Department of Transportation
Federal Motor Carrier Safety Administration

SUPPORTING STATEMENT PART A
"Study of Warning Devices for Stopped Commercial Motor Vehicles" ICR
OMB Control Number: 2126-xxxx

SUMMARY

- Federal Motor Carrier Safety Administration (FMCSA) is seeking Office of Management and Budget (OMB) approval of a new information collection entitled *Study of Warning Devices for Stopped Commercial Motor Vehicles*.

- This information collection involves the collection of data during a study about peoples' behavior while driving a car, as well as other information collected for administrative purposes in support of the study (e.g., screening potential participants during recruitment for the study). The primary purpose of the study is to test whether orange plastic triangles called "warning devices," affect passing motorists' driving behavior when placed on the road near a stopped commercial motor vehicle. In particular, FMCSA is interested in any potential effects of the warning devices on aspects of driving behavior which have the potential to influence the likelihood of a crash between a passing car and the stopped commercial motor vehicle. These aspects include, for example, how quickly drivers notice the stopped vehicle (i.e., by looking at it) as their vehicle approaches it, and how soon they begin to steer or reduce the speed of their own vehicle after seeing the stopped vehicle.

- Information collections (ICs) will consist of (1) an eligibility criteria screening, (2) the informed consent form for the research study, (3) IRS W-9 form as required to comply with tax requirements, (4) a basic hearing test, (5) a basic visual acuity and color vision screening, (6) a brief demographics survey, (7) a risk propensity questionnaire, (8) instrumented vehicle sensors, an eye-tracking device, GPS equipment, and video cameras, all of which collect data automatically during a driving study, (9) an acknowledgement form, (10) a post-experiment survey, and (11) compensation exchange.

- The estimated total hourly burden is 504.92 hours across all participants.

INTRODUCTION

This is to request the Office of Management and Budget's (OMB) approval of a new information collection request entitled *Study of Warning Devices for Stopped Commercial Motor Vehicles*.

Part A. Justification

1. CIRCUMSTANCES THAT MAKE THE COLLECTION OF INFORMATION NECESSARY

Parked or disabled commercial motor vehicles (PDCMVs) on the road negatively impact traffic operations and safety[1]. To increase the conspicuity of PDCMVs and mitigate crash risk, Federal Motor Carrier Safety Administration (FMCSA) requires specific warning devices to be carried[2]

on all commercial motor vehicles (CMVs) and, except in the case of necessary traffic stops, be deployed[3] near the vehicle whenever it is stopped on the road or shoulder. The Federal Motor Carrier Safety Regulations (FMCSRs) prescribe specific rules[4] concerning how and where the warning devices must be placed, based on road and traffic attributes (e.g., whether the road is straight or curved, whether the vehicle is stopped in a business or residential district, whether the road is divided or undivided, etc.) as well as the presence of conditions affecting visibility (e.g., time of day, physical obstructions, etc.). These requirements follow from the basic notion that increasing the conspicuity of a PDCMV makes it easier to see and recognize, thereby reducing the risk of a crash involving passing motorists.

In addition, the National Highway Traffic Safety Administration (NHTSA) prescribes performance and design specifications[5] for warning devices under 49 CFR §571.125 of the Federal Motor Vehicle Safety Standards. For instance, this standard establishes minimum specifications for factors affecting the conspicuity (including reflectivity, color, luminance) of warning triangles, the most commonly utilized type of warning device (due to their reusability, shelf life, and fire-risk concerns compared to flares or fusees). The purpose of this standard is "to assure that the warning devices can be readily observed during daytime and nighttime lighting conditions, have a standardized shape for quick message recognition, and perform properly when deployed." [6]

Public interest in warning device requirements for PDCMVs has increased in recent years for several reasons. For example, advances in automated driving system (ADS) technology have raised critical questions regarding potential barriers to regulatory compliance with warning device safety standards[7] and regulations[8] which reference a "driver". In addition, alternative types of warning devices developed by industry, including those intended to increase driver safety during device deployment, have resulted in multiple applications for exemption from the corresponding safety regulations[9,10]. These recent issues related to warning device requirements also call attention to the historically unresolved questions of whether the use of such devices improves traffic safety and, if so, how and to what extent.

Past attempts by FHWA[11,12] and other researchers[13] to answer those questions yielded generally inconclusive or inconsistent results, which possibly influenced NHTSA's past decision not to pursue conducting its own research on the topic[14]. FMCSA (previously under FHWA) itself has never conducted experimental research on the impact of using warning devices. As the only regulatory authority which still requires commercial motor vehicle operators to use warning devices, the responsibility to answer these questions finally and definitively is perhaps best ascribed to FMCSA.

Given the increasing focus on ADS, as well as questions surrounding the safety of commercial motor vehicle drivers when deploying warning devices, and the availability of new technology and alternative devices since these issues were last explored in the 1980s, there is a need to thoroughly evaluate the use of warning devices under current regulations. In addition, advanced research instruments unavailable or not in use at the time of all past research on this topic are now in common use and would permit far more sophisticated analyses of the effects of warning devices on driver behavior. This includes sensors which can precisely measure and record the location of vehicles (e.g., differential GPS), eye-tracking devices which allow the researcher to determine the precise moment when a driver first glanced at a PDCMV, and instrumented vehicles which record accurate, high-frequency data related to drivers' interactions with a

vehicle's controls.

Implementing these modern tools in a controlled experiment at closed-course, state-of-the-art driving research facility will allow the most comprehensive examination of the effects of warning devices to date. The results of the study may support future rulemaking related to warning devices and provide baseline data necessary to inform agency decisions on exemption applications for alternative warning device products. Table 1, below, presents the research questions to be investigated in this study.

Table 1. Research Questions to be Answered.

No.	Research Questions	
1	Understand driver **visual behaviors** (detection time) with and without warning devices under day/night and straight/curved road conditions.	
	a	At what frequency and duration will drivers first look at warning devices compared to the PDCMV?
	b	At what distance from the PDCMV will drivers first look at warning devices compared to the PDCMV (initial gaze vs. saccade)?
	c	How much gaze time is spent looking at the oncoming vehicle, the participant's vehicle (e.g., speedometer), the PDCMV, the warning device, and the roadway?
	d	What is the scan pattern between all roadway elements?
	e	How do any of the previous visual behaviors change across experimental conditions?
2	Understand **driving behaviors** (reaction time) with and without warning devices under day/night and straight/curved road conditions.	
	a	What behaviors (e.g., accelerating, braking, steering, or some combination) are solicited from participants with and without warning devices?
	b	At what distance behind the PDCMV are these behaviors solicited with and without warning devices?
	c	What are the distances between the participant's vehicle and the confederate vehicle and PDCMV with and without warning devices at any given point?
	d	Are driving behaviors moderated by propensity to risk or any other demographics (e.g., age)?
	e	How do any of the previous driving behaviors change across experimental conditions?

The Secretary of Transportation's authority to conduct studies pertaining to CMV safety may be found in 49 U.S.C. 504, 31133, 31136, and 31502, and has been 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 (see Attachment F), "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

This information collection will take place during:

a) recruitment activities prior to an individual's participation in the study,
b) screening and administrative procedures immediately prior to the experiment,
c) an individual's participation in the driving experiment, and,
d) administration of a survey instrument immediately following the experiment.

FMCSA has established a contract with Virginia Tech Transportation Institute (VTTI) to collect the information associated with this ICR. Under indirect oversight of an FMCSA Contracting Officer's Representative, experienced VTTI research staff will perform all data collection activities described in this document and associated attachments, to include the administering the tests, surveys, questionnaires, and driving research data collection (eye-tracking data, instrumented vehicle data, GPS data, and camera footage).

FMCSA's purpose for collecting this information is to develop an understanding of whether and to what extent the deployment of warning devices near a stopped commercial motor vehicle affects the driving behavior of passing motorists, and, in particular, those elements of driving behavior which have the potential to influence the likelihood of a crash involving the stopped vehicle. How this information will affect agency activities and decision making depends on exactly what the information shows. For instance, FMCSA may obtain evidence that warning devices have little or no effect on how quickly drivers recognize and respond to the presence of a stopped commercial motor vehicle – a finding that could suggest the potential need for FMCSA to revisit whether such devices are necessary at all.

However, FMCSA might also obtain evidence that warning devices have effects on specific aspects of driving behavior – and to certain extents. In that case, the information gathered would potentially be useful to the agency in assessing applications for exemption from its current warning device requirements, because it would provide a baseline for assessing whether proposed alternatives in such applications truly meet or exceed the level of safety achieved through compliance with the current requirements.

Of course, the findings of the research might also suggest that the devices primarily affect critical aspects of driving behavior in specific sets of conditions (e.g., on curved roads where the view of a stopped vehicle might be obscured, or at night when object conspicuity is reduced due to lower levels of ambient lighting). In that case, the information gathered could be useful in guiding potential changes to the current list of exceptions to FMCSA's warning device requirements.

In any case, the findings will contribute to safety by ensuring that FMCSA's decisions and regulations are data-driven and based on safety.

Detailed information on each component of the collection, including what will be collected, how, by whom, and for what purpose, is provided in Table 2 below.

Table 2. How Data will be Collected, by Whom, and the Purpose of Collecting it.

Information Collected	How it will be Collected	Who will Collect It	Purpose of Collecting It
IC1 Recruitment Response (Including Eligibility Screening) (see p. 11 — 18 in Attachment G, Recruitment Materials)	Participant will be read a script of questions over the telephone by a research staff member and be asked to respond verbally. The researcher will record the participant's answers by paper and pen.	Research staff employed by Virginia Tech Transportation Institute.	This information includes a wide variety of study eligibility criteria. Most of the questions are asked to ensure participant/staff safety during the driving experiment and concern health conditions, driving experience, etc. This information will not be used or included in any reports, briefings, or the public dataset. It will be used to establish eligibility for participation and assist in distributing demographics across experimental conditions (if applicable).
IC2 Informed Consent Form	Participant will be asked to read the form and sign by pen and paper.	Research staff	Required by Department of Transportation regulation 49 CFR § 11.116 and by the Virginia Tech Institutional Review Board.
IC3 IRS W-9 Form	Participant will be asked to complete the form by pen and paper.	Research staff	This information is necessary to ensure compliance with federal tax laws applicable as a result of providing the participants with monetary compensation in exchange for their participation in the study.
IC4 Hearing Test (see p. 2, 5 in Attachment H, Data Collection Materials)	Participant will be asked to verbally repeat each of four sentences spoken to them in a normal voice. This information will be recorded by the research staff member by pen and paper on a combined form that also contains a demographic survey the participant will complete later.	Research staff	This is a driving experiment requiring the participant to operate a vehicle on a closed-course road at the research facility. Although hearing plays a limited role in driving safety, the participant will be accompanied in the vehicle by a member of the research staff and for safety purposes, needs to be able to hear any instructions they are given by the staff. This information will not be included in the public dataset.
IC5A	Participant will be asked to read from a standard Snellen eye chart and	Research staff	To ensure the safety of the participant and research staff, we need to ensure that the participant's visual

