

DIVISION OF RESEARCH, INNOVATION & SYSTEM INFORMATION
Research Initial Scope of Work
SUBMITTAL FORM - FY 19/20

I. Project Number: P1071
Project Title: Wrong Way Driver Mitigation

II. Task Number: 3705
Task Title: Identify communication methods for severely intoxicated drivers which will be used to develop effective engineering countermeasures

III. Project Problem Statement:

Wrong-way collisions account for only about 3 percent of accidents on high-speed divided highways, but they are much more likely to result in fatalities than other types of highway crashes. Most wrong-way events on controlled-access highways are head-on collisions caused by drivers who are severely intoxicated. Research has consistently identified the cause of most wrong way driving collisions as drivers whose blood alcohol content is twice or more than the legal limit of 0.08 percent, typically 0.20 and higher. Current countermeasures include installation of larger signs at driver sight level, flashing beacons, and retroreflective pavement markings. Research indicates these countermeasures are effective in producing self-corrective actions of wrong way driver movements when the driver is not intoxicated, but that they have had little to no effect on reducing wrong way collisions caused by severely intoxicated drivers. Current countermeasures require a certain level of cognitive ability to see the countermeasure, recognize what it means, and take appropriate action. The proposed research seeks to understand the cognitive abilities of severely intoxicated drivers as a first step in developing effective engineering countermeasures to prevent severely intoxicated drivers from entering highways in the wrong direction and causing fatal collisions.

IV. Objective:

The proposed research seeks to understand the cognitive abilities of severely intoxicated drivers as a first step in developing effective engineering countermeasures to prevent severely intoxicated drivers from entering highways in the wrong direction.

V. Task Description of Work and Expected Deliverables

The deliverables include an initial search for applicable research. The final product would be research that identifies the cognitive abilities of severely intoxicated drivers, and the types of stimulus to which they might respond, as a first step in developing effective engineering countermeasures to stop drivers from entering highways in the wrong direction.

Following are a list of assumptions that should be addressed:

- The cognitive abilities of 0.08 intoxicated drivers is different than drivers with an intoxication level of 0.20 and higher (severe intoxication).
- Severely intoxicated drivers are alcohol dependent, habitual drinkers that may have a different cognitive response to roadway warnings than casual drinkers or occasional binge drinkers at the same blood alcohol content.
- Severely intoxicated drivers do not respond appropriately to typical engineering or road safety countermeasures such as, but not limited to; warning signs, flashing beacons, and retroreflective pavement markings.

This task should be divided into a series of subtasks and expected deliverables along the lines of the following:

- Based on the task objective, design experiments to gather data on the cognitive ability of severely intoxicated (2 times the legal limit or higher) drivers. *Deliverable:* project plan and experiment design document
- Obtain approval for human subject testing. *Deliverable:* documented approval from appropriate authority
- Set up experiments. *Deliverable:* functioning experiment apparatus
- Recruit test subjects and conduct experiment. *Deliverable:* recorded data
- Analyze data and prepare final report. *Deliverable:* Report characterizing the cognitive abilities of impaired test subjects relative to non-impaired ones, identifying the types of stimulus to which these drivers may respond, and design recommendations for countermeasures tailored to severely intoxicated drivers

VI. Background:

Wrong-way collisions occur relatively infrequently, accounting for only about 3 percent of accidents on high-speed divided highways, but they are much more likely to result in fatal and serious injuries than are other types of highway crashes. The majority of wrong-way collisions on controlled-access highways are head-on events caused by drivers who are severely intoxicated (2 times the legal limit or higher).

Research on wrong-way driving has a long history, dating back to the 1960's and includes research to quantify the frequency of, determine the causal factors of, and evaluate countermeasures for preventing wrong-way movements. Research has consistently identified severely intoxicated (twice the legal blood alcohol content of 0.08 or higher) drivers as causing the majority of wrong way driving fatalities.

Currently used countermeasures include, but are not limited to, installation of larger signs at driver sight level, flashing beacons and retroreflective pavement markings. Current research at the University of California at Davis indicates these countermeasures are effective in producing self-corrective actions of wrong way driver movements (Ravani, Lasky, White, Yen, Donecker, Bennett & Swansten, ongoing research). However, data trends suggest there has been little to no effect

on reducing wrong way collisions caused by severely intoxicated drivers. The resulting theory is that current wrong way driver countermeasures are not effective for severely intoxicated drivers.

