

DEPARTMENT OF TRANSPORTATION

**1 INFORMATION COLLECTION
SUPPORTING STATEMENTS PART B**

Title: FMVSS Considerations for Vehicles with Automated Driving Systems: Seating Preference Study
OMB Control No. 2127-New

Abstract:¹

The National Highway Traffic Safety Administration (NHTSA) intends to seek OMB approval to conduct four information collections to gather both objective and subjective data regarding occupant/passenger seat preference in Automated Driving System-Dedicated Vehicles (ADS-DVs). Adults ages 18 and older who meet eligibility criteria such as holding a valid driver's license and having used a ride-sharing application at least once in the past year will be eligible to respond. Response is voluntary. It is a one-time collection, and eligible volunteers will participate in a single test-track experiment after giving informed consent. Questionnaire data will be collected at the beginning and end of participation for each participant and objective data will be collected during the test-track experiment via the data acquisition systems installed in each study vehicle. NHTSA will receive data and reporting from this collection. NHTSA intends to publish a report with the findings of this study.

Part B. Justification

The National Highway Transportation Safety Administration (NHTSA) is seeking approval to conduct four information collections to gather both objective and subjective data regarding occupant/passenger seat preference in Automated Driving System-Dedicated Vehicles (ADS-DVs). ADS-DVs are vehicles that lack manually operated driving controls, and therefore do not require a human driver or occupant to sit in the left front seat (the "driver's seat" in conventional vehicles). It is currently unknown where occupants may choose to sit when riding in an ADS-DV. New seating configurations for occupants of ADS-DVs may necessitate changes to how and where information is presented to occupants via in-vehicle displays about their responsibilities as occupants (e.g., closing doors, fastening seatbelts, awareness of ride status such as ride in progress, vehicle in motion, remain seated, etc.). Furthermore, occupants will need a human-machine interface (HMI) to provide input that they are ready for the ride to begin, or to request

¹ The Abstract must include the following information: (1) whether responding to the collection is mandatory, voluntary, or required to obtain or retain a benefit; (2) a description of the entities who must respond; (3) whether the collection is reporting (indicate if a survey), recordkeeping, and/or disclosure; (4) the frequency of the collection (e.g., bi-annual, annual, monthly, weekly, as needed); (5) a description of the information that would be reported, maintained in records, or disclosed; (6) a description of who would receive the information; (7) if the information collection involves approval by an institutional review board, include a statement to that effect; (8) the purpose of the collection; and (9) if a revision, a description of the revision and the change in burden.

that the ride stop. At present, no standardized or otherwise commercially produced HMIs exist for this purpose. Therefore, in order to conduct the research, a prototype HMI will be developed. The following research objectives will be addressed by the proposed data collection:

1. Describe the occupant distribution for ADS-DVs (i.e., seating distribution)
2. Use the prototype HMI to evaluate whether occupants would choose to initiate a ride in an ADS-DV without a seatbelt.

In the experiment, up to 100 participants will be recruited from the New River Valley area of Virginia to participate in the study. Eligibility for participation in the experiment will be determined using the **Eligibility Questionnaire**. Eligible participants will participate in a single data collection session at the Virginia Tech Transportation Institute (VTTI) in Blacksburg, VA. Each participant will ride in ADS-DVs, and their seat preference will be recorded. At the start of their participation, subjects will be asked to complete the **Demographic Questionnaire**. The **Demographic Questionnaire** contains 20 questions about the participant's driving experience, general familiarity with ride-sharing technology, and driving automation technology. Participants will then take part in a **Test-Track Experiment**. The **Test-Track Experiment** will consist of participants riding in 3 different VTTI developed ADS-DV vehicles in a counterbalanced order on a closed test course. Participants will ride in pairs. Participants will use a phone application to summon the designated vehicle to their current location, board the vehicle (last participant to enter will close the vehicle door), choose a seat, buckle their seatbelts, and use the HMI to indicate that they are ready to ride. The HMI will record instances in which participants attempt to start the ride without buckling their seatbelts but will not initiate the ride unless all seatbelts are buckled. Once all participants are 'ready to start the ride' the ADS-DV will take them to the next stop on the test track, where they will disembark and proceed to summon the next vehicle. Each vehicle will be equipped with the same prototype HMI, but each vehicle will have a different seating configuration. HMI locations will vary slightly between vehicles to accommodate the different seating configurations. Upon completion of the data collection session, participants will be asked to complete the **Post Experiment Questionnaire**. The **Post Experiment Questionnaire** contains 20 questions about participants' recent experience with the vehicle HMI, opinions of seating options in ADS-DVs, seat belt preferences for ADS-DVs, and overall attitudes toward ADS-DVs.