Visual Acuity Test (see p. 3, 5 in Attachment H, Data Collection Materials)	verbally report the smallest line they are able to discern. This information will be recorded by the research staff member by pen and paper on a combined form that also contains a demographic survey the participant will complete later.		acuity is not less than the minimum required to obtain a driver's license (20/40). This information will not be included in the public dataset or report.
IC5B Color Vision Test (see p. 3 – 4, 5 in Attachment H, Data Collection Materials)	Participant will be asked to view a series of seven pseudoisochromatic plates showing a number represented by dots of various colors on a background of dots of various colors. The participant will read the number represented by the dots if they are able and verbally report their answer to a research staff member. The researcher will record the overall results by pen and paper.	Research staff	The color specifications of the relevant visual stimuli in this study are controlled by Federal Regulation (e.g., the color of the body of the warning device, the color of the retroreflective surfaces/tape on the device, etc.). These colors include, for instance, red. Therefore, to ensure that color vision does not significantly interact with the other variables being measured, we need to know whether data was collected from an individual with red-green colorblindness. This information will not be included in the public dataset.
IC6 Demographic Survey (see p. 5 – 6 in Attachment H, Data Collection Materials)	Participants will be asked to complete an eight-question survey by computer after hearing/vision screening.	Research Computer	All of the driving data, eye-tracking data, and risk survey data in this study may potentially be correlated with various demographic variables. For example, driving experience might impact how long a person looks at the warning device. Age might affect reaction time. Sex may be correlated with risk attitudes. Thus, demographic information is necessary to ensure integrity of data analyses.
IC7 Risk Propensity Questionnaire[15] (see p. 6 in Attachment H, Data Collection Materials)	Participants will be asked to complete a 7-question survey by computer.	Research Computer	This survey attempts to index an individual's general propensity to engage in risky behavior. Past research has shown that the majority of drivers in the US rate themselves as "better than average" drivers[16]. It is possible, therefore, that the driver behavior questionnaire will not successfully identify drivers who tend to engage in risky

			behavior, i.e., because drivers will not rate themselves accordingly. This survey captures general risk propensity, which will enhance the extent to which "risky" drivers can be identified and data considered accordingly.
IC8A Eye-Tracking Data (Where the participant was looking and when)	The participant will put on a pair of eye-tracking glasses. After a brief calibration, the participant doesn't need to do anything to provide data except continue to wear the glasses for the duration of the driving portion of the study.	Research staff will set up the device, but the data will be recorded automatically by the device.	This data is the most important data in the study because no previous research has examined visual behavior when testing the effects of warning devices. While past research examined reaction times and response characteristics, these variables are only indirectly related to detection and recognition of the stopped vehicle. This data will be used to determine the precise moment that participants first looked at the stopped vehicle and warning devices. This data will better differentiate the effects of warning devices than metrics used in prior research. Other data will be derived from this information as well, such as, how frequently did participants look at the devices vs the vehicle first? What is the average time spent looking at the vehicle and devices?
IC8B Instrumented Vehicle Data	The participant will drive a car as described elsewhere in this document. The participant doesn't need to do anything else to provide the data.	Computers and sensors onboard the vehicle will record the data automatically.	Sensors will record the angles of the steering wheel, brake pedal, and accelerator pedal, in addition to vehicle speed and acceleration parameters and other inertial sensor data. This information will be used to determine when the participant began a control input after seeing the stopped vehicle. It will also be used to assess the characteristics of the response – do drivers rely more upon steering or speed changes (or both)? Do they start by steering or by releasing the accelerator pedal? Do they use the brake? What is the average magnitude of the response? This will help the researchers understand whether warning devices affect the speed of the response, the quality of the response, and the type of response executed

			by the driver.
IC8C Differential GPS Data	The participant will drive a car as described elsewhere in this document. The participant doesn't need to do anything else to provide the data.	GPS sensors will record this data automatically.	In combination with the eye-tracking and instrumented vehicle data, this information will tell researchers how far from the stopped vehicle the participant was when they first looked at the warning devices or vehicle, as well as when they began initial control inputs for a response. In addition, this information will assist in assessing the nature of the response, in that it will be used to calculate the minimum longitudinal/lateral distance between the participant's vehicle other vehicles. Because the participants will be driving a research vehicle on a closed-course road entirely contained within the VTTI driving research facility, the GPS data will not include any information that could reveal the participant's identity.
IC8D Eye-Tracking Camera Footage and Vehicle Camera Footage	The participant will put on a pair of eye-tracking glasses. After a brief calibration, the participant doesn't need to do anything to provide eye-tracking camera data except continue to wear the glasses for the duration of the driving portion of the study. For the vehicle camera footage, the participant will drive a car as described elsewhere in this document. The participant doesn't need to do anything else to provide the data. The cameras will not capture footage during any other time than the driving portion of the study – e.g., no footage will be recorded while the participant is providing survey data because they	Research staff will set up the eye-tracking device, but the video footage will be recorded automatically by the devices.	Various cameras will record data that is necessary for the analysis of eye-tracking data and corresponding visual scan pattern analysis. The cameras will face away from the participant and record either the participant's point of view (via the eye-tracking camera), the interior of the vehicle (namely the instrument cluster/controls), or the world outside the vehicle. This allows for plotting of fixation location over the video to support the scan pattern analysis. The latter will assist in determining whether the presence of warning devices affects the driver's scanning strategy (e.g., devices then vehicle then road ahead). While the camera footage will not be included in the public dataset, a small selection of short video clips will be referenced in the research report and posted as an appendix online. The footage will not show features or scenery elements that could be

	won't be wearing the eye-tracking device or driving the car.		used to identify the participants who are driving during the study – they will be focused on showing visual behavior when encountering the stopped vehicle and warning devices. The purpose of providing the videos is to demonstrate the presence/absence of observed effects and the experimental paradigm/operation of the apparatus.
IC9 Study Acknowledgement Form	Participants will be read a script by the research staff which explains the true purpose of the study. The participant will be asked to read and sign the form.	Research staff	Required for compliance with Institutional Review Board (IRB) procedures.
IC10 Post-Experiment Survey and Acknowledgement (see p. 7-9– in Attachment H, Data Collection Materials)	The participant will print their name, sign, and date the form by pen and paper and then give the form to a researcher. Next, the researcher will read eight questions to the participant and ask them to respond verbally. The researcher will record the participant's answers by pen and paper.	Research staff	This information will be used to better understand how the participants perceived the critical trials in the experiment – for example, did they understand the purpose of the warning devices? Did they find them easy to see? Other data collected in this study will tell us "whether" the warning devices affect behavior, "how", and "to what extent". In contrast, this information will help the researchers understand "why" the warning devices did or did not affect behavior. Name, date, and signature information will not be included in the public dataset.

2.1 Outline of Steps Involved in Collected Data from CMV Drivers

As previously described, this information collection will take place during a driving research study. The purpose of this section is to describe the experience of the participant, at a high level, from beginning to end.

Participants for this study will be licensed drivers recruited from the New River Valley and surrounding areas of Southwest Virginia. Participants will be operating a light duty passenger car during the driving portion of the study. Therefore, any licensed driver (whether they hold a standard, personal driver's license or a commercial driver's license) is potentially eligible to participate in the research, and no particular type of license-holder will be targeted preferentially with respect to recruitment.

A VTTI staff member will contact potential participants from an extensive VTTI database, which includes previous VTTI study participants and people who have expressed interest in participating in VTTI research, though to avoid potential biases in the data, participants from previous studies at VTTI with a similar methodology will not be eligible to participate. In addition to VTTI's database, news and electronic media ads may be used to recruit participants (see Attachment G, Recruitment Materials, p. 2 – 4).

The research team will screen interested participants to ensure eligibility to participate in the study. Those who are eligible will be scheduled to come to VTTI for the study session.

After arriving at the VTTI facility, the participant's experience will follow the essential flow shown in Figure 1 below. A detailed description of each step follows the figure.

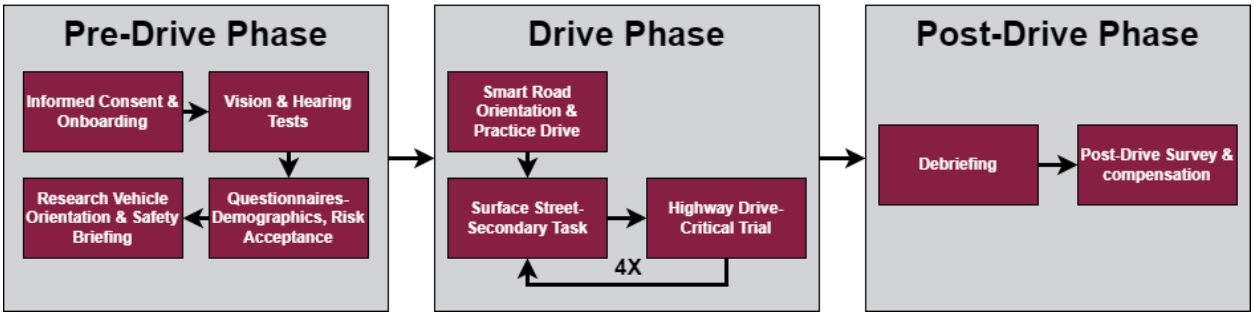

Figure 1. The general, three-stage flow of the experimental protocol. Participants will participate in Pre-Drive, Drive, and Post-Drive Phases, during which various types of information will be collected.

Upon providing a signed informed consent document, participants will be asked to show a valid driver's license before undergoing brief and basic vision and hearing testing. Although participants are asked to provide information about driving fitness related health items during the screening prior to arriving for the experiment, to ensure the safety of both participants and the research staff, it is necessary to verify that their vision and hearing meet the minimum criteria to participate in the study on the day of the appointment. Participants who arrive for the study but do not meet eligibility criteria will receive compensation at a prorated rate of $35 per hour for

the time they spent, be invited to participate in future studies, and dismissed – see Attachments G and H for further details on dismissal procedures.

As a final step before preparations for the driving portion of the study, participants will be asked to complete the demographics survey and the risk propensity survey described in Table 2.

To prepare for the driving session, participants will receive detailed instructions from research staff describing their tasks in the driving experiment. Included in these instructions will be information about the route (on the close-course track), vehicle speed and safety, the presence of other vehicles on the road, and so on.

Next, participants will be asked to put on the eye-tracking device, which is worn essentially in the same manner as a pair of eyeglasses. Research staff will proceed through device setup and calibration procedures to ensure the device is accurately tracking and recording visual behavior information (data collection at this point is merely to ensure proper function of the equipment – eye-tracking data collected prior to beginning the driving experiment will be discarded).

Individual participants will then be seated in the research vehicle with a member of the research staff who will accompany them for the duration of the driving portion of the experiment. The vehicle controls, mirrors, etc. will be adjusted for the participant's comfort and safety. Then, participants will engage in an orientation session to familiarize themselves with the research vehicle and the feeling of driving while wearing the eye-tracking device.

This closed-track experimental study at the Virginia Smart Roads (part of the Virginia Tech Transportation Institute facility, pictured below in Figure 2) will include the evaluation of warning devices (present vs absent) across two road geometry configurations (straight vs curved) and two temporal lighting conditions (day vs night).

Figure 2. Aerial photograph of the Virginia Smart Roads. The driving portion of the experiment will take place entirely within the closed-course sections of the roads shown in the photograph.

Regardless of temporal lighting condition, participants will be asked to operate a light passenger vehicle while navigating a prescribed route on the Virginia Smart Roads at highway speeds. Along the route, participants will intermittently encounter several scenarios involving a stopped commercial motor vehicle (CMV) on the shoulder of the road, partially blocking their travel lane. Participants' visual and driving behaviors will be recorded. Between critical trials, the participant will engage in a benign secondary driving task to help ensure that the participant's behavior is not unduly affected by actual or perceived knowledge of the purpose of the experiment.

The driving portion of the study will take just over one hour per participant on average, including orientation and instruction periods. Once the driving portion is complete, the participant will be instructed to park the research vehicle and disengage the engine. The participant will be asked to doff the eye-tracking device before exiting the vehicle.

After entering the main building at the VTTI facility, participants will be debriefed, including receiving details about the purpose of the experiment (certain details cannot be shared with the participant in advance, to not affect their visual behavior prior to encountering a stopped vehicle).

Finally, the participant will be asked to complete a post-experiment survey and a "future interest" form (for VTTI business purposes) before being issued monetary compensation of $87.50 in exchange for their participation in the complete study session.

