Department of Transportation
Federal Motor Carrier Safety Administration

SUPPORTING STATEMENT PART A
Human Factors Considerations in Commercial Motor Vehicle Automated Driving Systems and Advanced Driver Assistance Systems
OMB Control Number: 2126-xxxx

SUMMARY
- This new information collection request (ICR), a driving simulator study with a series of questionnaires, will evaluate the impact of secondary tasks, transfer of control, and training on driver behavior in commercial motor vehicles (CMVs) equipped with advanced driver assistance systems (ADAS) or automated driving systems (ADS). This study will be used to develop tools for the integration of ADS-equipped CMVs within the trucking industry and inform policy recommendations for ADS-equipped CMVs.
- The simulator study will consist of two 4-hour simulator study sessions completed at the Virginia Tech Transportation Institute (VTTI) with a simulated Level 2 (L2) ADAS or Level 3 (L3) ADS. L2 ADAS-equipped CMVs are capable of longitudinal and lateral control without input from a human driver, yet the driver is always expected to monitor the roadway to maintain safety (i.e., adaptive cruise control, lane centering). Whereas in L3 ADS-equipped CMVs the vehicle is intended to provide all functions necessary for driving without human monitoring, although, the driver is expected to resume control during a takeover request. Data collected will include quantitative and qualitive dependent variables, such as simulated driving performance, eye-glance patterns and duration, demographic characteristics, opinions and perceptions of situation awareness, risky driving, advanced technology, and effectiveness of driver training. The questionnaire data are needed to answer several research questions. Approximately, 100 CMV drivers are expected to participate in this study.

INTRODUCTION
This is to request the Office of Management and Budget's (OMB's) review and approval of a new Federal Motor Carrier Safety Administration (FMCSA) ICR titled Human Factors Considerations in Commercial Motor Vehicle Automated Driving Systems and Advanced Driver Assistance Systems.

Part A. Justification

1. **CIRCUMSTANCES THAT MAKE THE COLLECTION OF INFORMATION NECESSARY**

In 2019, 14.1 percent of all fatal crashes (4,696) and 8.6 percent (575,000) of nonfatal crashes involved at least one CMV.[1] Of these fatal crashes, 33 percent involved at least one driver-related factor such as speeding, distraction, or impairment (e.g., sleepiness). As part of its mission, FMCSA is charged by the United States Department of Transportation (USDOT) to engage in activities to reduce crashes and subsequent injuries and fatalities involving CMVs. Further, the USDOT's Research, Development, and Technology strategic plan calls for human factors research to better understand errors contributing to crashes, such as driver fatigue,

inattention, and reduced operator performance.[2] One method that shows promise in preventing CMV-involved crashes is equipping CMVs with ADSs. However, there are questions as to how ADSs affect driver distraction and how this distraction impacts situational awareness and driver readiness to resume control of the CMV. In fact, the USDOT acknowledges this need for research in their strategic plan: "In an era of rapidly evolving transportation technologies, human factors research also focuses on interactions with technology, and analyzes the potential for distraction or misunderstanding of the capabilities of new technologies" (p. 16).[2] Finally, the USDOT's *Automated Vehicles 4.0* reaffirms the need for human factors research on ADSs to prioritize safety, and specifically for FMCSA to investigate human factors associated with driver readiness while operating CMVs equipped with ADAS and ADSs.[3]

Higher levels of ADAS (i.e., L2) and lower levels of ADSs (i.e., L3) 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. 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. However, in an L3 vehicle the role of distraction is blurred. 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.

Results from passenger vehicles suggest that drivers engage in non-driving secondary tasks more frequently when L2 automation is active versus when the system is available and inactive.[4] Additionally, there was a significant increase in the length of off-the-road eye glances when L2 automation was active versus inactive; however, there was not a significant increase in involvement in safety-critical events. Another study with passenger vehicles found that high-level distraction tasks led to increased eye glances away from the forward roadway and slower reaction times while L2 was activated.[5] As these two studies were for passenger vehicles, it is unknown if the results are applicable to CMVs. CMV drivers are trained to be more engaged in the driving task compared to passenger vehicle drivers. Secondly, CMV drivers are subject to stricter regulations and policies related to non-driving secondary task engagement by FMCSA and their carriers. Finally, recent research shows that CMV drivers engage in a unique set of non-driving secondary tasks.[6] As a result of these differences, data are needed to understand how engagement in non-driving secondary tasks may affect readiness to assume control of an ADAS or ADS-equipped CMV.

