MONTGOMERY COUNTY PLANNING DEPARTMENT
THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

January 29, 2021

Ryan Posten
Associate Administrator, Rulemaking
National Highway Traffic Safety Administration
M–30, U.S. Department of Transportation, West Building
Ground Floor, Room W12–140
1200 New Jersey Avenue SE
Washington, District of Columbia 20590

RE: Docket Number NHTSA-2020-0106

Dear Associate Administrator Posten:

The Montgomery County Planning Department ("Department") welcomes the opportunity to comment on the National Highway Traffic Safety Administration's (NHTSA) development of a framework for Automated Driving System (ADS) safety (Docket Number NHTSA-2020-0106). Montgomery County is the most populous county in the state of Maryland and is located just outside our Nation's Capital. The Department has authority to plan for the orderly development and protection of the natural resources in Montgomery County through the adoption of master and functional plans, the review of development applications, and the development of land use and zoning regulations. The Department also plays a vital role in shaping the future of the transportation system in the county by defining transportation adequacy standards applied during development review and producing functional plans and documents that provide recommendations on bikeways and bicycle parking, transitways and transit stations, and context sensitive roadway classifications, design standards, right-of-way widths, target speeds and number of through lanes.

Transportation safety is a top priority in Montgomery County underscored by its 2016 resolution to adopt Vision Zero. The resolution aims to eliminate all traffic related fatalities and severe injuries by 2030. The Department is cautiously optimistic of the role ADS equipped vehicles will play in helping the county meet its safety goals by 2030 and beyond. Safety, however, should not come at the expense of an equitable and diverse transportation system. The following letter outlines three primary concerns the Department has regarding ADS safety: (1) the difficulty in defining an Operational Design Domain (ODD) in an environment as diverse as Montgomery County, (2) the appropriate interplay between full autonomy and allowing for vehicle passengers to make manual "overrides" to the ADS system, and (3) algorithmic biases embedded in some of the technologies employed in ADSs.

The ODD describes the specific operating domains in which the ADS is designed to function which may include "roadway types, speed range, lighting conditions, weather conditions, and other operational constraints."[1] The Department, however, recognizes that our streets serve many roles

[1] Staplin, L., Mastromatto, T., Lococo, K. H., Kenneth W. Gish, K. W., & Brooks, J. O. (2018, September). The effects of medical conditions on driving performance (Report No. DOT HS 812 623). Washington, DC: National Highway Traffic Safety Administration.

outside of vehicular travel which include accommodating other modes of travel, supporting economic exchange, facilitating social engagement, and providing a conduit for other forms of infrastructure and ecological processes. The Department would want to ensure that any defined non-interstate ODD, a prerequisite to ensure ADS safety, would not preclude any of these vital roles that streets play in our community. In addition to defining an all-inclusive ODD, additional considerations in a safety framework include Object and Event Detection and Response (OEDR), maneuvers that include other aspects of operation that go beyond controlling vehicle motion itself, and fault management. Together these factors create a "four-dimensional" validation matrix for which "the cross-product space of all possible factors across all four axes must be addressed."[2] The product of this matrix is extraordinarily massive.

The Department is also interested in NHTSA's stance on the appropriate interplay between full autonomy and allowing for vehicle passengers to make manual "overrides" to the ADS system. For example, when is it appropriate for a passenger to specify a different speed, path, maneuver, or other operational decision under normal operating environments? A review of the National Motor Vehicle Crash Causation Survey (NMVCCS) indicates there are five categories of driver-related contributing factors to automobile crashes: (1) sensing/perceiving (i.e., not recognizing hazards); (2) predicting (i.e., misjudging behavior of other vehicles); (3) planning/deciding (i.e., poor decision-making behind traffic law adherence and defensive driving); (4) execution/performance (i.e., inappropriate vehicle control); and (5) incapacitation (i.e., alcohol-impaired or otherwise incapacitated driver).[3] Approximately 67 percent of driver caused crashes are due to failures outside of sensing/perception errors and incapacitation, two "low-hanging" fruits conceivably addressed by ADS equipped vehicles. The research illustrates, however, that manual overrides of default ADS decisions could result in a substantial number of crashes due to planning/deciding (41%), execution/performance (23%), and predicting (17%) factors.

