Department of Transportation Office of the Chief Information Officer

Supporting Statement
Evaluation of Heavy Vehicle Collision Warning Interfaces

INTRODUCTION

This is to request the Office of Management and Budget's (OMB) review and approval of a new National Highway Traffic Safety Administration (NHTSA) information collection request (ICR) titled "Evaluation of Heavy Vehicle Collision Warning Interfaces (HV-CWI)."

Part A. Justification

To realize the potential benefits of FCW systems, these systems must generate appropriate driver responses to threats in a well-timed manner. However, FCW or crash warning interfaces (CWIs) must effectively convey the appropriate warning information to the driver for this to occur. This collection seeks to study these alert characteristics and driver responses in heavy vehicles. This information collection is completely voluntary and is seeking participants that hold a valid Class A commercial driver's license. All participants will be compensated for their time. This collection will be collecting vehicle kinematics, driver response times with regard to throttle release and brake pedal depression respective of the forward collision warning, and driver subjective input (survey style) based on alert timing, luminance, color, and sizing of the visual alert, and overall awareness and trust of the FCW warning. All data will be stored on a secure, password protected server. The collection will occur during a single period that will end once the total number of participants has been reached. Each entity will only participate once. The results will be submitted to the National Highway Traffic Safety Administration and upon agency review, will be published and made available to the general public.

1. CIRCUMSTANCES THAT MAKE COLLECTION OF INFORMATION NECESSARY

Transportation safety is the Department of Transportation's (DOT's) top strategic priority. Because the human toll and economic cost of transportation accidents are substantial, improving transportation safety is an important objective of all DOT modes. Within DOT, NHTSA is continually focused on reducing crashes, fatalities, and injuries. According to the Federal Motor Carrier Safety Administration (FMCSA), in 2011 approximately 345,000 large trucks and buses were involved in crashes (fatal, injury, and property-damage-only combined). [1] When looking at crash type, of the nearly 288,000 crashes involving large trucks, 24 percent were rear- end crashes. In 2013, the National Transportation Safety Board issued a letter to NHTSA that

[1] Federal Motor Carrier Safety Administration. (2013). *Large Truck and Bus Crash Facts 2011* (Report No. FMCSA-RRA-13-049). Washington, DC: Federal Motor Carrier Safety Administration.

reiterated two prior recommendations for the development of forward collision warning standards for heavy vehicles. [2]

- Recommendation H-01-6: develop standards including human factors guidelines (e.g., mode and type of warning) and the timing of alerts

- Recommendation H-01-7: once performance standards have been established, require all new CMVs to be equipped with a forward collision warning (FCW) system

To realize the potential benefits of FCW systems, these systems must generate appropriate driver responses to threats in a well-timed manner. However, FCW or crash warning interfaces (CWIs) must effectively convey the appropriate warning information to the driver for this to occur.

Original equipment manufacturers (OEMs) have steadily been improving FCW systems by adding capabilities such as CMB (Collision Mitigation Braking), engine braking, and integrated radar and camera sensors. While solving some of the deficiencies of early-generation systems (e.g., high false alarm rate, stationary object detection), these advancements have also produced new challenges, possibly bypassing some of the more basic concerns related to CWIs. Current FCW systems are available as OEM options and aftermarket retrofit kits. However, differences between OEM options and retrofit kits – and even more so between the different FCW system suppliers – represent another set of challenges. Differences in the timing, loudness, and sound of the auditory alert, as well as color, location, and size choice of visual alerts, can vary widely. These differences can present issues at the driver level in fleets using slip-seat operations or for drivers who change employers and/or vehicles.

The current study within this information collection request will evaluate the CWIs of FCW systems in a nighttime setting. This will allow researchers to compare driver throttle and brake reaction times, force of deceleration, and their first response to an FCW alert as well as their opinions to previous data that was collected during a daytime setting. This is critical in the design of CWIs as the luminance and alert timing may need to be adjusted during the nighttime operation.

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

NHTSA has contracted with the Virginia Tech Transportation Institute (VTTI) at the Virginia Polytechnic Institute and State University (VT) to administer this study and analyze its results. The investigators currently performing this study are Dr. Myra Blanco, Scott Tidwell, and Jon Atwood. In accordance with DOT policy on research involving human subjects, this study will be reviewed and approved by VT's Institutional Review Board before data collection begins.[3]

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[2] National Transportation Safety Board. (2013). *Safety Recommendations (Letter).* Washington, DC: National Transportation Safety Board. Retrieved February 25, 2014, http://www.ntsb.gov/doclib/recletters/2013/H-13-011-019.pdf

[3] In December 1981, the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research (the Commission) issued a report which included a recommendation that Federal agencies engaged in research involving human subjects adopt the

This study will examine driver interactions with CWIs, more specifically, FCW CWIs to determine what aspects provide the greatest safety benefits for heavy vehicle safety. Various aspects of visual and auditory alerts will be examined including colors used, size of the icon, and muting versus non-muting of the vehicle's radio. Objective driving data along with the questionnaire data will be analyzed and compiled in a thorough technical report that NHTSA will utilize as a basis for their comprehensive set of design principles for heavy vehicles as well as potential rule making regarding FCW systems in heavy vehicles.