Additionally, early research suggests that some CMV drivers lack understanding of the functionality of automated technologies in their vehicles, which translates to either an overreliance or complete disuse.[7] However, there is limited research on training associated with ADSs. One previous study investigated the effectiveness of behavioral training on the limitations of ADAS and ADSs on passenger vehicle driver performance.[8] The drivers who received this training found several safety benefits, including additional mirror checks, increased hazard detection, less time to halt secondary task engagement, and increased caution in situations where the system was indicated to be weak. Results from this study suggest that CMV-focused training has the potential to overcome ADAS and ADS misuse while helping CMV drivers understand the limitations of ADAS/ADSs and how to partner with the ADAS/ADS.

As mentioned above, there is limited safety research on ADAS/ADSs in CMVs. A recently completed gap analysis by FMCSA[9] on research involving ADSs in CMVs found a paucity of extant research related to ADS-equipped CMVs. To date, most commercial ADSs on U.S. roadways are in passenger vehicles, and CMV ADSs are only recently being implemented in real-world operations.[10] Therefore, FMCSA needs more data on ADS-equipped CMVs to understand driver behavior and policy implications. Data from three sub-studies included in this project will be used to provide insight into the following research questions.

Table 1. Research Questions to be Answered.

No.	Research Question	Sub-Study
1	How does driver distraction affect CMV driver readiness to take back manual control in an L2 vehicle when the automation is activated?	L2
2	What changes in CMV driving occur with the use of L2 ADASs when distraction is present and when it is not present?	L2
3	What CMV driver characteristics affect driver readiness and performance in an L2 CMV?	L2
4	What conditions are associated with driver engagement in secondary tasks and how does their effect on driver engagement impact CMV driver readiness and performance in an L2 CMV?	L2
5	During the transfer and sharing of control between the L3 system and the CMV driver, what factors affect the driver's ability to successfully take over the driving tasks considering physical (steering and braking), visual (eyes on forward roadway), and cognitive components?	L3
6	Which types of alerts require manual control to have the most positive impact on CMV driver readiness and performance during the transfer and sharing of control in an L3 CMV?	L3
7	How long at a minimum does the driver need to be warned ahead of time to take over the driving task in an L3 CMV?	L3
8	During the transfer and sharing of control between the L3 system and the CMV driver, what patterns of eye-glance behaviors affect the driver's ability to successfully take over the driving tasks in environments which are densely populated with other vehicles, vulnerable road users, and signs, signals, and pavement markings?	L3
9	Does training reduce the problems with CMV driver distraction when operating L2 vehicles?	Training
10	Does training reduce the problems with CMV driver readiness and performance during the transfer of control when operating L3 vehicles?	Training

The Secretary of Transportation's authority to conduct studies pertaining to CMV safety are in 49 U.S.C. 504, 31133, 31136, 31502, and is delegated to FMCSA at 49 CFR 1.73 (see Attachments A–E, respectively). Further, FMCSA is authorized to conduct research on CMVs under 49 U.S.C. 31108, "Motor Carrier Research and Technology Program."

This information collection supports the USDOT Strategic Goal of "Safety."

2. HOW, BY WHOM, AND FOR WHAT PURPOSE IS THE INFORMATION USED

### 2.1 Purpose of the Information Collection Effort

The purpose for obtaining data in this study is to evaluate driver readiness to assume control in Society of Automotive Engineer (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 via the heavy vehicle simulator, eye tracking, and questionnaire data: (i) determine the effect of distraction on CMV drivers of L2 vehicles, (ii) determine the effect of transfer of control on CMV drivers in L3 vehicles; and (iii) 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/ADSs as well as policy pertaining to the implications of ADAS/ADSs in CMVs

2.2 How Information Will Be Collected

Data will be collected from CMV drivers (hereafter referred to as "driver(s)") using VTTI's heavy vehicle driving simulator and a series of questionnaires. Drivers will be identified using VTTI's large database of truck drivers expressing interest in future studies as well as using fleets within a day's drive of Blacksburg, Virginia (Attachment F). Eligible drivers must hold a valid commercial driver's license with class A or B specification (CDL-A or CDL-B), 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. Questionnaire data will be collected prior to the simulator study (Attachments G–L)), during the simulator study (Attachment M–N)), and after the simulator study (Attachment O). In addition, participants will complete questionnaires about the training (Attachment P) in the second study session. Driver participation in the study is voluntary; therefore, there is no obligation to answer an undesired question in any part of the questionnaires nor continue to participate.