2.2 Data Collection Plans

VTTI will recruit 256 individuals to participate in this study. Half (128) will participate during the day, and the other half (128) will participate at night. Each participant will encounter four stopped CMVs while driving, each under slightly different conditions. The order of presentation will be "counterbalanced" so that each combination of conditions will be the "first scenario" experienced for 32 out of 256 participants. For example, for 32 participants, the first of four stopped CMVs will be encountered on a curved road at night without warning triangles deployed. Another 32 participants will first encounter the first of four stopped CMVs on a straight road with warning triangles deployed during the day. Figure 3 below presents an "illustration of the mixed-model design to be used for data collection in this study".

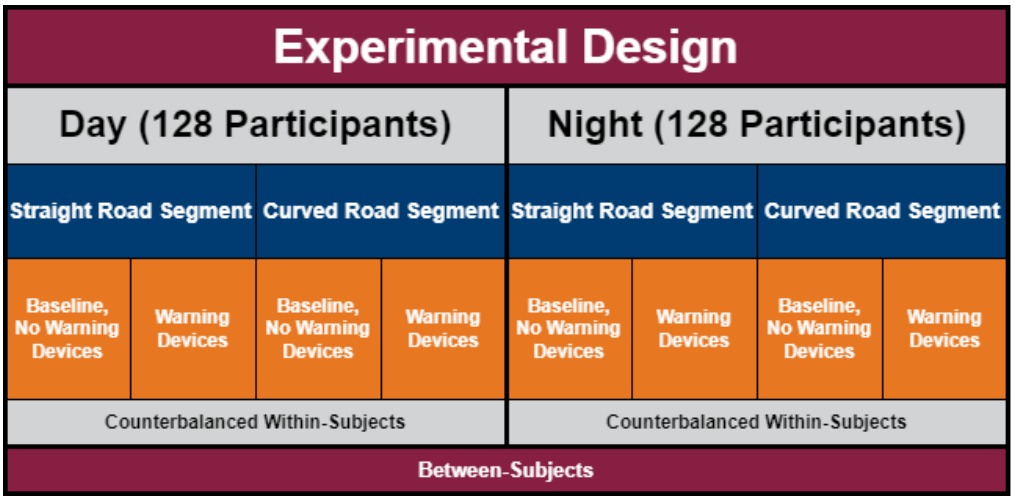

Figure 3. Illustration of the mixed-model design to be used for data collection in this study.

As shown in Figure 3, each participant will provide data during an evaluation of warning devices (within-subjects factor: present, absent) across two road geometry configurations (within-subjects factor: straight, curved) and will be assigned to one of two temporal lighting conditions (between-subjects factor: day, night) for the evaluation.

Figure 4 shows the intended setup of the experiment given the research vehicle (RV) driven by the participant, traveling on the same travel lane as a stopped CMV, with an opposing/other vehicle (OV) in the adjacent lane. The warning device configuration will follow 49 CFR §392.22 guidelines (i.e., the rules concerning the deployment of warning devices).

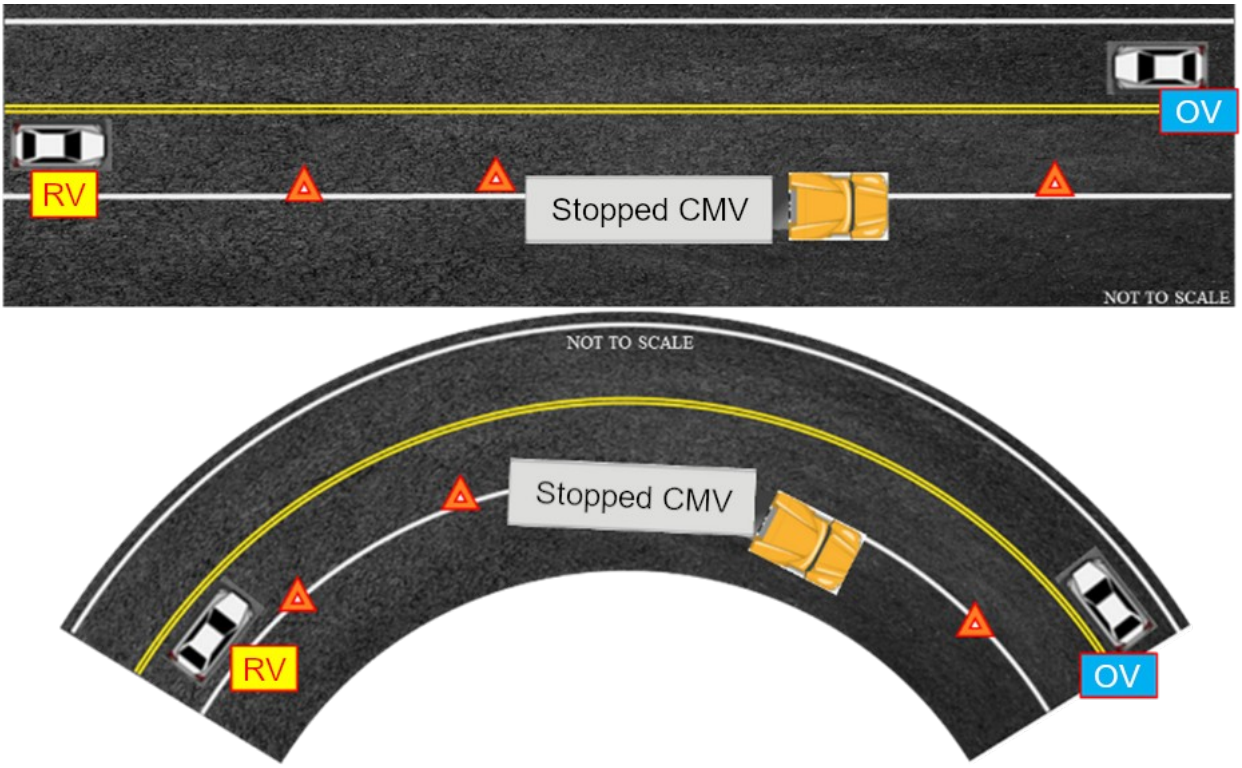

Figure 4. The experimental conditions with warning devices present for both day and night trials on straight road (top) and curved road (bottom) scenarios.

2.3 Who Will Collect the Information?

FMCSA has contracted with VTTI at the Virginia Polytechnic Institute and State University (i.e., Virginia Tech/"VT") to administer this study and analyze its results. The researchers/investigators currently assigned by VTTI to perform this study are Andrew Miller, Erin Mabry, Rich Hanowski, Matthew Camden, Rebecca Hammond, Susan Soccolich, Kuan-Ting Chen, Brian Pugliese, Christine Link-Owens, Xiaojian Jin, Mark Petersen, Christie Ridgeway, Lucas Parks, Feng Guo, Lucas Kerns, Daniel Faulkner, Pat Hicks, Tarah Crowder, Abhijit Sarkar, and Julie Hodge.

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 K) and prior to submission of this application for approval.

2.4 Potential Challenges in Comprehending Notices Associated with the Collection

Although the notices (e.g., advertisements) associated with this collection are designed to be straightforward, one technical point which may be difficult for participants to understand is that individuals who wear glasses may or may not be eligible to participate. The eye-tracking device, which takes a form essentially similar to eyeglasses, cannot be worn with the participants' prescription lenses. To mitigate this issue, FMCSA has invested in a set of corrective lens attachments for the eye-tracking device that allows for the accommodation of participants with a

wide range of prescription strengths for participants (correcting both nearsightedness and farsightedness).

To utilize these corrective lenses, however, the participant must be able to tell VTTI researchers the particulars of their eyeglasses prescription. While the eligibility criteria and need to bring prescription information to the study appointment is communicated to participants prior to the appointment, there remains a possibility that interested individuals do not understand the information due to its technical nature.

Attachment G reflects the various efforts taken by VTTI to communicate the eligibility criteria to potential participants and the range of prescriptions which can be accommodated using the corrective lens attachments purchased by FMCSA.

3. EXTENT OF AUTOMATED INFORMATION COLLECTION

Automated or fully automated information collection includes the following elements of the collection:

Questionnaires and Surveys: All questionnaires will be loaded onto VTTI-owned computers. All responses will be automatically uploaded to an online secure database once the participants submit their answers. Whenever determined safe, practicable, and in line with data security and retention policies, survey/questionnaire information previously provided by a participant will be used instead of recollecting the data. This principally refers to participants in this study who have already participated in other VTTI research studies in the past, and so have provided some of the data to VTTI already and consented to the storage and use of that information. For example, this includes any applicable demographic or preferential (e.g., available to participate in studies only during the day) information collected during an individual's participation in a previous study.

Eye-Tracking Data: After a brief setup and calibration of the device, the participant does not need to do anything additional to provide eye-tracking data, except wear the eye-tracking glasses. Eye-tracking data will be recorded automatically as the participant drives the vehicle and looks around the world inside and outside the vehicle as normal. The eye-tracking data, which primarily contains timestamped visual fixation coordinates in relative space, will then be processed through a variety of software algorithms to infer visual detection times (e.g., when did the participant look at the warning device or stopped vehicle), average fixation length, area of first fixation (vehicle or warning device), and other visual behavioral data. In other words, the participant does not need to provide narration during data collection (e.g., "I see a stopped vehicle") or to process the data. The raw and computed 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 errors later needed for analysis.

Camera Footage: Camera footage for scan pattern analyses will be collected via multiple cameras. One small camera is permanently integrated in the eye-tracking glasses and faces away from the participant. The other cameras are mounted to and/or oriented such that they face either the interior of the vehicle (i.e., vehicle controls/instrument cluster) or the world outside the vehicle. The camera footage will be recorded automatically. No action is necessary on the participant's part to start, stop, or store recording.

Instrumented Vehicle Data: Various sensors in the vehicle will automatically detect and record the state of vehicle parameters necessary to assess the participants' driving behaviors. For example, sensors will automatically detect the moment in time when the participant releases the accelerator pedal or begins adjusting the steering wheel in response to other vehicles encountered during the driving experiment. They will also record the state of the control inputs (e.g., steering wheel rotated -47°, brake depressed 100%, etc.) and vehicle kinematic information. The participant does not need to do anything additional to provide this data beyond simply driving the research vehicle as they would any other car. In other words, for example, the participant does not need to verbally state that they are pressing the brake to slow down.

Differential GPS Data: Various sensors in the participant's vehicle and other vehicles on the closed-course road during the experiment are outfitted with GPS sensors. These sensors automatically record the position and velocity of the participant's vehicle, allowing various metrics to be computed during data analyses. These include, for example, matching up the participant's initial visual fixation on the warning device with the distance between the research vehicle and the stopped CMV at the time of that initial fixation. Using analysis software, information such as the time between the research vehicle and the stopped CMV will be computed automatically. The participant does not need to do anything additional to provide the GPS data beyond operating the research vehicle. GPS devices are integrated with the research vehicle's hardware, and, therefore, tracking will only occur while the participant is operating the research vehicle, and all locations will be necessarily restricted to those within the VTTI driving research facility.

Overall, time spent providing the automatically recorded information described above represents roughly half the time it will take participants to provide all the information collected for this study. However, it also represents over 99% of the information that will be collected from each participant, greatly increasing the overall efficiency of the collection.

4. EFFORTS TO IDENTIFY DUPLICATION

FMCSA and the VTTI research team are unaware of other research conducted, currently or in the past, which could be used to fulfill the research goals of the *Study of Warning Devices for Stopped Commercial Motor Vehicles*.

As described previously in this document, research conducted by Highway Safety Research Institute (sponsored by FHWA) has provided some evidence supporting the use of warning devices for stopped commercial motor vehicles, but often with small sample sizes or inconsistent results. For instance, Lyles (1980)[11] showed that the presence of warning triangles deployed near a stopped vehicle was associated with lower passing vehicle speeds during the daytime, but also that the mere presence of a stopped vehicle (i.e., without warning triangles deployed) had a comparable effect. Knoblauch and Tobey (1980)[12] also found warning triangles to be effective in reducing passing motorists' vehicle speed during the daytime, but also that they were less effective than other devices (such as road flares), particularly for commercial motor vehicles (CMVs) compared to passenger cars. These inconsistent results are merely one example of many, and one of the aims of the current study is to more revisit and re-evaluate the effects of warning triangles through updated research paradigms in alignment with regulations and the use of new technologies.