3. EXTENT OF AUTOMATED INFORMATION COLLECTION

All of the questionnaire items include either check boxes, fill-in-the-blank open ended responses, or providing a rating based on scale. All questionnaires will be in paper form. There will be no electronic form of the questionnaires.

4. EFFORTS TO IDENTIFY DUPLICATION

NHTSA and the VTTI research team are unaware of other research conducted currently or in the past that could be used to fulfill the research objectives of evaluating the effectiveness of heavy vehicle collision waring interfaces in both heavy trucks and motorcoaches with the same level of detail and accuracy that this study has been designed to achieve. The scope of this project examines the visual and auditory alerts of an imminent forward collision warning. Auditory and visual alerts represent unique components of an HV-CWI. These components are of interest and will help to inform the design of future CWIs.

5. EFFORTS TO MINIMIZE THE BURDEN ON SMALL BUSINESSES

Commercial vehicle drivers employed by large, national or regional carriers will comprise most of the proposed study sample. However, it is likely that some owner-operators and independent drivers will be contacted. These individuals can be considered small businesses. To reduce work-related time conflicts, respondents are able to choose a time that it convenient for them to participate. In addition, respondents will be compensated for their time. Participation in the HV-CWI study is voluntary, so no small business will have a burden imposed on them that they are not willing to bear.

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pertinent regulations of the Department of Health and Human Services. These regulations, specified in 45 CFR, Part 46, deal with requirements for protection of human research subjects. In response to the Commission's recommendation, in March 1982, the Chairman of the Federal Coordination Council for Science, Engineering and Technology appointed an Ad Hoc Committee for the Protection of Human Research Subjects. The Ad Hoc Committee, composed of representatives of affected departments and agencies, developed a Model Policy which applies to research involving human subjects that is conducted, supported, or regulated by Federal departments and agencies. This policy is based on Subpart A of 45 CFR, Part 46. On January 8, 1984, the Secretary of Transportation agreed to implement the Model Policy without exception.

6. IMPACT OF LESS FREQUENT COLLECTION OF INFORMATION

NHTSA and its research team believe that, to meet its research objectives, this study collects data at the lowest frequency possible within a single ICR approval. This study will be conducted once over a four-month period.

The eligibility questionnaire will be conducted over the phone to determine potential participant eligibility for participation in the full study. Once deemed eligible, participants will be scheduled. Upon arrival to the facility, each participant will complete one demographics questionnaire and then proceed to the test track. There will be four total test trials completed per participant. The mid-study questionnaire will be administered after each of the first three test trial involving a secondary task while driving (i.e., three mid-study questionnaires per participant). The post-study questionnaire will be administered once to each participant after the fourth and last test trial has been completed. It is estimated that it will take approximately 50 drivers to obtain the necessary sample size required.

Accurate analysis of CMV driver usage, interaction and feedback of the collision warning interfaces will allow NHTSA to formulate the best possible design principles and potential rule making and therefore provide a benefit to society by preventing CMV crashes. NHTSA's safety goals are shared by motor carriers, researchers, public safety advocacy groups, trade associations and other organizations. An accurate data collection will benefit all those interested in CMV safety and facilitate better informed discussions among these parties.

7. SPECIAL CIRCUMSTANCES

There are no special circumstances related to this information collection.

8. COMPLIANCE WITH 5 CFR 1320.8

NHTSA published a notice in the Federal Register with a 60-day public comment period to announce this proposed information collection on October 29, 2015, 80FR66610. No comments received.

NHTSA published a notice in the Federal Register with a 30-day public comment period that announced this information would be sent to OMB for approval on June 6, 2016, 81FR36380.

9. PAYMENT OR GIFTS TO RESPONDENTS

Respondents will be compensated at $40 per hour (paid in cash) for their time participating in this study, which takes approximately two hours to complete (includes both driving time on the test track and questionnaires).

Monetary compensation for subjects participating in the information collection is considered essential for the reasons listed below:

Availability and time burden: Commercial truck drivers are difficult to reach for research studies due to irregular schedules and long working hours. Compensation for this time burden seems justified. This study also requests that respondents provide personal information such driving history and classification. Monetary compensation may influence respondents' initial resistance to providing such information, which is essential for the study to be successful.

Data quality: Compensating respondents will significantly increase response rates for the information collection, thus improving the validity and reliability to an extent beyond that possible through non-compensation.

Complex study design: The research is a between-subjects design and will require more than just a few participants. Compensation will increase the likelihood of obtaining participants and may substantially reduce attrition.