We anticipate 100 participants in total for the driving simulator study. Fifty drivers will participate in the L2 study sessions, and the other fifty drivers will participate in the L3 study sessions (see Figure 1). 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 complete the study, a new driver will be recruited to fill their position. 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.
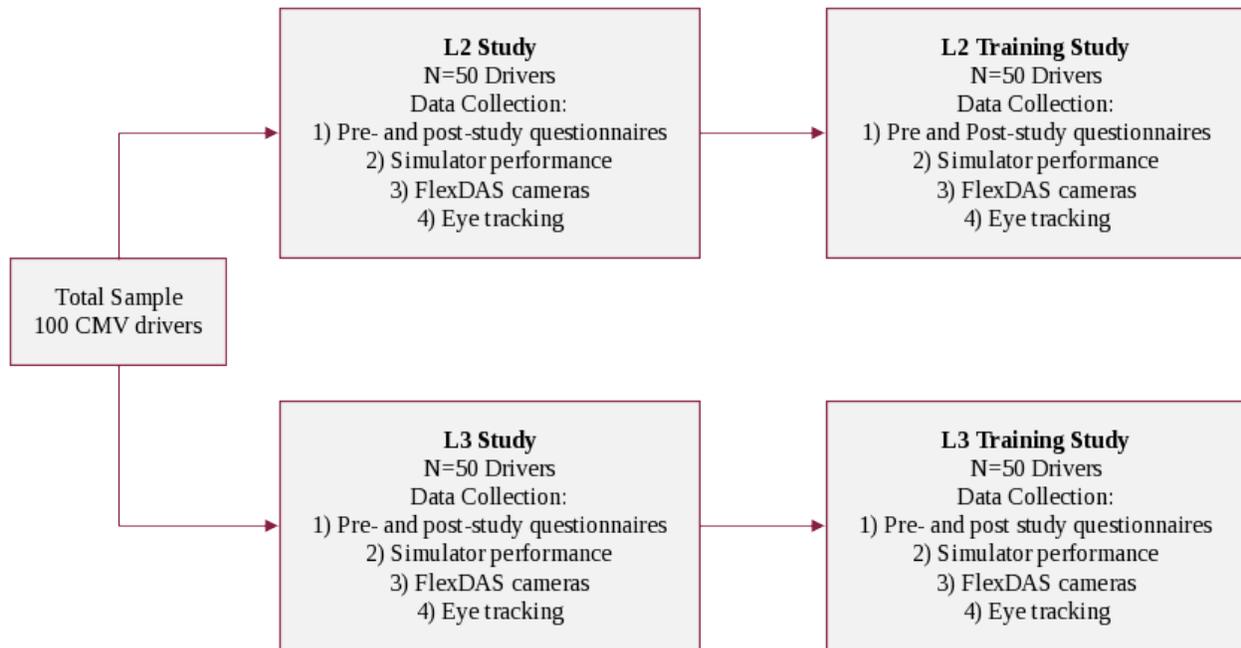
Figure 1. Flowchart of Study Sessions.

The different methods of data collection are outlined below.

2.2.1 Pre-Study Data Collection

When the participant arrives at VTTI on their scheduled study date, they will read and sign a paper copy of the study consent form describing participation in both the L2/L3 study session and the subsequent training study session (Attachment G). The participant will be given as much time as needed to review and ask questions. If the driver consents to participate in the study, they will complete the W-9 form for compensation purposes (Attachment H). Then the participant will be asked to complete three QuestionPro electronic questionnaires using a tablet provided by VTTI. These questionnaires cover (1) demographics, (2) driver behavior, and (3) perceptions of technology (Attachment G).

Next the participant will be asked to complete a 3-minute Psychomotor Vigilance Test (PVT) via an app on the VTTI tablet. Then the Simulator Sickness questionnaire will be reviewed with the participant so they are familiar with the questions and symptoms they should make the researcher aware of should they start to experience them.

2.2.2 Simulator Data Collection

Once the driver begins driving the heavy vehicle driving simulator, the driving simulator will collect continuous data such as steering input, brake input, acceleration/deceleration, speed, stop sign/traffic light violations, major and minor crashes, curb strikes, near-crashes, and lane excursions (Attachment Q). A video monitoring system called FlexDAS will collect continuous video and simulator data during the driving scenarios. While active, FlexDAS will be integrated to record data from the forward roadway simulation, the left-side and right-side simulations, a driver-facing camera, and an over-the-shoulder camera (when appropriate). The encrypted data are stored on a removable solid-state drive within the FlexDAS that can only be retrieved by select VTTI staff. Role-based access controls are utilized to ensure appropriate data use, as described in NIST 800-53, AC-3(7). Levels of access are based on the least-privilege model.

Further, participants will receive an anonymous Driver ID (e.g., Participant 001, 002, etc.) at the beginning of participation. The key linking the Driver ID to the driver and the key linking the driver to the data will not leave VTTI. Keys will be stored in a limited access project folder. All data collection methods (e.g., questionnaires, camera views, etc.) and the process for protecting data are included in the informed consent (Attachment G).

