Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Virginia Tech Transportation Institute

3500 Transportation Research Plaza (0536)
Blacksburg, Virginia 24061
(540) 231-1500 Fax: (540) 231-1555
http://www.ctr.vt.edu

Date: November 16, 2020

To: National Highway Traffic Safety Administration

Regarding: NHTSA's advance notice of proposed rulemaking and public comment (Federal Register Notice 2019-22036) related to camera-based rear visibility systems (i.e., Camera Monitor Systems, or CMS)

From: Robert E. Llaneras, Virginia Tech. Transportation Institute on behalf of industry sponsors

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We are submitting results of a recent CMS-based study in response to NHTSA's desire to obtain supporting information on Camera Monitoring Systems to aid in determining whether these systems can provide the same level of safety as the rearview mirrors currently required under FMVSS No. 111.

The study evaluated a set of prototype CMS-based systems intended to replace light passenger vehicle conventional exterior mirrors (driver and passenger-side mirrors) and characterized driver performance and interactions under both controlled and naturalistic settings. This effort gathered real-world performance data with a sample of 36 drivers, providing a large-scale, naturalistic driving dataset capturing driver interactions with camera-based systems and allowing benefits and safety equivalency to be assessed. Work was performed by the Virginia Tech Transportation Institute with industry sponsors (General Motors, Hyundai-Kia, Volkswagen, Ford Motor, Mitsubishi, Denso, and Ficosa).

We are sharing these results (provided in the form of a .pdf Power Point Summary) in an effort to advance the state-of-knowledge in this area. The study addresses many of NHTSA's concerns related to CMS including driver acceptance, glance behavior, and potential driver adaptations, among others. Overall results suggest that driver performance and interactions with camera-based systems are closely aligned with conventional mirrors. Evidence suggests, for example, that drivers can quickly acclimate to camera-based systems, and that systems were found to significantly improve a driver's ability to detect the presence of vehicles when in the "Blind Spot" area. Moreover, glance rates to support lane changes were not substantially changed by the introduction of camera-based systems; glance distributions found no evidence to suggest that driver's make excessively long glances to Camera-based displays when planning and executing signalized lane changes. Results also suggest that performance was found to be sensitive to design-related aspects associated with camera systems, suggesting that design specifications for Camera-based systems can be refined or optimized to address performance-based concerns. Optimization work along these lines has progressed since the implementation of this study which used protoype CMS technologies (some over 5 years old).

As referenced above, this study resulted in a large-scale, naturalistic driving dataset with drivers operating under both conventional and camera-based systems. Drivers logged 90,880 miles across all vehicle fleets with 46,730 miles under conventional mirror systems, and 44,149 miles of travel under the prototype camera-based systems. The dataset includes 25,655 signalized lane changes (at highway speeds), with 12,695 lane changes executed under the camera-based displays. Additional, more in-depth analyses and data mining efforts are possible with this resource. Efforts are currently underway, for example, to more fully explore time-to-collision judgments using data from rear-facing radar.

Sincerely,

Robert Eddy Llaneras, Ph.D.
Leader, Advanced Vehicle Applications Group
Virginia Tech Transportation Institute
3500 Transportation Research Plaza
Blacksburg, VA 24061
(540) 231-1524, ellaneras@vtti.vt.edu