and lights to warn others of their unusual speed and performance, ADS vehicles should employ automatic external warning when they operate in degraded or unpredictable manners. Until the pilot program test period ends, because testing exposes unwitting participants to mortal risk, every feasible safety measure must be employed.

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