Effect of Roadside Environment on Diverge Identification in Work Zones

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Background

Work zones can be dangerous, confusing environments for drivers. A daily-driven road can suddenly have an unfamiliar traffic pattern delineated by a sparse and sometimes inconsistent configuration of temporary traffic control devices. In a survey of work zone crash studies, Ullman et al. (2008) found that work zones typically increase the number of collisions by 20% - 30%. Diversions can be particularly difficult for drivers, as the appropriate travelled way is separated from the main roadway using barriers. Additionally, other traffic control devices used to indicate other traffic conditions, such as the mainline freeway or that a lane is closed. These difficulties may explain why 3.4% of crashes in work zones in New York State between 1995 and 1998 were intrusions, where a driver inappropriate pulls into a work zone while trying to exit the roadway (Bryden, Andrew, and Foruniewicz, 2000). Even though that value seems small, it is significant enough to be one of the top causes of work zone collisions.

Visualization

To recreate roadside environments that are typical for the environment in Georgia, we used images collected through Google Maps to gain a sense of the vegetation along rural freeways across the state. Using these images as a baseline, we added similar vegetation to previously constructed computer models of diversions that we used in our past studies. After generating scenes, we added five alternatives to be tested along with two equipment configurations. Scenes were generated in 360 Max Design and rendered at a resolution of 1680 x 1050 pixels.

Methodology

Participants are instructed to click on the ramp if it is open, click “Exit Closed” if it is closed, or click “Don’t Know” if they are unsure about the proper response. Each participant is given 3.5 seconds before the slide times out without a response. Slides are shown in three (3) fully randomized sets separated by five minute breaks.

The location of the mouse click and the response latency are recorded for each slide. Mouse position is reset after each image, allowing for a comparable latency record between slides. Responses are categorized as correct or incorrect and subcategorized by error type in post-processing. We anticipate testing 80 - 100 undergraduate students at the Georgia Institute of Technology and Morehead State University.

Experiment Design

5 Alternatives
- 44 Freeway Diverge
- 68 Freeway Diverge 2:1
- Portable Concrete Barrier
- Linear Variable
- Linear Device Variation

6 Roadsides
- No vegetation
- Trees on right
- Trees on left
- Trees on both sides
- Trees on right and median
- Light vegetation

2 Options
- Diverge Open
- Diverge Closed

3 Equipment Configurations
- None
- Truck, monopole, and handcue
- Roller, leader, and truck

3 Repetitions
- 3 seconds from diverge point
- 1 second from diverge point

Prior work had indicated that drivers have difficulty identifying a typical straight geometry diverge with even slight (± 2 ft) variations in drum placement, but this work was conducted without vegetation or equipment in the background. This experiment will help to see if previous results are transferable in a more visually complex environment.

Anticipated Findings

We anticipate the following information will be gained from the results of this study:
- Impact of proximity and location of vegetation on diverge response time and accuracy
- Impact of diverge occlusion on response time and accuracy
- Impact of equipment configuration on response time and accuracy

The results of this study will inform future research in a simulated driving environment where a wider variety of performance metrics can be collected.

References


