

ASSESSMENT OF THE USE OF A DRIVING SIMULATOR FOR TRAFFIC ENGINEERING STUDIES

PROBLEM STATEMENT

Driving simulators have been used predominantly for training specific target audiences such as novice drivers, law enforcement officers, and truck drivers. Visual databases and traffic scenarios have been developed to support the training mission. The steady improvement in simulator technology has opened the door to the possibility of using driving simulators in research applications involving both human factors and traffic operations. For example, the driving simulator at the University of Massachusetts was used in a National Cooperative Highway Research Program (NCHRP) project to identify the best traffic signal display for protected/permissive left-turn control.

The University of Central Florida driving simulator is a high fidelity simulator mounted on a motion base capable of operation with 6 degrees of freedom. It includes 5 channels (1 forward, 2 side views and 2 rear view mirrors) of image generation; an audio and vibration system; steering wheel feedback; an operator/instructor console with graphical user interface; sophisticated vehicle dynamics models for different vehicle classes; a 3-dimensional road surface model; a visual database with rural, suburban and freeway roads, and an assortment of buildings and operational traffic control devices; and a scenario development tool for creating real-world driving conditions.

This project was undertaken to see if UCF's driving simulator could be used to support research in the area of traditional traffic engineering and human factors.

OBJECTIVES

The goal of this project was to design one or two studies involving traffic engineering and human factors that could be conducted with the UCF driving simulator instead of by relying on actual field test data. Two separate projects were chosen. The first involved the subject of gap acceptance by drivers. Published data for gap acceptance was compared to the experimental results under similar merging conditions. The second study was a human factors investigation of a radar-based safety warning system using in-vehicle voice and text warnings to alert drivers of the presence of impending conditions requiring their attention.

FINDINGS AND CONCLUSIONS

Findings from the gap acceptance study contradicted published AASHTO (2001) data, which suggests that the minimum acceptable gap for a left turn from a minor road on to a major road is independent of the traffic speed on the major road. The simulator results indicated the acceptable gap was reduced as the major road speed increased.

In the human factors study, responses from the subjects indicated that the safety warning system accomplished the intended purpose of informing drivers and raising their perceived awareness of potential road hazards without confusing or distracting them. However, the subjects were undecided as to any perceived safety benefits.

This project demonstrated the feasibility of using the UCF driving simulator to conduct applied research in traffic engineering and human factors. However, the research team underestimated the time required to make changes to the simulator's visual database and develop appropriate traffic scenarios. Future studies will allocate more development time to accomplish these tasks.

More studies are needed to identify limitations on the scope of research conducted in the simulator as a result of performance limitations associated with the visual system (update rates, polygon counts, etc) and the traffic management software (number of moving models, control of external vehicles, etc).

BENEFITS

Based on the two limited pilot studies, the UCF driving simulator has the potential to be used as an experimental testbed to conduct traffic engineering and human factors research. The driving simulator should be considered for future FDOT research involving areas such as traffic operations, sign recognition, geometric design, and age-related studies, because it offers a safe alternative to field testing and it is an economical platform for conducting such research.

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