Eye-tracking data will be collected by an eye-tracking system and will be used in all simulation testing. This will collect objective measures of the driver's attention, gaze direction, reaction time, and drowsiness to inform conclusions on engagement in the driving/monitoring tasks, distraction from a task, and fatigue. The data will be collected through the eye-tracking system, but only project team members at VTTI will have access to the data and the ability to analyze results. All study staff have received extensive training in best practices for the protection of human subjects and are acutely aware of the importance of prioritizing the protection of participant privacy in the execution of all study-related procedures. As mentioned above, all data will be linked only to an anonymous ID (e.g., Driver 001) and will be stored on a secure server within password protected, limited access folders.

Between driving scenarios, drivers will be asked questions about the simulator environment to assess situational awareness (see Attachment M). Questions may inquire about other vehicles on the road, various signs, and other scene characteristics. These questions assess whether the participant was actively attentive to the details in the scenario.

2.2.3 Post-Study Data Collection
After participating in the simulator portion of the study, participants will be given an electronic post-study questionnaire (Attachment O). This electronic assessment will be delivered in the same format as the pre-study questions (via tablet). These questions will determine attitudes and experiences with ADAS/ADS technology after driving an L2/L3 simulated CMV.

2.2.3 Training Data Collection
Study participants will be asked to return for a second session to assess the effectiveness of driver training to improve safety while operating an L2 or L3 CMV. It is anticipated that some participants will not continue to the training study, so new participants will be recruited to fill their slot until training data from 100 participants are collected. The new participants will not have data from the L2/L3 study, but they will need to complete the electronic pre-study demographics questions and driver behavior questions as discussed in Section 2.2.1. These new participants will need to fill out a consent form for only the training portion of the study (see Attachment G). The new participants will provide data to account for the loss of data as a result of participant dropouts.

Participants will again take a 3-minute electronic PVT test to assess reaction time. Thus, the new participants will only have a single PVT from the training session while participants completing both sessions will have two PVT tests (one from the first study session and one from the training study session).

Participants will be randomly assigned to either the "trained driving" or the "split driving" condition. Those that are assigned to the trained driving condition will be presented with 20-minute computer-based training on ADAS/ADS technology and distraction. This group will then drive in a heavy vehicle driving simulator. Drivers in the split driving group will receive the

training midway through their driving experience (resulting in periods of control/baseline driving and trained driving). The only difference between these two conditions is when drivers receive training.

Regardless of when the drivers receive the training (i.e., at the beginning of the session or midway through the session), data collection methods from the training simulator session will be essentially identical to the initial simulator study. Data will be collected via the heavy vehicle driving simulator, FlexDAS (video capture), and eye-tracking technologies.

After completing the training, participants will complete an electronic post-training questionnaire via a tablet discussing attitudes about distraction, the effectiveness of the training, and previous experience with ADAS/ADS training (see Attachment P).

2.3 Who Will Collect the Information
FMCSA has contracted with VTTI at the Virginia Polytechnic Institute and State University (VT) to administer this study and analyze its results. The investigators currently performing this study are Matthew Camden, Richard Hanowski, Luke Neurauter, Susan Soccolich, Erin Mabry, T. Laurel Glenn, Scott Tidwell, Desta Alemayehu, and Christiana Ridgeway.

In accordance with USDOT's policy on research involving human subjects, this study was reviewed and approved by Virginia Tech's Institutional Review Board (IRB) prior to beginning data collection (see Attachment R).

3. EXTENT OF AUTOMATED INFORMATION COLLECTION

All questionnaires will be loaded onto VTTI-owned computers or tablets. All responses will be automatically uploaded to an online secure database once the participants submit their answers. Simulated driving performance and eye-tracking data will be stored on an encrypted hard drive and manually uploaded by VTTI onto a secure server. Using electronic entry for data collection also reduces data entry error later needed for analysis.

4. EFFORTS TO IDENTIFY DUPLICATION

FMCSA and the VTTI research team are unaware of other research conducted, currently or in the past, that could be used to fulfill the research goals of the Human Factors Considerations in CMV ADAS/ADSs project. A recently completed gap analysis by FMCSA on research involving ADAS/ADSs in CMVs found a paucity of existing research related to ADS-equipped CMVs.[11] Much of the work relating to ADS technology involved passenger vehicles. However, the CMV environment is unique considering the physical vehicle differences, opposing use cases, and varying driver characteristics when compared to passenger vehicles. In general, the authors indicated that existing research lacks an understanding of safe and effective use of ADS-equipped CMVs on U.S. roadways and specific research needs.

5. EFFORTS TO MINIMIZE THE BURDEN ON SMALL BUSINESSES

This study will involve a convenience sample of drivers with no efforts to target drivers from specific types or sizes or carriers. Participation in the study is voluntary, so no small business will have an imposed burden that it is not willing to bear.

6. IMPACT OF LESS FREQUENT COLLECTION OF INFORMATION

This is a new data collection effort. FMCSA has determined that this collection of information is necessary for study completion; currently, there is no existing data set that can be used for this project. Data will be collected from participants over two study sessions within a 12-month period. Each study session will last approximately 4 hours, for a total of 8 hours. Each driver's participation is limited to the time spent at VTTI.

