



Human Factors Study on the Use of Colors for Express Lane Delineators

November 2019

Project Number

BDV24-977-26

Project Managers

Gail M. Holley

Jennifer Fortunas

FDOT Traffic Engineering and Operations Office

Principal Investigator

Hatem Abou-Senna

University of Central Florida

Current Situation

To provide a more predictable and safer driving experience, markings, signage, and signals are standardized throughout the U.S. by the Federal Highway Administration's Manual for Uniform Traffic Control Devices (MUTCD). A proposed change to the MUTCD regarding delineators – those tall, slender poles that are often used to mark separations or divergences of lanes – may have a significant effect in Florida. Previously, the MUTCD mandated that delineators should be orange or the same color as the pavement marking they supplement. New recommendations limit the color to matching the pavement marking.

Delineators are widely used in Florida, especially orange delineators that separate general traffic from express lanes. The question is which color is most noticeable to the driver to safely traverse the road environment. Advances in human factors studies make it possible to more scientifically evaluate the most noticeable color for delineators.

Research Objectives

University of Central Florida researchers conducted a series of human factors studies to determine the response to drivers in various groups to delineator color and the effect on their driving performance.

Project Activities

The researchers conducted a literature review to bring together major theories and models related to driver perception, driver behavior, human factors parameters, and experimental studies using simulators and eye-tracking systems, with a special focus on use of color. Based on this review, the researchers developed a research plan and an experimental design in collaboration with FDOT subject matter experts.

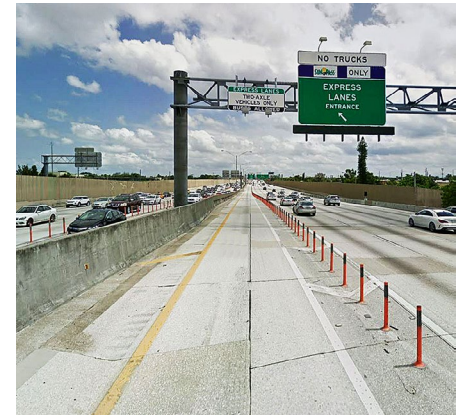
Researchers recruited and studied participants from younger (18-39), middle (40-64), and older (65+) age groups. Participants used a simulator to drive through a variety of virtual express lane configurations and encounter delineators of various approved MUTCD colors: white, yellow, orange, purple, or black. The simulator seat included many of a car's features, including a steering wheel, pedals, adjustable seat, an authentic shift lever, and a central console. Drivers experienced the road through a panoramic display and a digital sound system. Driver behavior was monitored by cameras recording the actions of a driver's hands, feet, face, and driving, while sensors recorded brake and gas pedal actions. An eye-tracking system followed eye movements. Participants were screened for color vision and simulator sickness. After brief training, participants drove ten scenarios.

Data such as deceleration, brake usage, speed, and vehicle distance from markers from 134 participants were statistically analyzed. Results showed that white outperformed other colors for driver awareness, performance, and noticing express lanes markers in objective and subjective tests. White was followed closely by yellow, with black being the least desirable.

Project Benefits

Results of this project will help support and further improve the efficiency offered by express lanes while adding to the overall safety of our roadway system.

For more information, please see www.fdot.gov/research/.



Orange delineators separate an express lane exit and the express lane from general traffic.