Some of the equitable concerns related to the safety of vulnerable road users (VRUs) and traffic-safety disparities are based in the technology itself. These concerns should and can be addressed at both the development and pre-deployment stages. There has been growing concern regarding algorithmic bias as it relates to potential disparities in age, skin color and gender. A handful of studies have emerged highlighting that even the most advanced facial recognition algorithms have difficulty correctly identifying individuals with darker skin tones. Since 2017, the National Institutes of Standards and Technology (NIST) has released studies evaluating facial recognition algorithms from leading artificial intelligence (AI) companies and has repeatedly found that they underperform based on demographic differentials.[4]

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[2] Koopman, P., Fratrik, F. (2019, January). How Many Operational Design Domains, Objects, and Events? AAAI Workshop on Artificial Intelligence Safety. Retrieved from https://users.ece.cmu.edu/~koopman/pubs/Koopman19_SAFE_AI_ODD_OEDR.pdf

[3] Mueller, A., Cicchino, J., Zuby, D. (2020, December). What humanlike errors do autonomous vehicles need to avoid to maximize safety? Journal of Safety Research, 75, 310-318. https://www.sciencedirect.com/science/article/abs/pii/S0022437520301262

[4] Simonite, T. (2019, July 22). The Best Algorithms Struggle to Recognize Black Faces Equally. *WIRED.* Retrieved from https://www.wired.com/story/best-algorithms-struggle-recognize-black-faces-equally/

In 2019, NIST published a study that measured the demographic differences in 189 commercially available algorithms by testing how well they executed two types of matching tasks.[5] The study reported two measures of false match, the false positive error rate and false negative error rate. The tests found that the false negative error rate was higher in women compared to men and that the false match rate discrepancy increased 10-fold for black females, the highest for any demographic group. The report does not explore the causes of the variations but observed that the rate for false negatives significantly decreased when algorithms were tested against standards-compliant images (e.g., ISO/IEC TR 29794-5:2010, Information technology – Biometric sample quality – Part 5: Face image data[6]) and recommends improved standards compliance for training data.[7]

Although both false positive and false negatives for demographic effects present challenges to the safe deployment of ADS, mitigating false negative errors is more applicable to the concerns of pedestrian safety. In a false negative scenario, an ADS-equipped vehicle or an autonomous vehicle (AV) fails to classify the pedestrian as a human-annotated object, resulting in a decision to not yield when in fact there was a pedestrian crossing, leading to either injury or death. In contrast, in a false positive scenario, the AV incorrectly identifies a pedestrian where there is none and proceeds to execute an evasive maneuver when none is required. Evasive maneuvers due to false positives could impact the safety of other vehicle users and may result in rear-end or side swept collisions if the AV fails to check surrounding traffic. Although crashes due to overcorrecting or evasive maneuvers represent a small percentage of crashes (3.1% based on 2018 NHSTA data), high false positive errors made by AVs and ADS-equipped vehicles could potentially increase this number.[8]

To date most studies evaluating the demographic variations of AI performance has focused on facial recognition systems used for law enforcement and national security purposes. However, these findings can help inform what additional gaps exist in the ADS Safety Framework and provides recommended avenues of research to mitigate demographic differentials that can improve the reliability of ADS. Currently, we have only identified one study that examines predictive disparities of machine learning as it relates to ADS applications. Researchers at the Georgia Institute of Technology found that the discrepancies in detecting pedestrians with darker skin tones on the Fitzpatrick skin type scale (4-6) could not be attributed to challenges related to pedestrian detection, such as time of day, occlusion, varied lighting conditions, or clothing. The study suggests that one cause of disparities is sampling bias, which distorted the model's behavior by prioritizing accuracy for the larger population, pedestrians with lighter skin tones (1-3). The researchers found that reweighting could correct the impacts of function loss prioritization in standard datasets, which they found overrepresented lower-Fitzpatrick (1-3) scored pedestrians by a factor three.[9]