During each 4-hour study session, drivers will be asked to complete the data collection requirements described in Section 2.1. Less frequent collection of information would result in a lack of data needed to answer some of the research questions. This would limit the data analysis.

7. SPECIAL CIRCUMSTANCES

There are no special circumstances related to this information collection.

8. COMPLIANCE WITH 5 CFR 1320.8:

FMCSA published a notice in the Federal Register with a 60-day public comment period to announce this proposed information collection on September 21, 2022 (87 FR 57748) (Attachment S). 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. Only four comments were specifically about the information collection effort (i.e., the final two topics).

One comment focused on this study's proposed data collection methodology related to the number of participants and the importance of evaluating driver fatigue though a long duration study session. 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. Related to the comment on driver fatigue, 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.

Three comments provided support for the study and provided additional insights based on recent investigations or research. Additionally, 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. Another comment noted the importance to distinguish features of L2 and L3 vehicles. To improve clarity on the study, FMCSA revised the title of the study and the ICR documents to describe the L2 part of the study as an ADAS.

9. PAYMENTS OR GIFTS TO RESPONDENTS

Participants will be compensated for their time in the study. Drivers will receive up to $200 per session (i.e., $50 per hour) for participating in each 4-hour study session. This compensation aligns with the 90th percentile wage for heavy vehicle operators (see below). Compensation aligning with the 90th percentile was selected as it could also reimburse for travel expenses (i.e., mileage, gas) and account for a higher value placed on driver's limited free time each week. As the participants are heavy vehicle operators, they work up to 70 hours each week, and are often only home for two days each week to be with family and to complete errands and chores. Because this free time is so limited, it is more valuable than the average hourly wage. Thus, compensation needs to be higher than the mean wage; compensation needs to adequately reflect asking participants to use part of the only 34 to 48 hours they are home each week. Compensation will be prorated to the nearest hour if participants choose to leave the study early. Participants will be paid via Clincard. A bonus of $100 will be provided to participants who complete both the L2/L3 simulator study and the subsequent training sessions. To assess the effectiveness of the training conducted in the second study session, it is critical that participants return for the second study session. Previous research efforts at VTTI found that a bonus of $100 was effective at reducing loss of data due to participants dropping out of the study between sessions. New drivers recruited to replace dropouts in the training study will not receive the $100 bonus. Thus, drivers that participate in both study sessions may receive up to $500 (up to $200 for each study session plus the $100 bonus), and replacement drivers may receive up to $200 for participating in the training study session. Reducing the hourly compensation or the bonus will have significant negative effects on the data collection effort.

10. ASSURANCE OF CONFIDENTIALITY

Drivers will receive a unique anonymous Driver ID (e.g., Driver 001) at the beginning of participation. The key linking the Driver ID to the driver and the key linking the driver to the data will not leave VTTI. Keys will be stored in a limited-access project folder. The study's principal investigator (PI), Matthew Camden, and limited members of the research team assigned by the PI will have access to the keycode. The key will be destroyed no later than 12 months after the end of the study contract. After being assigned a Driver ID, all questionnaires and other sensitive data will use this ID to avoid a breach of confidentiality. The electronic questionnaire data will be collected via a VTTI tablet, so no identifiable IP addresses will be collected. Information collected to compensate the participant will be obtained but will never be stored with study data.

Respondents may refrain from answering any questions that they do not feel comfortable answering. Respondents may also choose to leave the study at any time if they change their mind about participating.

Video and audio data will be collected using the VTTI FlexDAS. The storage drive will be swapped after each participant and uploaded to the VTTI server. Once on the secure VTTI server, the data will have limited access granted only to the research team working on the project; access will be controlled by the study PI. The continuous eye-tracking data belong solely to VTTI and will not be shared with the eye-tracking company. The eye-tracking data will be stored on the secure VTTI server and will be handled in the same manner as video and audio data. The heavy vehicle driving simulator does not collect any personally identifiable

information (PII), but a Driver ID will be assigned to the data. Therefore, all data will be stored on the VTTI limited-access secure server.

All study staff have received extensive training in best practices for the protection of human subjects and are acutely aware of the importance of prioritizing the protection of participant privacy in the execution of all study-related procedures. The consent form will explain to the participants what they can do to protect their privacy. The research team will go through all necessary steps to ensure the confidentiality of participant data whenever possible.

11. JUSTIFICATION FOR COLLECTION OF SENSITIVE INFORMATION

No questions of a sensitive nature will be asked for this data collection.