Past experience: Several of the research team members have extensive experience conducting research with commercial motor vehicle drivers (see, for example, Morgan, Tidwell, Medina, Blanco, Hickman, & Hanowski, 2011; Knipling, Hickman, Hanowski, & Blanco, 2005). Past experience indicates that it is difficult to obtain enough participants for studies of this size without providing adequate monetary compensation but that drivers will participate if they feel they are being provided with sufficient compensation. The compensation provided for participation in this study exceeds the national median CMV driver salary of $20.96 per hour reported by Bureau of Labor Statistics (2016).[4] Exceeding the median wage has been shown in other studies to be necessary to attract the number of drivers needed. Additionally, the commercial motor vehicle driver population is more difficult to schedule due their typical work hours and incentives are necessary to obtain their participation. Further, drivers are being recruited from up to three hours away and this compensation rate is necessary to ensure the number of participants needed is obtained.

10. ASSURANCES OF CONFIDENTIALITY

All information collected will be kept strictly anonymous to the extent that anonymity can be protected by law (e.g., DOT has the right to access all the data collected in the study). A researcher from the project team will always handle the questionnaires. No personally identifibale information (PII) will be contained on or within the questionnaires. A unique participant number will be generated for all respondents linking their questionnaires and driving data. A link between the respondents' participant number and PII is, however, needed to track participation and compensate respondents. These links will be stored separate from study data in an electronic file on a password protected, firewalled computer at VTTI.

11. JUSTIFICATION FOR COLLECTION OF SENSITIVE INFORMATION

This study does not include questions about sexual behavior and attitudes or religious beliefs. However, the eligibility questionnaire is designed to determine if the respondents are able to meet the study criteria and Virginia Tech Institutional Review Board (IRB) criteria and, as such, contains some general health questions, the ability to read/write in English, and if they have ever

[4] https://www.bls.gov/oes/2016/may/oes_nat.htm#53-0000. Accessed February 6, 2015.

been in an DOT reportable at-fault crash within the past year. Also, the demographics questionnaire asks respondents about the driving history and driving job classification.

12. ESTIMATES OF BURDEN HOURS FOR INFORMATION REQUESTED

Sixty CMV drivers are needed for the HV-CWI study. It is estimated that 100 CMV drivers will need to be contacted to obtain enough eligible CMV drivers for participation in the study. All 100 respondents will complete the eligibility question while those that participate will also complete the demographic questionnaire, three mid-study questionnaires, and the post study question. Sixty participants are needed to completed data collection.

Per participant, the eligibility questionnaire is estimated to take 10 minutes, the demographic questionnaire two minutes, three mid-study questionnaire 10 minutes combined, and the post study questionnaire 15 minutes. Additionally, there is observation/test track time that is also part of participating. This time is estimated at 60 minutes. The estimates of burden hours for the respondents are presented in Table 1 below.

Table 1. Estimated Burden Hours

Instrument	Number of Respondents[5]	Frequency of Responses	Number of Questions	Estimated Individual Burden	Total Estimated Burden Hours	Total Annualize Cost to Respondents[6]
Eligibility questionnaire	100	1	26	10 minutes	17 hours	$ 434.01
Demographic questionnaire	60	1	7	2 minutes	2 hours	$ 51.06
Mid study questionnaires	60	3	9	10 minutes total	10 hours	$ 255.30
Post study questionnaire	60	1	12	15 minutes	15 hours	$ 382.95
Observation/Test Track	60	1	0	60 minutes	60 hours	$ 1,531.80
				TOTAL	104 hours	$ 2,655.12

13. ESTIMATES OF TOTAL ANNUAL COSTS TO RESPONDENTS

There are no additional costs to respondents beyond those associated with the hourly burden presented above, which are not to be included in this section.

14. ESTIMATE OF COST TO THE FEDERAL GOVERNMENT

[5] The number of respondents in this table includes drop-out rates. It is possible these numbers will be lower.

[6] Estimated based on the mean hourly rate for Virginia (all occupations) is $25.53 as reported in the May 2016 Occupational Employment and Wage Estimates, Bureau of Labor Statistics. https://www.bls.gov/oes/2016/may/oes_va.htm

The study has a total budget of $435,088. This breaks out to direct costs of approximately $225,000 in study costs, $25,000 in analysis costs, and $20,000 in participant costs. The remaining difference is the indirect overhead costs.

15. EXPLANATION OF PROGRAM CHANGES OR ADJUSTMENTS

This is a new data information collection is to realize the potential benefits of crash warning interfaces and how these systems must generate an appropriate driver response to threats in a well-timed manner. This collection results in a program change of adding an additional 104 hours to NHTSA's overall burden hour total.

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 NHTSA. It is expected that this report will be published by NHTSA.

17. APPROVAL FOR NOT DISPLAYING THE EXPIRATION DATE OF OMB APPROVAL

No such approval is being requested.

18. EXCEPTIONS TO THE CERTIFICATION STATEMENT

None.