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[5] National Institutes of Standards and Technology. (2019, December 19). NIST Study Evaluates Effects of Race, Age, Sex on Face Recognition Software: Demographics study on facial recognition algorithms could help improve future tools. Retrieved from https://www.nist.gov/news-events/news/2019/12/nist-study-evaluates-effects-race-age-sex-face-recognition-software

[6] International Organization for Standards. (2010). *Information technology – Biometric sample quality – Part 5: Face image data* (ISO Standard 29794-5:2010). https://www.iso.org/standard/50912.html

[7] Grother, P., Ngan, M., and Hanaoka, K (2019). Face Recognition Vendor Test (FRVT) Part 3: Demographic Effects. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Internal/Interagency Report (NISTIR) 8280. https://doi.org/10.6028/NIST.IR.8280

[8] National Highway Traffic Safety Administration. "Driving Behaviors Reported for Drivers and Motorcycle Operators Involved In Fatal Crashes, 2018" [Table]. Retrieved from https://www.iii.org/table-archive/21313

[9] Wilson, B., Hoffman, J. and Morgenstern, J. (2019). Predictive Inequity in Object Detection. *ArXiv.* Retrieved from https://arxiv.org/pdf/1902.11097.pdf

Algorithmic bias in the technology may be a market failure that requires a more defined federal role to address factors in development and training that result in demographic differentials. While research on this issue in the context of ADS is sparse, early findings are concerning and warrant additional investigation. Addressing sources of demographic differentials through regulation poses several challenges including increased data collection, annotation and acquisition costs to developers. However, further research into this area has the potential to ensure that ADS-equipped vehicles do not exacerbate existing pedestrian traffic safety disparities faced by communities of color[10] and the elderly.[11] The Agency should investigate the feasibility of using the Voluntary Safety Self-Assessment (VSSA) as a channel by which demographic differentials in the technology are assessed with stakeholders in the ADS community. The effectiveness of the VSSA might be strengthened by extending the "crash-worthiness" safety element to include demographic differential reporting.

The Department also has other concerns of the potential impacts of ADS equipped vehicles on its three policy framework pillars: economic health, equity, and environmental resilience. These concerns, however, are currently outside the Agency's rule-making authority or enforcement authority. The Department looks forward to future opportunities to engage with NHTSA and other federal and private players in the ADS arena. Whatever safety framework is applied, it will be local jurisdictions that will ultimately be impacted with the outcomes and consequences. Existing channels of coordination such as the AV TEST Initiative are an important first step to initiate dialogue between different states where AV testing is occurring, but it is an incomplete approach for coordination with localities. More intentional and dedicated local government peer-exchanges are needed to ensure best practices for preparing for deployment can be shared, including how safety is defined by local agencies responsible for permitting. NHTSA should explore the feasibility of creating a sub-initiative composed of listening sessions and visioning exercises targeted at local jurisdictions. There is an opportunity for the Federal Government to use its convening power to jumpstart these conversations.

Thank you for the opportunity to provide these comments. Please contact Russell Provost, Transportation Planner Coordinator, at Russell.Provost@montgomeryplanning.org or 301-495-4638 with any comments or questions.

Kind regards,

Jason Sartori
Chief, Countywide Planning & Policy
Montgomery County Planning Department

JS:RP:aj

[10] Hamann, C., Peek-Asa, C., and Butcher, B. (2020). Racial disparities in pedestrian-related injury hospitalizations in the United States. *BMC Public Health, 20*(1459), https://doi.org/10.1186/s12889-020-09513-8

[11] National Highway Traffic Safety Administration. (2018). *Traffic Safety Facts: Older Population* [Fact sheet]. U.S. Department of Transportation. Retrieved from https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812928