12. ESTIMATE OF BURDEN HOURS FOR INFORMATION REQUESTED

It is estimated that the driver sample will be drawn from CMV drivers who have previously participated in research at VTTI and drivers located within a day's drive of Blacksburg, Virginia. The objective is to recruit 100 participants from this accessible population. As discussed in detail in Part B, 100 participants account for participant drop out. As shown in the power analysis in Supporting Statement Part B, the minimum number of participants is 90; however, 100 participants will provide a margin of error in case the effect size is smaller. It is estimated that 10 drivers may drop out from the study and replacements would be found. Thus, 110 drivers would complete some of the tasks shown in Table 2. The only eligible participants are CMV drivers with a CDL-A or CDL-B who are 21 years old or above.

Respondent burden is associated with completing the study questionnaires and "driving" in the heavy vehicle simulator for extended periods of time in both the L2/L3 ADAS/ADS and training sessions. All 100 respondents will spend approximately 1 hour completing pre-simulator-study materials consisting of the following: Consent Form (Attachment H), W-9 Compensation Form (Attachment J), Demographics & Previous Experiences questionnaire (Attachment G), Perceptions of Technology & Vehicle ADS questionnaire (Attachment G), 3-minute PVT, Driver Behavior questionnaire (Attachment G), and Simulator Sickness questionnaire (Attachment G). Researchers pilot tested the length of each questionnaire to estimate the burden minutes per response. During primary data collection, the participants will spend approximately 3 hours per session in the driving simulator participating in different ADAS/ADS scenarios for both the L2/L3 simulator session and the training session. Between scenarios, participants will answer questions related to their situation awareness (Attachment G). After participating in the L2/L3 study, participants will complete the Post-Study ADAS/ADS Experiences & Perceptions questionnaire (Attachment G). Following the training study, participants will complete the Post-Training Study questionnaire (Attachment G). The estimates of burden hours resulting from the participating respondents are presented below in Table 2.

Table 2. Respondent tasks.

Type of Respondent	Task Name	No. Of Respondents	No. Of Responses per Respondent	No. Of Responses	Burden per Response (minutes)	Total Burden Hours
Eligible CMV Drivers	Recruitment	200	1	200	5 minutes	16.7
	Consent form	110	1	110	15 minutes	27.5
	W-9 form	110	1	110	2.5 minutes	4.6
	Pre-study Demographics & Previous Experiences questionnaire	110	1	110	4.5 minutes	8.3
	Perceptions of Technology & Vehicle ADAS/ADS questionnaire	110	1	110	6.25 minutes	11.5
	PVT	110	2 (1 response for the 10 replacement drivers)	220	3 minutes	11
	Pre-Study Driver Behavior questionnaire	110	1	110	3.6 minutes	6.6
	Situation Awareness questionnaire	110	1	110	2.8 minutes	5.1
	Simulator Sickness questionnaire	110	1	110	1.25 minutes	2.3
	Post-Study ADAS/ADS Experiences & Perceptions questionnaire	100	1	100	6.1 minutes	10.2
	Post-Training Study questionnaire	100	1	100	6.1 minutes	10.2
	L2/L3 Simulator Session (Session 1)	100	1	100	180 minutes	300
	Training Simulator Session (Session 2)	100	1	100	180 minutes	300
	Study Total	–	–	**1,590 Responses**	–	**714 hours**

The data collection process will progress across a period of 18 months. The total number of study responses is 1,590. Burden hours for the study total 714 hours, or an average annual burden of 476 hours. The 100 drivers that participate in the study are expected to see a burden of 8 hours over the 18 months, or an average annual burden per participant of 5.3 hours.

Only CMV drivers will undertake the study tasks. We assume that the impacted CMV driver occupation corresponding to the Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES) is Heavy and Tractor-Trailer Truck Drivers, which has a median hourly wage of $14.77, $23.23, and $34.97, for the 10th, 50th, and 90th percentiles, respectively, for the Truck Transportation industry (NAICS code 533032), from the BLS May 2021 National Industry-Specific Occupational Employment and Wage Estimates.[12] To arrive at a loaded wage, we first estimated a load factor of 1.40 by dividing the total cost of compensation for private industry workers of the trade, transportation, and utilities industry ($32.07) by the average cost of hourly wages and salaries ($22.91) as reported by the BLS in its Employer Costs for Employee Compensation for December 2021 ($32.07 ÷ $22.91 = 1.40).[13] Multiplying the mean hourly wage by the load factor results in a loaded hourly wage range of $20.68 to $48.96 ($14.77 x 1.40 = $20.68; $23.23 × 1.40 = $32.52; $34.97 x 1.40 = $48.96). Table 3 shows the calculated wage for the truck driving population.

Table 3. Respondent occupation and wage.