Data Analysis Plan

Behavioral measures collected via the **Test-Track Experiment**, the **Demographic Questionnaire**, and **Post Experiment Questionnaire** will be used to address research objectives 1 and 2. For research objective 1, participants' seat choices and choice to initiate ride without a seatbelt will be assessed via video and analysis of the vehicle sensor network. The **Post Experiment Questionnaire** will be used to describe participants' subjective opinions of their seat preference and subsequent seat belt use when riding in an ADS-DV. Behavioral measures collected during the **Test-Track Experiment** and the **Post Experiment Questionnaire** will be used to address research objective 2 by measuring both interactions with and subjective opinions of the prototype ADS-DV HMI. Generalized Linear models will be created to determine whether and how these subjective opinions for both research objectives change based on gender, age, experience, and other variables from the **Demographic Questionnaire**. For research objective 2, generalized linear mixed models will be used with the **Demographic Questionnaire** to

determine if subpopulations of participants exhibit differences based on their previous experience with advanced driver assistance systems (e.g., collision avoidance systems, adaptive cruise control, lane centering assist, lane keeping assist, etc.). The following table outlines the research objectives, questionnaires, data sources that will be used, dependent and independent variables, and planned analyses.

Table 1. Research Questions and Proposed Analysis Methods

Research Objective	Dependent Variables	Independent Variables	Data Source	Analysis Approach
1- Seating preference – behavioral measures	Seating choices made when riding in ADS-DVs (e.g., forward facing, rear facing, rear row, front row)	Demographic questionnaire responses	Vehicle network, video reduction, self-report questionnaires	Generalized linear mixed model
1- Seating preference – subjective response	Responses to Post Experiment Questionnaire (e.g. yes/no, Likert scale)	Vehicle type, demographic questionnaire responses	Self-report questionnaires	Generalized linear mixed model
2. HMI Interaction	Participant responses to HMI icons/telltales (e.g. incorrect button presses on the touchscreen)	Demographic questionnaire responses	Vehicle network, video reduction, self-report questionnaires	Generalized linear mixed model

B1. Describe potential respondent universe and any sampling selection method to be used.

The respondent universe is adults aged 18 and older who hold a valid driver’s license, and who have used a ride-sharing application at least once in the past year. Up to 100 participants will be recruited for participation in the primary data collection effort. The participants will be selected from the New River Valley (NRV) and surrounding areas in Virginia by the VTTI recruitment group. The selection criteria will include an equal number of male and female participants aged 18 and over, who hold a valid driver’s license, and have used a ride-sharing application at least one in the past year. The VTTI recruitment group maintains a database of participants that have previously participated and/or responded to advertisements efforts with interest in participating in research studies and can contact potential participants that meet study criteria. The recruitment group will also advertise the study using social media (e.g., Facebook) or other online methods (e.g., online classified ads) to identify potential participants that meet selection criteria. Interested individuals may then contact the recruitment group directly for screening. Whether participants are contacted via the database or contact the recruitment group directly, the recruitment group will administer the **Eligibility Questionnaire** to identify participants that meet study criteria and whom would be selected to participate in the study.