Another challenge in considering the results of the past research is that it often examined use of the warning devices either in a manner inconsistent with FMCSA's regulatory requirements (e.g., different numbers of devices or non-compliant deployment patterns) or in combination with other types of devices (e.g., flashing lamps) thus rendering it unclear whether the warning devices contributed to any observed changes in driver behavior.

Furthermore, measurements taken using the technologies and methods available at the time of the described past research are considerably less accurate, more subjective, more error-prone, and less informative than the methods and instruments proposed for the current research.

VTTI has also conducted prior, proprietary research for third parties examining the effects of warning devices, including warning triangles, when deployed near stopped CMVs. However, that research did not include an examination of eye-tracking data, considered to be among the most critical contributions to the literature of the current study. Advancements in eye tracking technology have enhanced the ability to evaluate the effectiveness of roadside warning devices by precisely monitoring where individuals direct their gaze in real-time. These technologies provide quantifiable data on attention patterns in a way that research from decades ago could not. This data offers insights into the effectiveness of such devices in capturing and maintaining drivers' attention, ultimately aiding in the optimization of roadside safety measures.

In addition, whereas this work focuses on establishing the baseline effects of warning triangles (vs. their absence) in various driving scenarios, VTTI's previous work on the topic mainly involved a comparison of the effects of warning triangles with the effects alternative warning device designs which are not currently allowed for use by the Federal Motor Carrier Safety Regulations.

Finally, the authors of one past study[13] noted that in certain circumstances, the presence of warning triangles reduced the frequency at which passing motorists steered away from (or "gave room to") stopped vehicles. In other words, drivers appeared to be less likely to have a visible response to the stopped vehicle when the warning triangles were deployed near the stopped vehicle.

In light of that finding, one contribution of the planned research described in this ICR is the inclusion of both driver behavior metrics and risk propensity questionnaires in an attempt to determine whether drivers who report engaging in riskier driving behaviors and/or greater levels of risk propensity are less likely to have detectable responses (such as steering away from the vehicle or releasing the accelerator pedal) than other drivers. If so, it would potentially help provide evidence that driver's risk-related attitudes influence response to warning triangles.

5. EFFORTS TO MINIMIZE THE BURDEN ON SMALL BUSINESSES

There will be no known or anticipated impact on small businesses as a result of the information collection activities described in this research. This study will involve a convenience sample of licensed drivers. There are no efforts to target drivers associated with specific types or sizes of businesses, nor is there a requirement that participants own or work for business of any type. Participation in the study is voluntary, so even in the event of participation, no small business will have an imposed burden that it is not willing to bear. Finally, because this research will take place at a closed-course driving facility operated by VTTI, information collection activities will

not cause significant disruptions to the regular flow of traffic in the area.

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.

As it pertains to the issue of information collection, all data (except for the screening/eligibility criteria already described in this document which may be provided before participation and then verified at the time of a participant's study appointment) collected in this study will be collected/provided by the participant once and only once.

This collection is important to FMCSA's mission of reducing crashes. If this information is not collected:

- FMCSA will be disadvantaged when it comes to decision-making related to regulatory burdens on the industry (and particularly the automated driving system industry in complying with warning device regulations that reference or require a *driver*).
- FMCSA will be disadvantaged as it pertains to decision-making on applications for exemption/waiver for alternative warning devices, particularly those which vary substantially for those currently permitted by regulation.

Because such decision-making is necessarily safety-critical (i.e., relating to required devices intended to help prevent crashes involving commercial motor vehicles), collection of this information is both timely and impactful.

7. SPECIAL CIRCUMSTANCES

There are no special circumstances related to this information collection.

8. COMPLIANCE WITH 5 CFR 1320.8:

FMCSA published the 60-day Federal Register notice on January 8, 2025, and the comment period closed on March 10, 2025 (90 FR 1591). (Attachment L). A total of 9 comments were received from the public. These comments revolved around six major themes: regulatory considerations and impact, environment or condition-based study factors, study factors for other devices, automated vehicle considerations, safety benefits and effectiveness of warning devices, and risks or challenges with warning devices. Responses to these issues are provided below. Many comments addressed multiple topics; however, each response is organized by the primary issue raised.

8.1 Regulatory Considerations and Impact

The Agency acknowledges the submission of public comments related to the structure and effectiveness of current regulatory provisions governing warning devices. These comments have been included in the rulemaking docket. FMCSA appreciates the public's engagement in identifying areas where additional clarity or modernization of safety regulations may be

warranted. The Agency will consider these comments as it continues to evaluate opportunities for refinement of the regulatory framework consistent with statutory authority and its safety mission.

8.2 Environment or Condition-Based Study Factors

The Agency has reviewed comments addressing the influence of roadway geometry, lighting, and environmental context on the efficacy of warning devices. FMCSA appreciates this input and affirms that environmental variables have been integrated into the study design to ensure that the data collected will be representative of diverse and relevant roadway conditions. These comments will remain part of the administrative record and may be referenced in future analytical activities or research planning.

8.3 Study Factors for Other Devices

Comments concerning the operational reliability and safety implications of alternative or supplemental warning devices were received and reviewed. FMCSA appreciates the public's interest in emerging technologies, including alternative forms of warning devices. While the current study is limited to an evaluation of warning devices already prescribed by the Federal Motor Carrier Safety Regulations, feedback regarding alternative devices will be retained for consideration in the context of potential future research on warning devices.

8.4 Automated Vehicle Considerations

The Agency has noted comments concerning the compatibility of current warning device requirements with the operation of automated driving systems (ADS) in commercial motor vehicles. FMCSA acknowledges the importance of ensuring safety-equivalent compliance for evolving technologies and appreciates the public's attention to this issue. These comments have been preserved in the docket and may inform future policy development in coordination with broader departmental efforts on automation.

8.5 Safety Benefits and Effectiveness of Warning Devices

Public comments recognizing the potential safety benefits of properly deployed warning devices have been reviewed and entered into the docket. FMCSA appreciates the public's support for research intended to empirically assess the performance of such devices. These comments reinforce the Agency's objective to advance transportation safety through the application of rigorous, data-driven methods and to ensure that regulatory decisions reflect verified outcomes.

8.6 Risks or Challenges with Warning Devices

The Agency acknowledges public concerns regarding limitations associated with warning device usage, including deployment risks, situational effectiveness, and potential misuse. FMCSA appreciates these submissions and notes their relevance to both research design and potential future considerations related to driver safety and regulatory improvement. These comments have been retained in the administrative record for future reference as applicable.

9. PAYMENTS OR GIFTS TO RESPONDENTS

Participants will be compensated for their time in the study with an hourly rate of $35, consistent with standard VTTI test track rates for the general populace of passenger vehicle operators. The average session time is one visit lasting approximately 2-2.5 hours. If the participant chooses to withdraw before fully completing the portion of the experiment they have been assigned, they

will be compensated for the portion of time of the study for which they participated. If the session ends early for any reason, they will be paid at the rate of $35 per hour, rounded up to the nearest half-hour. All participants will receive a minimum of $35. Participants that complete the study in full will be compensated up to $87.50. Participants will be compensated at the end of the session with a pre-loaded MasterCard (ClinCard).

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), Andrew Miller, 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 (09/30/2028) the end (09/30/2027) of the study contract. After being assigned a Driver ID, all sensitive data will use this ID to avoid a breach of confidentiality. Information collected to compensate the participant will be obtained but will never be stored with study data.

Video and audio data will be collected using the developed GTTR. The encrypted data on the storage drive will be uploaded to the VTTI server when filled or when individuals' participation is complete. 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. Therefore, all PII 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 informed consent form explains to the participants steps they can take to protect their privacy. The research team will go through all necessary steps to ensure the confidentiality of participant data, including those described above, whenever possible.

The confidentiality and data security procedures for this study, including those described above (as applicable) were included in this study's IRB application and approved by the corresponding IRB accordingly.

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. The research team or project sponsor may also include specific clips of de-identified video as an appendix to the final research report (as previously described in this document) and, as appropriate, at research conferences and project meetings. Participants' names or other identifying information, including video that contains unblurred/un-redacted areas of the participants' body readily identified as belonging to the participant (e.g., the participant's face or other distinctive features), will never be associated with the showing of such video clips at conferences or included in any digital report appendices. The data from this study will be included in the FMCSA Data Repository (IRB 24-816), including a de-identified dataset for public use. Identifiable data, as applicable, will be available only to qualified researchers with privacy and security protections in place.

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

12.1 Burden hours: Collection Characteristics

There are a few important characteristics of this collection generally that merit enumeration before examining the burden hours for individual information collections (e.g., different surveys/questionnaires, automated sensor data collection etc.).

12.1.1 **CHARACTERISTIC 1: Here, "256" always refers to the same set of 256 participants**

First, to achieve desired statistical power (see Supporting Statement B), information must be collected from a minimum number (256) of participants for each individual information collection (e.g., each separate survey as applicable). To have usable data, each participant must provide information for each individual information collection. Therefore, where the number of respondents is listed as "256" for a given information collection in this section, this is the *same* 256 respondents listed elsewhere. That is, these are not unique/separate groups of 256 respondents.

12.1.2 **CHARACTERISTIC 2: Numbers > 256 include attrition dropouts, screened cases**

Second, not all respondents will provide information for all information collections – e.g., those who provide information only during recruitment and/or screening procedures (and thus are dismissed from the study due to, e.g., ineligibility). These respondents will not provide information for any additional information collections (e.g., instruments/forms, etc.) after attrition or screening. When the number of respondents exceeds 256 in this section, it refers to the 256 respondents who will provide information on every information collection (e.g., form) plus any respondents who will drop out prior to completing every information collection.

12.1.3 **CHARACTERISTIC 3: Automated collections are simultaneous, no additional effort**

Third, some information collections will occur simultaneously – namely those that are collected/provided automatically. When the 256 participants engage in the driving portion of this research study, they will automatically (without additional effort) be providing, via equipment/sensors/devices:

- Eye-tracking data
- Instrumented vehicle sensor data related to their driving behaviors
- GPS location information as recorded by the vehicle they are driving during the study
- Camera footage recorded by cameras affixed to the vehicle and/or integrated with the eye-tracking device

Consequently, the data collected automatically will be treated as "multiple forms within the same information collection", because they are all collected simultaneously and automatically. All the respondent needs to do is operate the vehicle during the approximately 65-minute driving portion of the research study described elsewhere in this document.

12.1.4 **CHARACTERISTIC 4: Besides dropouts, each IC gets 1 response from each of 256**

Fourth and finally, while there are several "information collections" involved in this overall collection of information (e.g., separate surveys/questionnaires), each of the respondents will provide data on each information collection only once, and the collection will be either during recruitment or during the study appointment. The total time for each participant providing information for all information collections will be approximately 2 ½ hours in aggregate, and no additional information will be requested or collected after the participants' respective study appointments.

12.2 Predicted overall number of participants based on estimated rates of attrition and screening dismissals

We plan to recruit participants from Blacksburg, Virginia, and the surrounding areas. The objective is to collect complete data for all enumerated information collections from 256 participants. Based on VTTI's experience conducting driving research, it is estimated that approximately 357 total respondents must be screened and/or recruited to achieve this target. This estimate of 357 includes an estimated attrition rate of approximately 10% and a roughly 20% rate of participants who are screened out and dismissed due to ineligibility. These rates are rough estimates based on VTTI's experience recruiting for other driving research studies. Table 3 below uses those rates, and illustrates the math used to derive the estimated requirement of 357 respondents in a step-by-step-by-step fashion.

