[**4910-EX-P]**

DEPARTMENT OF TRANSPORTATION

Federal Motor Carrier Safety Administration

[Docket No. FMCSA-2022-0174]

Agency Information Collection Activities; Approval of a New Information Collection Request: Human Factors Considerations in Commercial Motor Vehicle Automated Driving Systems and Advanced Driver Assistance Systems

AGENCY: Federal Motor Carrier Safety Administration (FMCSA), Department of Transportation (DOT).

ACTION: Notice and request for comments.

SUMMARY: In accordance with the Paperwork Reduction Act of 1995, FMCSA announces its plan to submit the Information Collection Request (ICR) described below to the Office of Management and Budget (OMB) for review and approval. This notice invites comments on a proposed information collection titled *Human Factors Considerations in Commercial Motor Vehicle Automated Driving Systems and Advanced Driver Assistance Systems*. It is a driving simulator study with a series of questionnaires that will evaluate how commercial motor vehicle (CMV) drivers engage in CMVs equipped with SAE International Level 2 (L2) advanced driver assistance systems (ADAS) and Level 3 (L3) automated driving systems (ADS). Approximately 100 CMV drivers will participate in the study. The study will examine the effect of non-driving secondary task engagement, transfer of control, and training on driver behavior in CMVs equipped with ADAS and ADS.

DATES: Comments on this notice must be received on or before [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*].

ADDRESSES: Written comments and recommendations for the proposed information collection should be sent within 30 days of publication of this notice to

www.reginfo.gov/public/do/PRAMain. Find this information collection by selecting "Currently under 30-day Review - Open for Public Comments" or by using the search function.

FOR FURTHER INFORMATION CONTACT: Theresa Hallquist, Office of Research and Registration, DOT, FMCSA, West Building 6th Floor, 1200 New Jersey Avenue SE, Washington, DC 20590-0001; 202-366-1064; theresa.hallquist@dot.gov.

SUPPLEMENTARY INFORMATION:

Title: Human Factors in CMVs Equipped with ADS and ADAS.

OMB Control Number: 2126-00XX.

Type of Request: New ICR.

Respondents: Commercial motor vehicle drivers.

Estimated Number of Respondents: 100.

Estimated Time per Response: 4 hours.

Expiration Date: This is a new ICR.

Frequency of Response: Two responses.

Estimated Total Annual Burden: 476 hours.

Background:

Higher levels of ADAS and lower levels of ADS present an environment that is ripe for overreliance. An L2 vehicle offers longitudinal and lateral support to the driver; however, the driver is still responsible for driving at all times. An L2 vehicle is an example of higher levels of ADAS. At this level, engaging in non-driving secondary tasks can be highly detrimental to driving performance as the driver may not recognize and respond to hazards timely or appropriately. In an L3 vehicle, the role of distraction is blurred. L3 is the lowest level considered to be ADS. The driver takes on a more supervisory role and is in full control of the vehicle in a limited number of situations. When an L3 vehicle alerts the driver that a takeover is required, the driver needs to have

situational awareness to resume full control of the vehicle. Engagement in non-driving secondary tasks may prevent the driver from maintaining situational awareness of the driving environment.

A recently completed study by FMCSA on research involving ADSs in CMVs found a lack of research related to ADS-equipped CMVs. To date, most commercial ADSs on U.S. roadways are in passenger vehicles, and CMV ADSs have only recently begun being implemented in real-world operations. Therefore, FMCSA needs more data on ADS-equipped CMVs to understand driver behavior and policy implications.

The purpose for obtaining data in this study is to evaluate driver readiness to assume control in SAE L2 ADAS and L3 ADS-equipped CMVs and develop and test a CMV driver distraction training program designed to improve driver readiness. Specifically, there are three primary objectives for the data collection:

(1) determine the effect of distraction on CMV drivers of L2 vehicles;

(2) determine the effect of transfer of control on CMV drivers in L3 vehicles; and

(3) develop and evaluate a training program that is designed to decrease the levels of distraction that were identified in CMV drivers in L2 vehicles and designed to improve the problems with the transfer of control that were identified in L3 vehicles.

Answers to these research questions will provide insight into the human factors associated with semi-automated CMVs. Moreover, these findings will inform training materials to educate drivers on distraction and the functionality of ADAS and ADS as well as policy pertaining to the implications of ADASs and ADSs in CMVs.

The study includes data collection from a series of questionnaires and a driving simulator-focused experiment. The collected survey data will support the simulator experiment data. The survey data will be used in two ways: in the assessment of driving performance data as covariates in the model (to control for certain demographic variables, such as age, gender, and experience) and to answer a research question on the

relationship between driver characteristics and driver readiness and performance. Data on driver readiness and performance will be collected from the simulator experiment. Eligible drivers will hold a valid commercial driver's license, currently drive a CMV, be 21 years of age or older, and pass the motion sickness history screening questionnaire.