The NRV consists of the counties of Montgomery, Pulaski, Giles, and Floyd in Virginia. Cities/towns include Blacksburg, Christiansburg, Pulaski, and Radford. Per U.S. Census data (obtained via <https://censusreporter.org/profiles/79500US5151040-new-river-valley-planning-district-commission-puma-va/>) as well as reported by Onward New River Valley (<https://www.newrivervalleyva.org/data/>) the NRV has a population of over 180,000 individuals, with a median age of 34 years of age. Nearby areas also include Roanoke County, which includes the cities of Salem and Roanoke. Roanoke County has a population of 94,186 people (<https://censusreporter.org/profiles/05000US51161-roanoke-county-va/>).

Estimated Incidence

Based on VTTI's previous experiences with test track studies, it is anticipated that some number of data collection sessions may be canceled partway through, for reasons such as weather, equipment malfunction, or a participant choosing to discontinue participation. In these instances, participants may have responded to the **Demographic Questionnaire**. In instances such as these, data will be discarded and replacement participants will be recruited. Every effort will be made to avoid cancellation of data collection sessions; it is difficult to estimate the exact number of participants that may partially complete the study, but the maximum number of participants (including dropouts) will be 100.

B2. Describe procedures for collecting information, including statistical methodology for stratification and sample selection, estimation procedures, degree of accuracy needed, and less than annual periodic data cycles

The experiment was designed to collect both subjective and objective data for participants riding ADS-DVs on a closed test track. Descriptive statistics, tables, and plots will be used to understand the data collected.

Questionnaire data will be collected at the beginning and end of participation for each participant. Objective data will be collected via the data acquisition systems installed in each study vehicle. All demographic data collected at the beginning of participation will potentially be used to stratify participants. To the greatest extent possible, an equal number of males and females will be recruited. Stratifications will be created based on the results of the demographic questionnaires for gender and age. Regression models will be created to identify any potential differences among stratified subgroups in their responses to the **Post Experiment Questionnaire**. Generalized linear mixed models will be used to analyze any potential differences in seat preferences observed in the experiment or other behaviors observed during participation in the experiment. The proposed data collection will be a one-time occurrence for each participant.

The procedure for the collection of information for FMVSS Considerations for Vehicles with Automated Driving Systems: Seating Preference Study is summarized as follows:

- VTTI's recruitment group will contact and recruit participants for a one time visit to VTTI's headquarters in Blacksburg, VA, for the experiment.

- VTTI personnel will meet with each participant and have them complete an informed consent form.
- Those willing to participate will complete the **Demographic Questionnaire**.
- VTTI personnel will then escort the participant to the staging area for the study.
- Participants will experience ADS-DVs as part of the experiment. The data acquisition systems will collect video data and vehicle network data while participants are riding in ADS-DVs.
- After completion of the study, a VTTI experimenter will ask the participant to complete the **Post Experiment Questionnaire**.

B3. Describe methods to maximize response rate and to deal with issues of non-response.

Participants are being compensated for their time. Participation involves an in-person visit to the VTTI facility. Participants are free to leave the study at any time without completing one or more of the questionnaires. Participants are also free to decline completions of any of the questionnaires while still participating in the objective data collection. The approach to data collection will be to re-collect any missing participants. As such, non-responses are not expected to have an impact on the analyses.

B4. Describe tests of procedures or methods to be undertaken.

Questionnaire responses will be initially collected verbally and then entered into an electronic format. Data processing will consist of tabulation of quantitative and coded open-ended responses. Data analysis will be conducted by NHTSA’s contractor, VTTI. Summary statistics will be analyzed to determine whether significant differences exist when stratifying the participants based on gender, age, experience, previous ADS-DV experience, or other demographic information. Open-ended responses will also be analyzed to add context to participants’ quantitative responses.

None of the questionnaires have been distributed to anyone outside of this research team. The designed questionnaires have been distributed to the research team members for validation.

Data tables, including important cross-tabulations, will be prepared along with a final report of the key findings.

B5. Provide name and telephone number of individuals who were consulted on statistical aspects of the IC and who will actually collect and/or analyze the information.

In preparation of sending this package to OMB for approval, NHTSA provided contacts at various agencies with the opportunity to comment on the approach for this plan. The following individuals are primarily responsible for data collection and analysis:

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