Some research exists that identifies or measures the effects of alcohol intoxication on different levels of cognitive load. The National Highway Safety Administration (NHTSA) conducted tests in the mid to late 1970's to examine the techniques and use of field sobriety testing by law enforcement, however specific research on how the tests were developed and if that research has application to this request has not been found. Research has not been found that evaluates the cognitive abilities of severely intoxicated drivers. Current countermeasures require a certain level of cognitive ability to see the countermeasure, recognize what it means, and take appropriate action. This research proposal seeks to understand the cognitive abilities of severely intoxicated drivers as a basis for developing engineering countermeasures to prevent fatal wrong way collisions.

VII. Estimate of Duration:

This task shall last for a maximum of 24 months.

VIII. Related Research:

The National Highway Safety Administration (NHTSA) conducted tests in the mid to late 1970's to examine the techniques and use of field sobriety testing by law enforcement, however specific research on how the tests were developed and if that research has application to this request has not been found. Some research exists that identifies or measures the effects of alcohol intoxication on different levels of cognitive load. Studies conducted by Moskowitz and others (Moskowitz & Bums, 1971; Moskowitz & Sharma, 1973), demonstrated that alcohol produces an impairment of drivers' ability to maintain observations over the wide range of input sources while driving. The subjects processed information at a decreased rate and hence attended to a smaller number of inputs (Moskowitz, Ziedman, & Sharma, 1976). It was also found that the first look at critical events for impaired drivers occurred later compared to the non-impaired drivers. Alcohol also affected drivers' eye movements by decreasing their frequency and increasing dwell duration, thus reducing the drivers' ability to search the environment for potential dangers or attend to the cues necessary for proper maneuvers (Moskowitz et al., 1976). These findings are consistent with a more recent study sponsored by Texas DOT and FHWA. Researchers at Texas A&M Research Institute conducted a nighttime closed-course study to investigate the behaviors of alcohol-impaired drivers and determine their interpretations of various wrong way driving traffic control devices. The researchers found that alcohol-impaired drivers concentrate their glances in a smaller area of the windshield. The impaired subjects did not actively search the forward-facing scene as much as non-impaired subjects and tended to look less to the left and right and more toward the pavement area directly in front of the vehicle (Finley, Miles, & Park, 2017). However, research has not been found that specifically evaluates the cognitive abilities of severely intoxicated (2 times the legal limit or higher) drivers. Current countermeasures require a certain level of

cognitive ability to see the countermeasure, recognize what it means, and take appropriate action. This research proposal seeks to understand the cognitive abilities of severely intoxicated drivers as a first step in developing effective engineering countermeasures to prevent fatal wrong way collisions.

IX. Deployment Potential:

This task is part of the Wrong Way Driver Mitigation project, which so far has investigated the effectiveness of conventional countermeasures to cause drivers to self-correct. This task is in the conceptual stage since it focuses on determining the cognitive abilities of severely intoxicated drivers and to what type of stimulus they might respond. Future tasks could use the findings of this one to develop, and eventually deploy in the field, effective engineering countermeasures to prevent severely intoxicated drivers from entering highways in the wrong direction.

Date:

June 26, 2019

Research Initial Scope of Work Guidelines

FY 2019/20

INTRODUCTION:

The Project Manager/Task Manager (PM/TM) who decides to advertise their FY19/20 **approved** task(s) should follow the guidelines below. The completed Initial Scope of Work Submittal Form and any back-up documents should be forwarded to Yvonne Cooks **on or before the deadline**.

GUIDANCE ON INITIAL SCOPE OF WORK SECTIONS:

- I. **Project Number and Title:** (Limit titles to *no more than 60 characters*.)
- II. **Task Number and Title:** (Limit titles to *no more than 60 characters*.)
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- III. **Project Problem Statement:** (Describe the project problem statement.)
- IV. **Objective:** (Describe the overall task objective(s).)
- V. **Task Description of Work and Expected Deliverables:** (Optional section for the PM/TM to provide specifics about work requested in the proposal.)
- VI. **Background:** (A brief background statement or description of how the task relates to the project, and to departmental operations.)
- VII. **Estimate of Duration:** (Duration estimate for *this task*. Please align the schedule with the RPMD.)
- VIII. **Related Research:** (Results of PM/TM's literature review and/or Preliminary Investigation for new projects, or research results from previous tasks in this project. Also include additional research results/data and relevant literature.)
- IX. **Deployment Potential:** (Is this an incremental part of a larger research project? What stage of research is this project in now? What might be the eventual deployable product? What division/office/entity is the identified sponsor?)
- X. **Author and Date:** (Self-Explanatory)