Table 3 below illustrates the process of recruiting a sufficient number of participants to achieve the goals of the research while also accounting for screening and attrition losses. To accomplish that, the table uses "steps in the recruiting process". In step 1, 256 participants are recruited. However, it is predicted that only about 184 (see far right column) will actually contribute data due to attrition or being screened. That is because 51.2 are predicted to be screened or found ineligible, and of those who remain, about 20.48 will be lost due to attrition, leaving 184 predicted participants who will provide data from the original 256 participants recruited during "recruitment step 1".

In the hypothetical step 2, the research team would plan to recruit an additional 72 participants, because 72 participants are needed to reach the goal of 256 after considering the 184 participants who already provided data during the first recruitment step on the previous row of the table. This procedure repeats for each line of the table until step 6 when a full 256 participants are predicted to have provided data out of 357 individuals recruited.

The term attrition as used in this document primarily includes participants who schedule a study appointment but do not keep the appointment or reschedule. While unlikely, it also would include any more unusual circumstances, such as participants who arrive for their appointment but voluntarily leave the study prior to the completion of information collection activities (including data collection), and participants who, for any reason, are dismissed or released from the study prior to the completion of information collection activities.

Table 3. Estimated Recruitment Totals Factoring in Screening and Attrition.

Recruitment Step	Participants Recruited in Step	Number Screened or Found Ineligible (20%)	Remaining Number Participating	Number Lost to Attrition (10%)	Resulting Number of Participants with Full Data (Rounded to Nearest Integer)
1	256	51.2 (.20 * 256 = 51.2)	204.8 (256 – 51.2 = 204.8)	20.48 (.10 * 204.8 = 20.48)	184 (184 Total)
2	72 (72 + 184 = 256)	14.4 (.20 * 72 = 14.4)	57.6 (72 – 14.4 = 57.6)	5.76 (.10 * 57.6 = 5.76)	52 (236 Total)
3	20 (20 + 236 = 256)	4 (.20 * 20 = 4)	16 (20 – 4 = 16)	1.6 (.10 * 16 = 1.6)	14 (250 Total)
4	6 (6 + 250 = 256)	1.2 (.20 * 6 = 1.2)	4.8 (6 – 1.2 = 4.8)	0.48 (.10 * 4.8 = 0.48)	4 (254 Total)
5	2 (2 + 254 = 256)	0.4 (.20 * 2 = 0.4)	1.6 (2 – 0.4 = 1.6)	0.16 (.10 * 1.6 = 0.16)	1 (255 Total)
6	1 (1 + 255 = 256)	0.2 (.20 * 1 = 0.2)	0.8 (1 – 0.2) = 8	0.08 (.10 * 0.8 = 0.08)	1 (256 Total)
Total	**0 (256 + 72 + 20 + 6 + 2 + 1 = 357)**	0 (51.2 + 14.4 + 4 + 1.2 + 0.4 + 0.2 = 71.4)		0 (20.48 +5.76 + 1.6 + 0.48 + 0.16 + 0.08 = 28.56)	**0 (184 + 52 + 14 + 4 + 1 + 1 = 256)**

* Note: Due to rounding, numbers may be slightly different than displayed in the table.

Note that, due to rounding in the table but not necessarily elsewhere, other figures in this application used in practice may vary from those in the table above by ± 1 respondent. Eligible participants are between 18 and 80 years old with a valid U.S. driver's license and drive at least 2 days per week on average. Further information on eligibility criteria, screening questions, and justifications, is provided in Attachment G (see p. 12 – 16).

Participant burden is primarily associated with screening and recruitment procedures, travel to and from the VTTI facility to participate in the study, completion of the study forms/surveys/questionnaires, coordination with the research team on site, and participation in the driving experiment. Participants will be using an instrumented vehicle provided by the study team for the experiment and are not expected to bring their own vehicles to the Virginia Smart Roads facility.

12.3 **Narrative of Burden Hours by Information Collection (IC)**

12.3.1 **IC1: Recruitment**

All 357 respondents, which includes the aforementioned minimum of "256" participants with complete data provided for all ICs as well as the additional respondents lost via attrition or eligibility screening illustrated in Table 3, will spend approximately 11 minutes "responding to the recruitment advertisement." "Responding to the recruitment advertisement" means having a phone call with a VTTI research staff member and answering screening/eligibility questions verbally. This estimate was derived as follows.

Informal "pilot testing" of this instrument was arranged (N = 3) with three FMCSA employees not otherwise involved with the study/project. During the pilot test, the individual reading the instrument to the participant skipped reading the initial portion of the script (as reading time will vary by research staff member in practice).

Instead, the word count of the initial portion of the script (353 words) was divided by the estimated average spoken-aloud English reading speed of typical US adults, 183 words per minute[19], yielding an estimate of 1.93 minutes.

Next, the individual reading the instrument to the participant read each item aloud to the participant before recording their verbal response. Their answers varied and so the number of scripted follow-up questions differed between pilot testing participants. A stopwatch recorded the time elapsed. Times were rounded to the nearest ¼-minute increment (i.e., 15-seconds). The results are shown below. The far-right column provides the sum of the mean interview time from pilot testing and the estimated average time for a researcher to read the initial portion of the script.

Table 4. IC1 Estimated Participant Burden, Based on Pilot Testing.

Participant 1	Participant 2	Participant 3	Mean Completion Time	Estimated Reading Time	Standard Deviation of Completion Time	Estimated Participant Burden Minutes (Mean Completion Time +

						Estimated Time to Read Initial Portion of the Script)
11.00 min	8.00 min	7.25 min	8.75 min	1.93 min	1.98 min	**10.68 min**

Finally, the resulting "*m* + Reading" value from the table was rounded up to generate the burden estimate of 11 minutes or 0.18 hours per participant.

For the purposes of calculating the burden on those whose who leave the study due to attrition, it is assumed that all attrition is due to the most typical case of attrition: signing up to participate but not reporting for one's study appointment (nor rescheduling). In a short study such as this, attrition due to leaving the study mid-participation is a lower risk than it is for longer, e.g., longitudinal study designs. Therefore, for this estimate, the only burden hours on those who leave the study through attrition *or* screening (during the Recruitment IC) is responding to the recruitment advertisement.

12.3.2 **IC2: Informed Consent**

Participants will be sent a copy of the Informed Consent Form prior to their appointment and while instructed not to complete it ahead of time, are expected to have read it prior to arrival for their study appointment. The form contains various information, including required statements/clauses, related to the terms and conditions of participation in the study. The primary task for this IC is to read the aforementioned information, print one's name, sign the form, and write the date of participation.

Because this IC involves far more reading than responding, the burden estimate is assumed to be approximately the number of words in the document (3,003) divided by an estimate[17] of the average adult silent reading speed of non-fiction text in the English language (238 words per minute): approximately 0.21 hours (12.62 minutes), plus a nominal 0.01 hours (0.50 minutes) to sign and date the document, for a total rounded down to 13 minutes or 0.22 hours per participant.

12.3.3 **IC3: IRS Form W-9**

The IRS form W-9 is a simple, routine tax form (see Attachment J). The information will not be used or analyzed for this study, but rather, is required for both VTTI's as well as participants' compliance with federal tax laws which are applicable due to the monetary compensation provided to participants in exchange for their participation in the research study.

The form is very simple for individuals (vs businesses). It is anticipated that participants will need to enter their name, address, and social security number before signing and dating. It is estimated that nearly all adults in the United States (roughly 96%) have their social security number memorized[18].

A nominal burden of 1 minute is assigned to complete each element of the W-9 form described above. The total burden is therefore estimated at approximately 0.07 hours (4 minutes) to complete per participant.

12.3.4 **IC4: Hearing Screening**

The hearing screening, conducted verbally, is exceptionally brief. It involves listening to and repeating each of four short sentences spoken by a member of the research staff. The sentences have an average length of 7.25 words (max of 9 words). Based on the very simple and short task, it should take a participant no longer than about 0.02 hours (1 minute) to complete.

12.3.5 **IC5: Vision Screening**

Like the hearing screening, the visual acuity and color vision screening are also very brief. Between the two consecutive elements of the vision screenings, it is anticipated that a total burden of 3 minutes will be required per participant to complete both visual acuity screening and color vision screening.

12.3.5.1 **IC5A: Visual Acuity Screening**

The screening involves a simplified Snellen eye chart test (the "read the smallest line you can make out" test) without follow-up testing. Participants must achieve at least the equivalent of 20/40 near visual acuity to avoid being screened out. The test is very brief because most participants can quickly ascertain which line is the "smallest they can read" and do so. Including instructions, the screening itself lasts approximately 24 seconds per participant.

12.3.5.2 **IC5B: Color Vision Screening**

Participants will be shown seven colorful pseudoisochromatic plates, each of which depicts a two-digit number, in rapid succession. The participant's job is to read aloud the number on each plate. To discourage guessing or the use of non-color visual cues, the protocol allows the participant only 3 seconds to read and consider each of the plates. Therefore, after instructions are provided, the test itself lasts approximately 21 seconds per participant.

12.3.6 **IC6: Demographics Questionnaire**

To estimate burden hours for IC6, informal "pilot testing" was arranged (N = 3) with three FMCSA employees not otherwise involved with the study/project.

The individual reading the instrument to the participants during the pilot test read each question aloud to the participants before recording their verbal response. The individual reading the instrument used a stopwatch to record the time elapsed. Times were rounded to the nearest ¼-minute increment (i.e., 15-seconds). The results are shown below.

Table 5. IC6 Estimated Participant Burden, Based on Pilot Testing.

Participant 1	Participant 2	Participant 3	Mean Completion Time	Standard Deviation of Completion

				Time
2.00 min	1.25 min	1.75 min	**1.67 min**	0.38 min

Finally, the observed mean completion time was rounded up to the nearest minute to generate a burden estimate of 2 minutes or 0.03 hours per participant.

12.3.7 **IC7: Risk Questionnaires**

To estimate burden hours for IC7, which includes both the driver behavior questionnaire and the risk propensity questionnaire, informal "pilot testing" was arranged (N = 3) with three FMCSA employees not otherwise involved with the study/project. Because the two questionnaires are completed together/sequentially and are substantially similar in both format and content, I treated them as one IC and allowed the stopwatch to continue running during the transition from the driver behavior questions to the risk propensity questions.

The individual reading the instrument to the participants during the pilot test read each question aloud to the participants before recording their verbal response. The individual reading the instrument used a stopwatch to record the time elapsed. Times were rounded to the nearest ¼-minute increment (i.e., 15-seconds). The results are shown in the following table.

Table 6. IC7 Estimated Participant Burden Hours, Based on Pilot Testing.

Participant 1	Participant 2	Participant 3	Mean Completion Time	Standard Deviation of Completion Time
9.00 min	5.00 min	5.50 min	**6.50 min**	2.18 min

Finally, the observed mean completion time was rounded up to the nearest minute to generate a burden estimate of 7 minutes or 0.12 hours per participant.

12.3.8 **IC8: Burden Hours Associated with Automated ICs Occurring During the Driving Portion of the Study**

During primary data collection, each participant will spend approximately 1.08 hours or 65 minutes with the research team in the driving tasks, which include an acclimatization practice drive and four experimental drives. Participants will be instructed and reminded (as necessary) to operate the vehicle at specific speeds depending on the area of the closed course they are driving in. These speeds were accounted for in the 65-minute estimate provided above.

The driving portion of the study proceeds in the fashion shown in table 7:

Table 7. Estimated Participant Burden Hours by Driving Event, for Automated ICs.