BLS OES Occupation Code	BLS OES Occupation Description	10th Percentile Hourly Wage	Median Hourly Wage	90th Percentile Hourly Wage	Load Factor	Loaded Hourly Wage
53-3032	Heavy and Tractor-Trailer Truck Drivers	$14.77	$23.23	$34.97	1.40	$20.68–$48.96

The loaded hourly wage for each respondent task was multiplied by the total burden hours per task to arrive at the total cost per task. In all, these tasks involve 1,300 responses and cost $14,275.40–$33,797.09 over 18 months, which are annualized at 867 responses and $9,516.93–$22,531.39. The breakdown is illustrated in Table 4.

Table 4. IC2: Respondent task costs.

Respondent Task	Hourly Wage Range	Total Burden Hours	Cost per Task
Recruitment	$20.68 to $48.96	16.7	$345.36–$817.63
Consent form	$20.68 to $48.96	27.5	$568.70–$11,346.40
W-9 form	$20.68 to $48.96	4.6	$95.13–$225.22

Respondent Task	Hourly Wage Range	Total Burden Hours	Cost per Task
Pre-study Demographics & Previous Experiences questionnaire	$20.68 to $48.96	8.3	$171.64–$406.37
Perceptions of Technology & Vehicle ADAS/ADS questionnaire	$20.68 to $48.96	11.5	$237.82–$563.04
PVT	$20.68 to $48.96	11	$227.48 – $538.56
Pre-Study Driver Behavior questionnaire	$20.68 to $48.96	6.6	$136.49–$323.14
Situation Awareness questionnaire	$20.68 to $48.96	5.1	$105.47–$249.70
Simulator Sickness questionnaire	$20.68 to $48.96	2.3	$47.56 – $112.61
Post-Study ADAS/ADS Experiences & Perceptions questionnaire	$20.68 to $48.96	10.2	$210.94–$499.39
Post-Training Study questionnaire	$20.68 to $48.96	10.2	$210.94–$499.39
L2/L3 Simulator Session (Session 1)	$20.68 to $48.96	300	$6,204.00–$14,688.00
Training Simulator Session (Session 2)	$20.68 to $48.96	300	$6,204.00–$14,688.00
Study Total	–	–	**$14,765.53–$34,957.44**

Totals for this ICR:

- **Estimated Total Burden Hours:** 714 hours

- **Estimated Total Responses:** 1590 responses

- **Estimated Total Respondents:** 100 respondents (with an additional 10 respondents to replace participant drop out)

- **Estimated Total Annual Burden Costs:** $9,843.69– $23,304.96

13. ESTIMATE OF TOTAL ANNUAL COSTS TO RESPONDENTS

There are no additional costs to respondents beyond those associated with the hourly burden presented above.

14. ESTIMATE OF COST TO THE FEDERAL GOVERNMENT

The research design, protocol development, and implementation of the research methods will be completed between Fiscal Year (FY) 2022 and FY 2025. The total cost for the contract is $1,560,513. This includes the development of the research protocol, programing the driving simulator, participant recruitment, participant payments, executing the study procedures, analyzing the data, and writing the final report. Additionally, FMCSA's cost for the Contracting Officer Representative's time to administer and manage the project is $31,318 between FY 2022 and FY 2025. The COR is a GS 14, step 10 and the pay in the DC area is $172,075. The fully loaded pay including fringe benefits is $223,697.50 (Fringe benefit rate is 30 percent). It takes 3.5 percent of this person's time each year for 4 years. Therefore, the cost to the Government is $31,317.65 ($223,697.50 times 3.5 percent times 4 years is $31,317.65). Thus, the total cost to the Federal Government is $1,591,831 ($1,560,513 plus $31,318).

15. EXPLANATION OF PROGRAM CHANGES OR ADJUSTMENTS

This is a new information collection.

16. PUBLICATION OF RESULTS OF DATA COLLECTION

The results of this information collection will be documented in a technical report to be delivered to and maintained by FMCSA. The report will detail the data relied upon, analyses, results, and conclusions which will help inform policy on ADAS/ADS regulation in the trucking industry and the situations impacting human factors in ADAS/ADS-equipped CMVs. All data collected in this effort will be reported in general terms such as "Only 27% of drivers indicated a positive attitude towards ADAS/ADS technology prior to participating versus 87% after the study."

Only authorized project personnel and authorized employees of the research sponsors will have access to study data that personally identifies participants or that could be used to personally identify participants while the participant is enrolled in the study. The research team or project sponsor may also show specific clips of deidentified video at research conferences and project meetings. Participants' names or other identifying information will never be associated with the showing of such video clips at conferences. The data from this study will be included in the FMCSA Data Repository (IRB #20-539). A de-identified public-use data set will be posted online, and identifiable data will be available to qualified researchers with privacy and security protections in place.

17. APPROVAL FOR NOT DISPLAYING THE EXPIRATION DATE OF OMB

APPROVAL

No such approval is being requested.

18. EXCEPTIONS TO CERTIFICATION STATEMENT

None.