Data will be collected over two study sessions. The first study session will collect data on the effects of non-driving secondary tasks and readiness to resume control of an L2- or L3-equipped CMV. The second study session will assess the effectiveness of driver training to improve safety while operating an L2 or L3 CMV. Questionnaire data will be collected prior to the simulator study, during the simulator study, and after the simulator study. In addition, participants will complete questionnaires about the training in the second study session. All questionnaires will be preloaded in an app format for drivers to complete on a tablet.

We anticipate 100 participants in total for the driving simulator study. Fifty drivers will participate in the L2 study sessions, and the other 50 drivers will participate in the L3 study sessions. During consent, each participant will agree to participate in both the L2/L3 simulator study session and the training study session. For a participant who chooses not to continue, a new driver will be recruited to fill their position. These new participants will not have data from the L2/L3 study but will need to complete a new consent form, pre-/post-study questionnaires, and the training questionnaire. Each study session will be completed in 4 hours, resulting in a total of up to 8 hours of participation for drivers that complete both study sessions.

Multiple analyses will be used, including an assessment of driver distraction and its effects on driver readiness and driving performance. In the L2 and L3 studies, general linear mixed models (GLMMs) will be used to answer the research questions. In the transportation safety field, GLMMs are often used to analyze driver behavior and assess relationships between driving scenarios and behaviors. To evaluate the effectiveness of

the training program, linear mixed models will be used with random intercepts. Driver random intercepts will account for participants' correlated behaviors and expectations in the L2 or L3 system before and after training.

FMCSA published the 60-day *Federal Register* notice on September 21, 2022, and the comment period closed on November 21, 2022 (87 FR 57748). A total of 93 comments were received from the public. These comments revolved around nine issues: general safety concerns with CMVADS, concern for job loss due to ADS-equipped CMVs, concerns related to the operation of ADS within specific operational design domains, concerns with specific ADS and/or ADAS, the failure of ADS sensors, the security of ADS-equipped CMVs, driver inattention/distraction when operating an ADS, data collection efforts, and support for the study. Responses to these issues are below. Many comments touched on multiple issues; however, the comments below are organized based on the primary feedback provided.

General Safety Concerns with ADS-Equipped CMVS

Fifty percent of the comments received expressed general safety concerns related to ADS-equipped CMVs. FMCSA is actively engaged in many research and administrative activities to help improve the safety of CMV drivers and the general public, including research on ADS. There are many research questions that need to be answered before ADS-equipped CMVs are deployed at scale. Some of these research questions are focused on the ADS technology itself to ensure that the ADS technology functions as intended and incorporates the appropriate redundant failsafe systems. However, other research questions are focused on the human factors related to how individuals within the CMV industry will interact with ADS-equipped CMVs.

Crashes involving ADAS illustrate why research focused on human factors is critical prior to full-scale deployment of ADS. Many of the incidents involve a mismatch between driver expectations of the technology and the driver's true role and responsibility

to monitor vehicle features. This study is focused on L2 and L3-equipped CMVs. The systems included in this study would require a driver inside the vehicle who is ready to resume control of the vehicle when needed or requested (e.g., during icy conditions).

Results from this study will be used to develop and evaluate a training program designed to improve drivers' understanding and expectation of ADS. This training program will also attempt to improve drivers' attention maintenance and hazard anticipation while operating L2 and L3 vehicles. Although FMCSA believes this is a critical research study to understand how driver inattention may affect performance of L2 and L3 CMVs, it is only one research study of many that are needed to ensure the safety of drivers on the roadways.

Concerns for Loss of Jobs Due to ADS-Equipped CMVS

Ten comments from the public focused on the potential loss of jobs as a result of ADS-equipped CMVs. The trucking industry employs millions of individuals in the U.S. who are vital to the U.S. economy. Additionally, there are millions of other individuals who work in roles that support the transportation industry (e.g., gas stations, truck stops, maintenance facilities, etc.). Better pay for drivers, effective training, safe equipment, and improved quality of life for drivers are important factors for retaining safe drivers within the industry.

ADAS and ADS offer possible solutions that help drivers maintain a better quality of life. For example, they may offer improved health through crash reduction and allow more home time through more regional operations for drivers who so desire. As mentioned above, this study is focused on L2 and L3 ADS-equipped CMVs. Both systems under investigation in this study would require a driver to be in the truck at all times and ready to resume control of the vehicle when requested. Thus, the technologies investigated in this study would not result in driver job loss.

Concerns for ADS in Specific Operational Domains

Seven comments provided by the public focused on concerns related to ADS-equipped CMVs operating outside of their intended operational design domain. Each ADS is designed to operate within specific conditions. These conditions provide parameters for the safe operation of ADS on the road. Before widespread deployment of ADS, more development, testing, and verification of ADS-equipped CMVs is needed to understand safe parameters and before they can operate in all conditions or anticipate and respond to all possible infrequent events.

As mentioned above, the safety technologies being investigated require a driver inside the vehicle at all times who could assume control of the CMV if conditions dictate. Drivers operating an L2 or L3-equipped CMV must be ready to assume control in these situations. These situations demonstrate why it is important to research driver inattention and vigilance of the driver when operating L2 and L3 vehicles. This research will provide information to ensure drivers are capable and safe to assume control of the CMV when needed through the development and evaluation of a training program to educate drivers on ADS capabilities and highlight the importance of maintaining attention while operating L2 and L3 vehicles.