Step	**Driving Event**	**Burden Type**	**Burden per Participant**
1	Vehicle Orientation	Pre-Drive Phase	15 Minutes
2	Transition	Navigate to Start	1 Minute

3	Critical Trial Lap	Highway Driving	5 ¼ Minutes
4	Transition	Between Locations	1 Minute
5	Benign Task	Urban Driving	5 Minutes
6	Transition	Between Locations	1 Minute
7	Critical Trial Lap	Highway Driving	5 ¼ Minutes
8	Transition	Between Locations	1 Minute
9	Benign Task	Urban Driving	5 Minutes
10	Transition	Between Locations	1 Minute
11	Critical Trial Lap	Highway Driving	5 ¼ Minutes
12	Transition	Between Locations	1 Minute
13	Benign Task	Urban Driving	5 Minutes
14	Transition	Between Locations	1 Minute
15	Critical Trial Lap	Highway Driving	5 ¼ Minutes
16	Transition	Between Locations	1 Minute
17	Benign Task	Urban Driving	5 Minutes
18	Transition	Navigate to End	1 Minute
Total	N/A	N/A	**65 Minutes** **(1.08 Hours)**

* Note: Due to rounding, numbers may be slightly different than displayed in the table.

Note that the ordering of certain events may vary in practice based on counterbalancing procedures (e.g., benign and critical task laps may be in the reverse order shown in the table above).

To derive the estimates in the table, the following techniques were utilized.

For the critical trial segments, it was determined via Google Earth that the approximate distance traveled for one lap on the highway portion (see Figures below) of the Virginia Smart Roads is 4.35 miles. At 55 mph, the instructed speed for the highway segments of the driving portion of the study, it would take approximately 4.75 minutes (0.08 hours) to travel one lap.

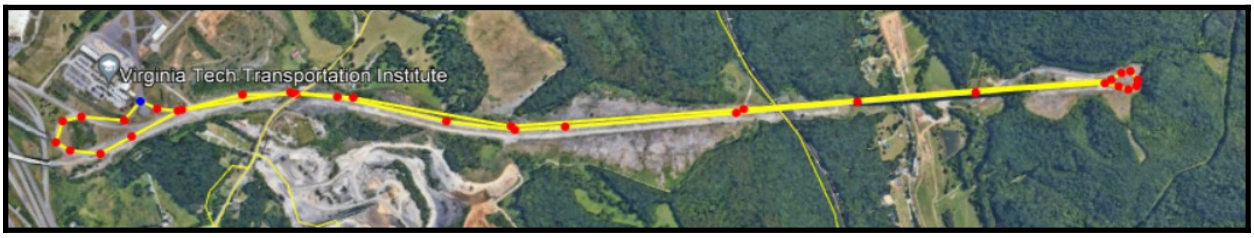

Figure 5. Google Earth path used to estimate distance of critical trial laps.

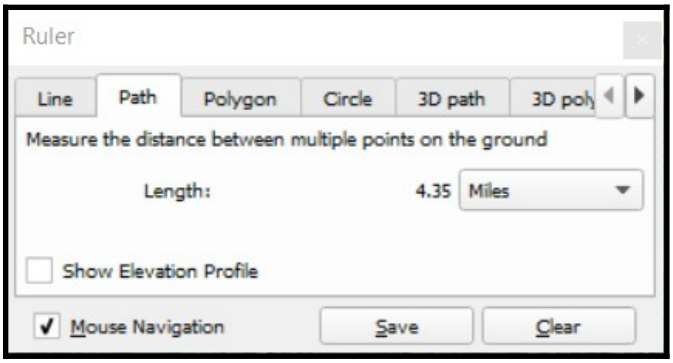

Figure 6. Google Earth measurement tool showing the path is approximately 4.35 miles in length

A 15-minute orientation to the vehicle was scripted during paradigm planning for the study – this value was incorporated in the burden estimate for this IC accordingly.

Benign task periods, which take place on the lower speed roads in the northwest portion of the Virginia Smart Roads Facility, vary in nature but were designed to have an elapsed time of approximately 5 minutes each (e.g., a road cone slalom task). The purpose of the benign task periods was described in a previous section of this document.

Finally, each transition period between steps in the driving portion of the experiment, which involves navigating to and through either an onramp or offramp on the highway portion of the Virginia Smart Roads, was assigned a nominal burden of one minute. At approximately 0.10 miles in distance each, the offramp/onramp segments of the highway portion of the Virginia Smart Roads would take roughly 25 seconds at 20 mph to traverse. Thus, the assigned value of 1 minute is considered a conservative estimate.

As shown in Table 7, the total length of the driving portion of the experiment is therefore figured as:

15 + 1 + 5.25 + 1 + 5+ 1 + 5.25 + 1 + 5+ 1 + 5.25 + 1 + 5+ 1 + 5.25 + 1 + 5 + 1 = 65 minutes or 1.08 hours of burden.

During this 1.08-hour period, the participant need only follow the instructions provided in driving the vehicle. No additional effort is required to provide the information that is

automatically recorded during the driving phase of the experiment. This information is enumerated in the subheadings below and elsewhere in this application.

12.3.8.1 **IC8A: Eye-Tracking Data**

To "respond," the participant need only wear the eye-tracking device and drive the research vehicle as described in section 12.3.8 of this application. The data is collected automatically during the driving portion of the study with no further action on the part of the driver required. The data is collected simultaneously with other data that is recorded automatically during the same phase of the study. Therefore, this sub-component of this IC adds no additional hours burden.

Further details on this collection are provided elsewhere in this application.

12.3.8.2 **IC8B: Instrumented Vehicle Sensor Data**

To "respond", the participant need only drive the research vehicle as described in section 12.3.8 of this application. The data is collected automatically during the driving portion of the study with no further action on the part of the driver required. The data is collected simultaneously with other data that is recorded automatically during the same phase of the study. Therefore, this sub-component of this IC adds no additional hours burden.

Further details on this collection are provided elsewhere in this application.

12.3.8.3 **IC8C: GPS Data**

To "respond", the participant need only drive the research vehicle as described in section 12.3.8 of this application. The data is collected automatically during the driving portion of the study with no further action on the part of the driver required. The data is collected simultaneously with other data that is recorded automatically during the same phase of the study. Therefore, this sub-component of this IC adds no additional hours burden.

Further details on this collection are provided elsewhere in this application.

12.3.8.4 **IC8D: Camera Footage Data**

To "respond", the participant need only drive the research vehicle as described in section 12.3.8 of this application. The data is collected automatically during the driving portion of the study with no further action on the part of the driver required. The data is collected simultaneously with other data that is recorded automatically during the same phase of the study. Therefore, this sub-component of this IC adds no additional hours burden.

Further details on this collection are provided elsewhere in this application.

12.3.9 **IC9: Study Acknowledgement and Signature Form**

Upon conclusion of the driving portion of the experiment, participants will be read a statement describing the purpose of the study and be asked to sign and date an acknowledgement form (see

Appendix G, p. 9). This is estimated to take a nominal and approximate 0.03 hours or 2 minutes per participant.

12.3.10 **IC10: Post-Experiment Survey**

To estimate burden hours for IC10, informal "pilot testing" was arranged (N = 3) with three FMCSA employees not otherwise involved with the study/project. Because this survey is intended to be administered *after* a respondent has participated in the driving study and asks questions about their experience, Each pilot testing participant was provided with a very brief description of the study procedures so that they could role play their answers to the questions. While none of the participants are otherwise involved with the study/project, all are FMCSA employees and are thus familiar with warning triangles and the corresponding safety regulations pertaining to their use, and so were able to provide detailed responses to the follow-up questions included on the IC.

Each question was read aloud to the participant before recording their verbal response, except in a few cases in which it was not necessary to read the follow-up "why" because the participants explained their "yes" or "no" answer immediately after providing it. The individual conducting the pilot test used a stopwatch to record the time elapsed. Times were rounded to the nearest ¼-minute increment (i.e., 15-seconds). The results are shown below.

Table 8. Estimated Participant IC6 Burden, Based on Pilot Testing.

Participant 1	Participant 2	Participant 3	Mean Completion Time	Standard Deviation of Completion Time
5.50 min	3.50 min	5.75 min	**4.92 min**	1.23 min

Finally, the observed mean completion time was rounded up to the nearest minute to generate a burden estimate of 5 minutes or 0.08 hours.

12.3.11 **IC11: Compensation Exchange**

This IC is not an actual "IC" in that no information is collected from the participant – however, it is the crucial last step in the overall collection and imposes a nominal hours burden on each respondent and therefore was given its own IC designation in this application.

After the post-experiment survey has been completed, participants will be provided compensation in exchange for their participation. This involves a brief passing of a pre-loaded card from a research staff member to participant and takes less than 0.02 hours or 1 minute to complete.

12.4 **Estimated Travel-Related Burden Hours**

Because participants will need to physically report to the VTTI facility to participate in the experiment, it will be necessary for them to travel. To estimate the burden hours associated with travel, 2022 population estimates for incorporated places in the New River Valley region of

Virginia were reviewed (the area from which respondents will be recruited). Although not all locations in the area have population estimates listed in the dataset (City and Town Population Totals: 2020-2022[19]) utilized for this effort, it represents over half the population of the historical Blacksburg-Christiansburg-Radford metropolitan statistical area, so represents a reasonable "ballpark" for the purposes of this estimate.

Next, travel distance and travel time estimates were generated using Bing Maps and Google Maps. Distance estimates were based on an origin located at whatever coordinates the respective source considered the default location for the incorporated place in question and a destination of the primary street address of the Virginia Tech Transportation Institute: 3500 Transportation Research Plaza, Blacksburg, VA 24061. The travel time point estimates were based on estimates for travel by car obtained from the respective sources at approximately 1530 Eastern time on a Wednesday.

After collecting the information needed from Bing Maps and Google Maps, the mean distance and travel time figures were computed for each of the incorporated places with an available population estimate in the previously referenced US Census Bureau dataset.

To generate the overall estimate of "average" travel distance, the mean travel distance figures for each incorporated place were multiplied by their 2022 population estimate figure. The sum of the products was figured, then divided by the sum of the population figures of all the incorporated figures in the sample. The effect of these operations was that the distance figures were weighted by the proportion of the sample represented by potential respondents who reside in each location. As an example, this means that the mean 5.4-mile travel distance estimate generated for Christiansburg (estimated population: 22,562) was weighted much more heavily in the overall estimate than the mean 38.85-mile travel distance estimate for Glen Lyn (estimated population: 93).

As shown in Table 9 on the following page, this resulted in a rounded estimate of one-way travel for the average participant of 8.76 miles. This figure was doubled to reflect round-trip travel needs, resulting in an ultimate mileage estimate of 17.52 miles per participant.

While not incorporated in the burden hour estimates, the travel distance was important for estimating the cost to participants – see Section 13 for further information.

The procedure for estimating an overall "average" travel time was substantially similar to the method used for travel distance. The mean travel time figures generated from Bing Maps and Google Maps were multiplied by the 2022 population estimates for each incorporated place from the Census file. After deriving the sum and dividing it by the total population represented in the sample, we obtained a rounded estimate of one-way travel time of 15 minutes. After doubling the figure to account for round-trip travel, we obtained an overall estimate of "average" round-trip travel time of 30 minutes per participant.

Table 9. Travel Burden Hour and Travel Distance Estimates, Per Participant.

Incorporated Place	2022 Population Estimate	Bing Maps One-Way Trip Time and Distance Estimates		Google Maps One-Way Trip Time and Distance Estimates		Mean of Bing and Google One-Way Trip Time and Distance Estimates		Population-Weighted Overall (All Participants) One-Way Trip Time and Distance Estimates	
		Minutes	Miles	Minutes	Miles	Minutes	Miles	Minutes	Miles
Rich Creek	735	42	35.9	40	35.70	41.0	35.80	30,135.0	26,313.00
Glen Lyn	93	43	38.4	44	39.30	43.5	38.85	4,045.5	3,613.05
Narrows	2,046	38	32.0	37	32.70	37.5	32.35	76,725.0	66,188.10
Pearisburg	2,832	34	27.3	31	28.00	32.5	27.65	92,040.0	78,304.80
Pembroke	1,129	25	21.3	24	21.50	24.5	21.40	27,660.5	24,160.60
Blacksburg	45,610	12	3.6	8	3.30	10.0	3.45	456,100.0	157,354.50
Christiansburg	22,562	11	5.3	10	5.50	10.5	5.40	236,901.0	121,834.80
Dublin	2,671	34	20.4	30	19.10	32.0	19.75	85,472.0	52,752.25
Radford	16,738	26	20.2	25	14.10	25.5	17.15	426,819.0	287,056.70
Floyd	449	37	29.5	35	29.50	36.0	29.50	16,164.0	13,245.50
SUMMARY	Σ = 94,865	*m* = ** Expression is faulty **	*m* = ** Expression is faulty **	*m* = ** Expression is faulty **	*m* = ** Expression is faulty **	*m* = ** Expression is faulty **	*m* = ** Expression is faulty **	Σ = 1,425,062.0	Σ = 830,823.30

* Note: Due to rounding, numbers may be slightly different than displayed in the table.

