



End of Project Report



1. Project Information:

1a. Project No. and Title: 142PUY2.2 Driving Simulator Based Interactive Experiments: Understanding Driver Behavior, Cognition and Technology Uptake under Information and Communication Technologies

1b. Principal Investigator(s): Srinivas Peeta

1c. Start Date: 01-01-2015

1d. End Date: 01-31-2018

1e. Report Date: 01-31-2018

2. Project Benchmarks:

2a. Students:

Name	Undergrad/ Graduate	Voluntary Information (for aggregate demographic trending only)		
		Male/Female	US/Foreign	Ethnicity
Shubham Agrawal	Graduate	Male	Foreign	Asian
Dong Song	Graduate	Male	Foreign	Asian
Irina Benedyk	Graduate	Female	Foreign	White

2b. Presentations:

Agrawal, S., I.V. Benedyk, D.Y. Song, and S. Peeta. Quantifying Impacts of Real-time Travel Information on Route Choice Behavior using Psychophysiological Analysis: A Driving Simulator-based Study. INFORMS Annual Meeting 2017, Houston, TX.

Song, D. and S. Peeta. Understanding Satisfaction with Travel Experience under Real-Time Travel Information Provision - A Latent Variable Modeling Approach”, INFORMS Annual Meeting 2017, Houston, TX

Song, D. and S. Peeta. Analyzing Traveler Satisfaction Under Real-Time Travel Information Provision: Placebo Effects of Information, 8th International Conference on Applied Human Factors and Ergonomics 2017, Los Angeles, CA

Peeta, S., S. Agrawal, I.V. Benedyk, J. Wang, Y. Guo, and D. Song. “Quantifying the Physiological Impacts of Real-Time Travel Information on Route Choice Behavior: A Driving Simulator-Based Study”, 8th International Conference on Applied Human Factors and Ergonomics 2017, Los Angeles, CA

Song, D., S. Peeta, Y. Hsu, and S. Agrawal. Role of Psychological Effects of Real-Time Travel Information Provision on En Route Traveler Route Choice Decisions, 9th International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design, Manchester Village 22017, VT

Song, D. and S. Peeta. Psychological Effects of Real-Time Travel Information on Traveler Route Choice Decision-Making Process, Transportation Research Board 96th Annual Meeting 2017, Washington, D.C.

2c. Journal Papers/Reports:

No journal publications or reports

2d. New Courses:

No new courses were offered based on this study

2e. Outreach Conference:

None

3. Project Impacts

3a. USDOT Priorities:

This study develops and conducts interactive driving simulator-based experiments by focusing on physiological indicators to analyze the cognitive effects induced by real-time travel information provision while driving, and their impacts on the route choice decision-making process. It focuses on a key USDOT priority related to understanding the value of real-time information in the Advanced Traveler Information Systems context, and its impact on driver cognitive state. The study will help various stakeholders (from the public and private sectors) in developing real-time information-based traffic control solutions.

3b. Significant Accomplishments in Research, Education and Technology Transfer:

On the research side, the developed interactive driving simulator experiment and online coordination between the multiple biosensors, HD cameras, and driving scenario allow researchers to collect a variety of behavioral data regarding driver's decision-making and driver dynamic cognitive states under different travel situations and various information scenarios. On the education side, undergraduate and graduate students were provided the opportunity to work in an integrated driving simulator lab that can lead to multiple dimensions of possible research in the area of traveler behavior and safety. In addition, the driving simulator lab was used as a platform to educate high school students in dimensions related to driver performance, behavior, and safety.

3c. Challenges and Lessons Learned:

This study emphasizes the importance of explicitly capturing drivers' real-time psychological factors in an integrated choice model under the travel information provision. The major challenge of this study is to integrate the dynamic traffic simulation capability with the driving simulator and multiple biosensor devices, and to define psychophysiological measures to understand impact of information on driver cognition. An integrated framework provides an ability to measure and establish causes of changes in driver cognitive states under different travel situations and real-time information provision. The challenges and lessons learned are summarized as follows. First, drivers' psychological states depend on the knowledge in real-time travel information including past experiences with en-route or pre-trip real-time travel information and experiences with information on personalized devices, all of which need to be separated. Second, information complexity and the cognitive capability may play a critical role in the context of the benefits derived from real-time travel information, which needs to be captured through the variables/indicators identified in survey questions. Third, driver perception of real-time travel information may be impacted by information accuracy, adequacy, and favorableness, which need to be controlled in the design of interactive driving simulator experiment. Fourth, biosensors (such as EEG, ECG, and eye tracker) can be used to quantify the driver cognitive state while performing driving tasks under real-time information provision.

3d. Photographs for NEXTRANS Publications (please attach separately):

3e. End User Impact Statement

The broad impacts of this study are as follows. First, the research findings through the interactive driving simulator experiments will aid federal, state and local transportation agencies to realistically and reliably assess the potential benefits of real-time information and help to establish the next

generation of Advanced Traveler Information Systems. Second, the interactive driving simulator experiments will aid in determining meaningful performance measures for real-time information systems beyond just the putative travel time savings. Third, these experiments enable the identification of a broader set of parameters for public and private sector entities to develop better methods to provide information to travelers and enhance the quality and safety of the travel experience.