Concerns with Specific ADAS/ADS

Six comments expressed concerns related to a specific advanced driver assistance feature or a particular ADS. These comments illustrate how additional research and development are needed for many of the features that will support ADS in CMVs. Although the technology to support ADS (i.e., automatic emergency braking) has improved, there are still areas in need of improvement prior to the deployment of ADS-equipped CMVs. One of the objectives of this study is to better understand the effect of driver inattention while operating a CMV equipped with these support technologies. Ensuring drivers of L2 vehicles maintain attention to the road is important so that the drivers can anticipate hazards and potential scenarios where the L2 features may not

operate as intended. Similarly, research to study inattention while operating an L3 vehicle is needed to determine what training and education will help drivers prepare to resume control when requested. This research, conducted in a simulator, will help the industry better understand how drivers of L2 and L3 vehicles can be prepared to take over control when necessary to ensure the safe operation of the CMV and the safety of the general public.

Concerns Related to Sensor Failure

Twelve comments primarily discussed concerns related to the failure of ADS sensors. Drivers' concerns related to the importance of properly maintained and functioning sensors are valid. Sensors do fail and/or become dirty if covered in debris, making them inoperable. It is critical for ADS to have redundant sensors or a backup alternative sensor system in case of failure. Research on the functionality of the technologies and sensors is ongoing. However, human factors-focused research is also necessary to ensure the safety of L2 and L3 vehicles. The technologies researched in this study require a driver to be in the vehicle and ready to take over control when needed or alerted. This study will examine how driver inattention affects a driver's ability to successfully respond to or anticipate hazards or scenarios that may require human control of the vehicle. This research is critical to help in-vehicle drivers be prepared when a sensor does fail or if the technology does not anticipate a hazard appropriately.

Concerns Related to the Security of ADS

Two comments focused on securing ADS against threats. The security of ADS-equipped CMVs is of incredible importance. Research and efforts related to the security of the vehicles is needed. However, this is a separate area of research and development and should not detract from the importance of human-factors research. As mentioned above, the purpose of this study is to ensure in-vehicle drivers are capable and ready to

respond to unexpected hazards, scenarios, and requests to take over control of the vehicle when needed.

Concerns that Inattention/Distraction Will Increase with ADAS And ADS

Five comments discussed concerns related to potential increases in driver distraction, inattention, and reduced vigilance with the use of crash mitigation technologies. There is a need for research focused on driver inattention while operating CMVs equipped with ADAS and ADS. More data are needed to understand the prevalence of inattention when using, and drivers' overreliance on, crash mitigation technologies. This study is designed to gather data on these concerns in a safe environment without putting the CMV driver and the general public at risk. Results from this study will be used to develop training materials and information that may reduce this risk.

Concerns with the Data Collection Efforts

One comment focused on this study's proposed data collection methodology. As mentioned in the *Federal Register* notice, each study session will last approximately 4 hours. Although driver fatigue is an important area of research, this study is focused on driver distraction. However, driver fatigue may be observed in the study and will be identified and documented via eye tracking technologies.

Power analyses were performed to approximate the number of participants needed to find statistically significant results (if present). The sample included in this study was based on this power analysis with additional participants to account for attrition. However, the sample is a convenience sample, and there are no attempts to say the sample is representative of the U.S. CMV industry. Demographic information (e.g., gender, age, health, etc.) will be collected and may be used to help control for potential confounding or extraneous variables during the statistical analyses.

Support for the Study

Three comments provided support for the study and provided additional insights based on recent investigations or research. Additional comments expressed the importance of focusing research on higher levels of ADS (i.e., L4 or L5). Although FMCSA agrees much more research and data are needed on more advanced ADS, some original equipment manufacturers and developers of L2 and L3 vehicles are deploying vehicles with lower levels of driver assistance or automation. For example, L2 CMVs are available for purchase now. Research is needed to understand how inattention affects performance in vehicles with these levels of ADS and to ensure the safety of the CMV driver and the general public.

FMCSA agrees that distinguishing between features of L2 and L3 vehicles is important. This study focuses on both advanced driver assistance features (via L2 vehicles) and the lowest level of ADS (via L3 vehicles). Additional distinctions are provided in the supporting documentation, and FMCSA will ensure that distinctions between functionalities are included in the discussion of the results. To help improve this clarity, FMCSA proposes to revise the study title to include ADAS (in reference to the L2 sub study).

Public Comments Invited: You are asked to comment on any aspect of this information collection, including: (1) whether the proposed collection is necessary for the performance of FMCSA's functions; (2) the accuracy of the estimated burden; (3) ways for FMCSA to enhance the quality, usefulness, and clarity of the collected information; and (4) ways that the burden could be minimized without reducing the quality of the collected information.

Issued under the authority of 49 CFR 1.87.

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