The round-trip travel time figure from Table 9 was incorporated into the estimate of burden hours shown in Table 10 in the next subsection.

12.5 Burden Hours Table

The estimates of total burden hours resulting from the participating respondents are presented in Table 10 in this subsection. There are several important things to keep in mind in interpreting the table:

- Information collection activities are planned for an 18-month period. It is assumed for calculation of burdens that recruitment of respondents will occur at a constant rate over the course of the collection. Because "Year 2" is only six months, it reflects half the respondents of "Year 1", which is a full 12 months.

- Similarly, "Year 1" in the table represents the first 12 months, and "Year 2" represents the last 6 months. Where values are multiplied by 0.67, this corresponds to the first "year", and were multiplied by 0.33, this corresponds to the second "year".

- Respondents will be asked to provide information for the ICs in the same year they were recruited. Therefore, not counting the estimated 101 respondents who will not provide information on all ICs due to attrition and eligibility screening dismissals, the 2/3 of respondents recruited in Year 1 (N = 171) will have one response for each IC during Year 1 and no responses for any ICs during Year 2. Similarly, the remaining 1/3 of respondents (N = 85) will be recruited during Year 2 and therefore those participants will have exactly one response for each IC in the table during Year 2 but no responses for any ICs during Year 1.

- IC1 includes the 256 "participants" and the estimated 101 respondents who will leave the study due to attrition or eligibility screening dismissal. All other ICs include only the "256" participants, and the 256 participants are the same individuals regardless of where the number appears in the table (there are not separate groups of 256 respondents – it is all the same group).

- The total burden hours formula takes the burden-per-respondent figure measured in minutes, divides it by 60 to convert to an accurate number of burden hours, then multiplies the result by the corresponding number of respondents (by Year 1, Year 2, or overall total).

- The total number of respondents overall is equal to the total number of responses for each IC.

- The total annual number of respondents is equal to the total annual number of responses for each IC.

- Therefore, the annual number of responses is figured by taking the total number of respondents and weighting it by 2/3 (0.67) for the twelve-month period of "Year 1" or by 1/3 (0.33) for the six-month period of "Year 2", multiplying it by the number of responses per respondent for the IC (always 1). The result represents both the

corresponding annual number of responses for the IC as well as the annual number of respondents for the IC (again, because they are always equal).

- See Section 12.1 of this document for additional guidance related to unique characteristics of the ICs/data shown in Table 10.

Table 10. Estimated Total Burden Hours by Task.

Information Collection (IC)		**Responses and Respondents**						**Burden Hours**		
IC Description	**IC No.**	**Annual Responses per Respondent**				**Total Annual Responses and Total Respondents** **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18		**Estimated Burden per Response**	**Total Annual Burden Hours and Total Burden Hours** **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18	
Recruitment Response	IC1	Respondents #1 – #239		Respondents #240 – #357		Year 1	(357 * 0.67) * 1 = 239	0.18 Hours (11 Minutes)	Year 1	(11 / 60) * 239 = 43.82
		Year 1	1	Year 1	0	Year 2	(357 * 0.33) * 1 = 118		Year 2	(11 / 60) * 118 = 21.63
		Year 2	0	Year 2	1	Total	357 Respondents		**Total**	**65.45 Hours**
Informed Consent Form	IC2	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.22 Hours (13 Minutes)	Year 1	(13 / 60) * 172 = 37.27
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(13 / 60) * 84 = 18.2
		Year 2	0	Year 2	1	Total	256 Respondents		**Total**	**55.47 Hours**
IRS W-9 Form	IC3	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.07 Hours (4 Minutes)	Year 1	(4 / 60) * 172 = 11.47
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(4 / 60) * 84 = 5.6
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**17.07 Hours**
Hearing Test	IC4	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.02 Hours (1 Minute)	Year 1	(1 / 60) * 172 = 2.87
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(1 / 60) * 84 = 1.4
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**4.27 Hours**

Information Collection (IC)		Responses and Respondents						Burden Hours		
IC Description	IC No.	Annual Responses per Respondent				Total Annual Responses and Total Respondents **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18		Estimated Burden per Response	Total Annual Burden Hours and Total Burden Hours **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18	
Vision Tests	IC5	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.05 Hours (3 Minutes)	Year 1	(3 / 60) * 172 = 8.6
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(3 / 60) * 84 = 4.2
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**12.80 Hours**
Demographics Questionnaire	IC6	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.03 Hours (2 Minutes)	Year 1	(2 / 60) * 172 = 5.73
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(2 / 60) * 84 = 2.80
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**8.53 Hours**
Driver Behavior and Risk Propensity Questionnaires	IC7	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.12 Hours (7 Minutes)	Year 1	(7 / 60) * 172 = 20.07
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(7 / 60) * 84 = 9.8
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**29.87 Hours**
Driving Portion of the Study	IC8	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	1.08 Hours (65 Minutes)	Year 1	(65 / 60) * 172 = 186.33
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(65 / 60) * 84 = 91
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**277.33 Hours**
	IC9	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.03 Hours (2 Minutes)	Year 1	(2 / 60) * 172 = 5.73

Information Collection (IC)		**Responses and Respondents**						**Burden Hours**		
IC Description	**IC No.**	**Annual Responses per Respondent**				**Total Annual Responses and Total Respondents** **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18		**Estimated Burden per Response**	**Total Annual Burden Hours and Total Burden Hours** **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18	
Study Acknowledgement Form		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(2 / 60) * 84 = 2.8
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**8.53 Hours**
Post-Experiment Survey	IC10	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.08 Hours (5 Minutes)	Year 1	(5 / 60) * 172 = 14.33
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(5 / 60) * 84 = 7
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**21.33 Hours**
Issuance of Compensation	IC11	Respondents #1 – #172		Respondents #173 – #256		Year 1	(256 * 0.67) * 1 = 172	0.02 Hours (1 Minute)	Year 1	(1 / 60) * 172 = 2.87
		Year 1	1	Year 1	0	Year 2	(256 * 0.33) * 1 = 84		Year 2	(1 / 60) * 84 = 1.4
		Year 2	0	Year 2	1	Total	256 Respondents		Total	**4.27 Hours**
Study Summary, Potential participants	**ICs** N: 1	**IC1 only** Responses per Respondent: 1				**IC1 only** Total Responses: 101 Total Respondents: 101		**Total Burden per Response:** 0.18 Hours	**Burden on 101 Potential Participants**	**18.51 Hours**
Study Summary, Participants	**ICs** N: 11	Responses per Respondent: 1				Total Responses: 256 Total Respondents: 256		**Total Burden per Response:** 1.90 Hours	**Burden on 256 Participants**	**486.41 Hours**

Information Collection (IC)		Responses and Respondents		Burden Hours		
IC Description	**IC No.**	**Annual Responses per Respondent**	**Total Annual Responses and Total Respondents** **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18	**Estimated Burden per Response**	**Total Annual Burden Hours and Total Burden Hours** **Year 1:** Months 1 – 12 **Year 2:** Months 13 – 18 **IC Total:** Months 1 – 18	
Study Total	**ICs N:11**	Responses per Respondent: 1	Total Responses: 357 Total Respondents: 357	**Total Burden per Response:** 0.18 Hours or 1.90 Hours	**Overall Total Burden**	**504.92 Hours**

* Note: Due to rounding, numbers may be slightly different than displayed in the table.

12.6 Estimated Total Cost of Burden Hours

Respondents for this study will not be recruited based on occupation. It is reasonable to assume that respondents could have any occupation applicable to the sample's locale. Therefore, to estimate respondents' cost burden, we have based the calculations on the median hourly wage in the sample's locale. Specifically, potential respondents in the Blacksburg-Christiansburg-Radford metropolitan statistical area of Virginia have a median hourly wage of $21.93 according to Bureau of Labor Statistics (BLS) 2023[20] release of Occupational Employment and Wage Estimates.

To determine the loaded hourly wage rate, we first referenced the most recent Blacksburg Area Economic Summary from BLS[21], which reports average hourly employer compensation costs for the locale's region as $40.34. We then added this value to the previously obtained median hourly wage rate of $21.93, generating an estimated loaded hourly wage of $62.27.

This estimate was multiplied by the burden hours per IC to arrive at the cost to the respondent per IC.

Due to the substantial variation in cost to the respondents for the 256 projected participants compared to the 101 projected respondents who will leave the study due to attrition or eligibility screening dismissals, separate tables (Table 11 and Table 12) are provided on the next two pages to show the estimated cost for each group, followed by a summary of total costs to participants.

Table 11. Burden Hour Total Costs By Task, For Participants Who Leave Study Due to Attrition or Screening Dismissals (N = 101).

IC No.	Loaded Hourly Wage	Burden Hours				Cost by IC			
		Per Respondent	Year 1 Total	Year 2 Total	Overall Total	Per Respondent	Year 1 Total	Year 2 Total	Overall Total
IC1	$62.27	0.18	12.28	6.23	18.51	$11.21	$764.68	$387.94	$1,152.62
IC2	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Transportation	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC3	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC4	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC5	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC6	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC7	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC8	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC9	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC10	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IC11	$62.27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Study Total	-	**0.18**	**12.28**	**6.23**	**18.51**	**$11.21**	**$764.68**	**$387.94**	**$1,152.62**

Table 12. Total Burden Hour Costs by Task For Full Study Participants (N = 256).

IC No.	Loaded Hourly Wage	Burden Hours				Cost by IC			
		Per Respondent	Year 1 Total	Year 2 Total	Overall Total	Per Respondent	Year 1 Total	Year 2 Total	Overall Total*
IC1	$62.27	0.18	31.45	15.49	46.94	$11.42	$1,958.39	$964.56	$2,922.95
IC2	$62.27	0.22	37.27	18.2	55.47	$13.49	$2,320.80	$1,133.31	$3,454.12
Transportation	$62.27	0.00**	86	42	128.00	$31.14	$5,355.22	$2,615.34	$7,970.56
IC3	$62.27	0.07	11.47	5.6	17.07	$4.15	$714.24	$348.71	$1,062.95
IC4	$62.27	0.02	2.87	1.4	4.27	$1.04	$178.71	$87.18	$265.89
IC5	$62.27	0.05	8.6	4.2	12.80	$3.11	$535.52	$261.53	$797.06
IC6	$62.27	0.03	5.73	2.8	8.53	$2.08	$356.81	$174.36	$531.16
IC7	$62.27	0.12	20.07	9.8	29.87	$7.26	$1,249.76	$610.25	$1,860.00
IC8	$62.27	1.08	186.33	91	277.33	$67.46	$11,602.77	$5,666.57	$17,269.34
IC9	$62.27	0.03	5.73	2.8	8.53	$2.08	$356.81	$174.36	$531.16
IC10	$62.27	0.08	14.33	7	21.33	$5.19	$892.33	$435.89	$1,328.22
IC11	$62.27	0.02	2.87	1.4	4.27	$1.04	$178.71	$87.18	$265.89
Study Total	-	**00**	**0326.72**	**0159.69**	**0486.41**	**06**	**0$25,700.07**	**$12,559.24**	**0.31**

* Note: Due to rounding, numbers may be slightly different than displayed in the table.