ATTACHMENTS:

A. Title 49 U.S.C. § 504 titled, *"Reports and records."*
B. Title 49 U.S.C. § 31133 titled, *"General powers of the Secretary of Transportation."*
C. Title 49 U.S.C. § 31136 titled, *"United States Government regulations."*
D. Title 49 U.S.C. § 31502 titled, *"Requirements for qualification, hours of service, safety, and equipment standards."*
E. Title 49 CFR § 1.87 titled, *"Delegation to the Federal Motor Carrier Safety Administrator."*
F. Recruitment Materials
G. Two-Study Consent Form
H. W9 Form
I. Pre-study Demographics Questionnaire
J. Pre-study Perceptions of Technology Questionnaire
K. PVT
L. Pre-study Driver Behavior Questionnaire
M. Situation Awareness Questionnaire
N. Simulator Sickness Questionnaire
O. Post-study Technology Experiences and Perceptions Questionnaire
P. Post-training Study Questionnaire
Q. Simulator Data Collection
R. Virginia Tech IRB approval letter.
S. Federal Register 60-day notice (85 FR 57750), September 21, 2022.

[1] FMCSA. (2021). *Pocket guide to large truck and bus statistics* (RRA-21-004). Federal Motor Carrier Safety Administration, USDOT. Retrieved from https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2021-12/FMCSA%20Pocket%20Guide%20to%20Large%20Truck%20and%20Bus%20Statistics%202021.pdf

[2] USDOT. (2020). *Research, development, & technology strategic plan FY 2018-2022.* Retrieved from https://www.transportation.gov/sites/dot.gov/files/2020-11/DOT%20RDT%20Strat%20Plan%20-%20112320%20-%20Final.pdf

[3] National Science and Technology Council, & USDOT. (2020). *Ensuring American leadership in automated vehicle technologies: Automated vehicle 4.0.* Retrieved from https://www7.transportation.gov/file/268996/download?token=am1hZ-a0.

[4] Dunn, N., Dingus, T., & Soccolich, S. (2019). *Understanding the impact of technology: Do advanced driver assistance and semi-automated vehicle systems lead to improper driving behavior?* (202-638-5944). AAA Foundation for Traffic Safety. https://aaafoundation.org/wp-content/uploads/2019/12/19-0460_AAAFTS_VTTI-ADAS-Driver-Behavior-Report_Final-Report.pdf

[5] Yang, S., Kuo, J., & Lenné, M. G. (2021). Effects of distraction in on-road level 2 automated driving: Impacts on glance behavior and takeover performance. *Human Factors*, *63*(8), 1485–1497. https://doi.org/10.1177/0018720820936793

[6] Hammond, R. L., Soccolich, S. A., Han, S., Guo, F., Glenn, T. L., & Hanowski, R. J. (2021). *Analysis of naturalistic driving data to assess distraction and drowsiness in drivers of commercial motor vehicles* (Report No. FMCSA-RRR-20-003). Federal Motor Carrier Safety Administration.

[7] Hammond, R. L., Hanowski, R. J., Miller, A. M., Soccolich, S. A., & Farrell, L. J. (2016). *Distraction and drowsiness in motorcoach drivers* (FMCSA-RRR-15-017). Federal Motor Carrier Safety Administration. https://rosap.ntl.bts.gov/view/dot/31577

[8] Shaw, E., Large, D. R., & Burnett, G. (2020). *Driver training for future automated vehicles: Introducing CHAT (CHeck, Assess, and Takeover).* RAC Foundation. https://www.racfoundation.org/research/safety/driver-training-for-future-automated-vehicles

[9] Eby, D. W., Molnar, L. J., Sullivan, J., & Kostyniuk, L. P. (under Agency review). *Driver limitations in automated-driving-system-equipped commercial motor vehicles: An analysis of research gaps*. Federal Motor Carrier Safety Administration.

[10] Nowakowski, C., Shladover, S. E., & Tan, H.-S. (2015). Heavy vehicle automation: Human factors lessons learned. *Procedia Manufacturing*, *3*, 2945–2952. https://doi.org/10.1016/j.promfg.2015.07.824

[11] Eby, D. W., Molnar, L. J., Sullivan, J., & Kostyniuk, L. P. (under Agency review). *Driver limitations in automated-driving-system-equipped commercial motor vehicles: An analysis of research gaps*. Federal Motor Carrier Safety Administration.

[12] Bureau of Labor Statistics, U.S. Department of Labor, May 2021 National Industry-Specific Occupational Employment and Wage Estimates for NAICS 5330324 - Truck Transportation.

[13] Bureau of Labor Statistics, U.S. Department of Labor, Employer Costs for Employee Compensation – December 2021, Table 4. Private industry, by industry group, accessed June 15, 2022.