**Time per respondent for transportation was not included in the burden hours estimate.

13. ESTIMATE OF TOTAL ANNUAL COSTS TO RESPONDENTS

As previously discussed in this document, participants will need to physically report to the VTTI facility to participate in the experiment. Consequently, it will be necessary for them to travel in order to provide information for the various ICs described in this application for approval.

There is one additional cost to respondents beyond those associated with the hourly burden presented above. Namely, the cost of fuel associated with transportation to and from the VTTI facility.

For this estimate, we made the following assumptions:

- To travel to and from the VTTI facility, all respondents will drive personal vehicles with short wheelbases and will achieve the average fuel economy (25.2 miles per gallon) for such vehicles according to the 2023[22] estimate for the year 2021 published by Bureau of Transportation Statistics.
- Fuel prices at the time of IC responses will be equal to the March 2024 average price of gasoline per gallon in the United States published[23] by the Bureau of Labor Statistics ($3.58).
- Respondents' roundtrip travel distance to and from the VTTI facility will be 17.52 miles as computed and described in Subsection 12.4 of this document.

The above assumptions were used to generate Table 13, which presents estimated fuel costs.

There is no straightforward means to disaggregate fuel costs by IC. Technically, the fuel costs are a prerequisite to responding to all ICs except for IC1 (the recruitment response). Half the costs are incurred between responding to IC1 and IC2, and the other half of the costs are incurred after responding to IC11. However, absent special circumstances, both halves of the cost are attributable to the participants' responses to ICs 2 – 11. They could, for this reason, be equally divided among those ICs. However, this would result in cost estimates that are less interpretable than simple reporting the total fuel costs associated with participating in the study.

Consequently, we have elected to simply state that all fuel costs are associated with IC2 – the first IC participants will respond to after reporting for their study appointment at the VTTI facility. This decision is reflected in the title of Table 13.

The justification for attributing all fuel costs to respondents' responses to IC2 is that, by the time the participant has traveled to the facility to sign the informed consent form and respond to the other ICs, they have already incurred the fuel costs of the origin trip, and have also essentially incurred the future fuel costs of their return trip, provided they intend to return to their point of origin.

Note that these costs will only be incurred by those who respond to IC2 – therefore, the projected 101 respondents who leave the study early due to attrition or eligibility screening dismissals will not incur any fuel costs. Only the 256 respondents who respond to IC2 will incur fuel costs.

Individual ("Each") costs per respondent were computed using the following equation:

$$Cost\ Eac\ h = \left(\left(\frac{(8.76\,mi \times 2\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) \approx \$2.49$$

Annual cost calculations varied due to the different number of projected respondents by year (see Section 12.5 for further details) of the collection. Separate equations were therefore necessary to calculate the respective total annual cost. Year 1 annual fuel costs for respondents recruited in "Year 1" (months 1 – 12) are as follows:

$$Total\,Cost\ Year\ 1 = \left(\left(\left(\frac{(8.76\,mi \times 2\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) \times \left(256 \times \frac{12}{18} \right) \right) \approx \$424.78$$

Year 2 annual fuel costs for respondents recruited during "Year 2" (months 13 – 18) are accordingly figured as shown in the following equation:

$$Total\,Cost\ Year\ 2 = \left(\left(\left(\frac{(8.76\,mi \times 2\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) \times \left(256 \times \frac{6}{18} \right) \right) \approx \$212.39$$

For the sake of completeness, individual fuel costs for participants projected to leave the study early due to attrition or eligibility screening dismissals are, as previously discussed:

$$Cost\ Eac\ h = \left(\left(\frac{(0.00\,mi \times 0\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) = \$0.00$$

Their corresponding Year 1 total costs are:

$$Total\,Cost\ Year\ 1 = \left(\left(\left(\frac{(0.00\,mi \times 0\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) \times \left(101 \times \frac{12}{18} \right) \right) = \$0.00$$

Year 2 costs for the same categories of respondents are similarly *nil*:

$$Total\,Cost\ Year\ 2 = \left(\left(\left(\frac{(0.00\,mi \times 0\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) \times \left(101 \times \frac{6}{18} \right) \right) = \$0.00$$

Finally, the total costs of fuel across the entire information collection:

$$Total\,Cost\ Year\ 2 = \left(\left(\left(\frac{(8.76\,mi \times 2\,trips)}{25.2\,mi/\,gal} \right) \times \$3.58/gal \right) \times 256 \right) \approx \$637.17$$

The results of the above computations are summarized in the table below.

Table 13. Fuel Costs Incurred by Respondents in Responding to IC2.

Fuel Cost	Fuel Economy	Mean Distance	**Fuel Costs for Respondents to All ICs (N = 256)**			
$3.58 / gal	25.2 mi / gal	17.52 mi	Each Respondent	Year 1	Year 2	**Total**
			$2.49	$424.78	$212.39	**$637.17**
Fuel Cost	Fuel Economy	Mean Distance	**Fuel Costs for Respondents to IC1 Only (N = 101)**			
$3.58 / gal	25.2 mi / gal	0.00 mi	Each Respondent	Year 1	Year 2	**Total**
			$0.00	$0.00	$0.00	**$0.00**

There are no other known costs to respondents as a result of responding to any or all of the ICs described in this document.

14. ESTIMATE OF COST TO THE FEDERAL GOVERNMENT

14.1 Contract-Related Costs

The research design, protocol development, and implementation of the research methods will be completed between Fiscal Year (FY) 2023 and FY 2026 (09/30/2027 contract end date). This includes the instrumentation of vehicles, driving research facility usage, participant recruitment, data collection, data analyses, and preparation of the final report.

A table summarizing the portion of the contract value that will directly support this information collection is provided on the following page. The information provided was derived from a "crosswalk" of budget per task outlined in the firm fixed price contract with the project's work plan/schedule. Due to the nature of proprietary pricing information, we were unable to disaggregate the costs in the table further than shown. However, because this contract has already been executed and the terms are firm fixed price, we trust that the reader will nonetheless place confidence in the following narrative and the semi-disaggregated figures reported in the table.

The procedure for attributing contract costs to individual ICs was straightforward. The subset of tasks (this contract is billed based on task completion) directly associated with the activities described in this ICR were identified. The fully-burdened labor hour costs for each task were then distributed among the 11 ICs using a weighting corresponding to the overall proportion of burden hours represented by the individual IC – e.g., the driving portion of the experiment represents 53.94% of the overall burden hours associated with information collection, so 53.94% of the corresponding task budgets were assigned to IC8. Next, because all other direct costs for the contract tasks associated with the IC are directly tied to IC8, all direct cost dollars in the contract for the corresponding tasks were assigned to IC8 in the table on the following page.

Finally, using the same procedures as described previously in this document, the annual total cost per IC and for the overall collection were computed. That is, we assumed that recruitment and information collection would be performed at a constant rate over the 18 months of projected data collection activities. Therefore, the total contract task costs assigned to each IC were weighted by 2/3 and 1/3 for Year 1 and Year 2 respectively to generate the annual cost estimate.

Table 14. Annual Contract-Related Costs to Government by Year and IC.

	Fully Burdened Labor Hour Costs			Other Direct Costs			All Costs
IC No.	**Year 1 Total**	**Year 2 Total**	**Overall Total**	**Year 1 Total**	**Year 2 Total**	**Overall Total**	**Total for IC Overall**
IC1	$40,416.33	$20,208.17	$60,624.50	0.00	0.00	0.00	$60,624.50
IC2	$47,771.02	$23,885.51	$71,656.53	0.00	0.00	0.00	$71,656.53
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IC3	$14,700.76	$7,350.38	$22,051.14	0.00	0.00	0.00	$22,051.14
IC4	$3,677.34	$1,838.67	$5,516.02	0.00	0.00	0.00	$5,516.02
IC5	$11,023.42	$5,511.71	$16,535.13	0.00	0.00	0.00	$16,535.13
IC6	$20,212.47	$10,106.24	$30,318.71	0.00	0.00	0.00	$30,318.71
IC7	$33,070.26	$16,535.13	$49,605.38	0.00	0.00	0.00	$49,605.38
IC8	$238,837.87	$119,418.94	$358,256.81	$129,990.52	$64,995.26	$194,985.78	$553,242.58
IC9	$7,346.08	$3,673.04	$11,019.11	0.00	0.00	0.00	$11,019.11
IC10	$22,046.84	$11,023.42	$33,070.26	0.00	0.00	0.00	$33,070.26
IC11	$3,677.34	$1,838.67	$5,516.02	0.00	0.00	0.00	$5,516.02
Study Total	**0**	**0**	**0**	**0**	**0**	**0**	**$859,155.38**

* Note: Due to rounding, numbers may be slightly different than displayed in the table.

Grand Total: $859,155.38

14.2 Cost of Government Employee Labor

FMCSA's efforts will be supported by one GS-14 employee in job series 0180 serving as contracting officer's representative of project manager for FMCSA's effort on the study/project.

The FMCSA employee's salary is paid at the Washington-Baltimore-Arlington, DC-MD-VA-WV-PA locality adjustment and during the projected 18 months of information collection activities will range between Step 1 (22.22% or 4 months) and Step 2 (77.78% or 14 months). Because wage increases outside step increases cannot be predicted with confidence over short periods of time, those adjustments are not considered in this burden estimate. The annual cost of salary at Step 1 is considered to be $144,042 and at Step 2 is $148,689, per the 2024-DCB Salary Table[24]. Added to these costs in Table 15 below is a standard 28% adjustment to account for fringe rates. It is assumed that there are 2,080 hours in a year.

Based upon the work plan and project schedule, the FMCSA employee's primary responsibilities during the 18 months of information collection activities are:

- Attend weekly meetings lasting 0.5 hours.
- Review monthly progress/status reports prepared by VTTI staff.
- Perform internal project reporting functions.
- Review payment requests and approve invoices upon task completion.
- Additional project management duties as assigned/as necessary to support project.

The breakdown over the course of 18 months by task is as follows:

Table 15. Computation of Cost of Government Employee Labor.

	Attend Meetings	Review Reports	Reporting Functions	Approve Invoices	Additional Duties
Hours	39.0	9.0	18.0	6.0	36.0
Step 1 Cost	$768.22	$177.28	$354.56	$118.19	$709.13
Step 2 Cost	$2,775.53	$640.51	$1,281.01	$427.00	$2562.03
Total Cost	$3,543.75	$817.79	$1,635.60	$545.20	$3,271.16
Annual Avg.	$2,362.50	$545.19	$1,090.40	$363.47	$2,180.77

Therefore, the total annual average cost to the government for the FMCSA employee's effort on the project during data collection is approximately $6,542.33.

The total actual estimated cost over the course of the entire 18 months for the 108 hours of labor, given fringe costs and predictable salary changes is $9,813.47. Although this cost may seem low given the project budget, it is important to note that:

- The FMCSA employee is responsible for managing a portfolio of projects of which this is only one (i.e., any given project would not typically require a large percentage of the employee's labor hours).
- The vast majority of project duties, including information collection, are contracted to VTTI to perform – the FMCSA employee will not collect information directly.
- VTTI has project managers of its own assigned to the project who handle a substantial proportion of the project management duties for this effort.

There are no additional costs to the Government beyond those cited above.

Based on the estimates presented above, total costs to the Government for the ICs described in this statement will be ($859,155.38 + $9,813.47) = $868,968.85.

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 decision makers on issues related to the effects and use of warning devices.

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. Virginia Tech IRB approval letter.

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[3] Placement of warning devices – General rule. 49 CFR §392.22(b)(1) (1998). https://www.ecfr.gov/current/title-49/part-392#p-392.22(b)(1)

[4] Placement of warning devices – Special rules. 49 CFR §392.22(b)(2) (1998). https://www.ecfr.gov/current/title-49/part-392#p-392.22(b)(2)

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