

INVESTIGATION OF HARDWARE IN THE LOOP TRAFFIC SIMULATION METHODS

PROBLEM STATEMENT

Traffic simulation has become an increasingly practical approach to estimate performance measures for all types of highway facilities. Simulation is used to some extent in most Florida Department of Transportation (FDOT) districts to address unusual traffic control problems that are not amenable to more simplistic analytical treatments. The principal limitation of simulation models, up to the present, has been the rigid emulation of basic traffic control equipment and mechanisms, accomplished by internal routines within the simulation model itself. This limitation has placed severe constraints on the utility of traffic simulation as a problem solving approach.

Recently a new class of devices has been developed to allow actual traffic control equipment to replace the controller emulation built into a traffic simulation model. The “Controller Interface Device” (CID) opens new horizons for the use of traffic simulation as a problem-solving tool. In spite of its potential utility, the CID has not been deployed extensively in Florida, mainly because it is a new technology whose benefits are not widely understood. A dedicated effort is needed to identify potential applications and to focus the attention of the traffic engineering community on the benefits of this new technology.

OBJECTIVES

The goal of this project was to use the CID to create a new traffic operations analysis tool with many applications for the Department. The specific objectives were to facilitate the implementation of hardware in the loop simulation in Florida and to develop guidelines for future deployment by FDOT

FINDINGS AND CONCLUSIONS

Six CID units were purchased and made available to district and local agencies for experimentation. Although the CID is quite useful, it is also somewhat complex. Consequently, substantial training is needed for potential users, who must become familiar with traffic simulation, controller operations, and the CID. Two software tools were therefore developed to facilitate the training process and to reduce the required workshop schedule to half a day. Workshops were held at different locations across the state.

The most promising future hardware in the loop simulation (HILS) applications utilizing the CID include the following:

- cross-training of traffic engineering and signal operations personnel in the broad aspects of traffic control

- investigation and proof-of-concept for proposed major traffic control system improvements involving advanced traffic control (adaptive) systems, which are not generally covered by current simulation models
- factory acceptance testing for new and complex traffic control systems after delivery but prior to installation in the field
- general controller testing in the shop

While the last topic falls short of an actual HILS application, because no simulation program is involved, it attracted considerable attention and interest in the workshops.

Taken individually, all of the project activities described in this project, including the development of tools and presentation of workshops, have been well received throughout the state. Those who have attended the workshops have expressed a definite interest in pursuing HILS projects in the future. The project was successful in identifying and demonstrating the value of HILS and in creating an awareness of this new technology among potential users.

BENEFITS

As traffic control systems become more complex in the ITS environment, the need for personnel training and testing will become more intense. The ability to deploy a simulated version of a traffic control system in the traffic management center or signal shop will become increasingly valuable and, quite possibly, necessary at some point in the future. By introducing and facilitating the application of HILS in Florida, this project has opened the door to some real traffic control system improvements that will potentially reduce traffic congestion and road user costs, and improve traffic safety. The CID units purchased under this project will continue to be available for use by the districts and local agencies.

This research project was conducted by Ken Courage, of the University of Florida Transportation Research Center. The project web address is <http://trc.ce.ufl.edu/research/HILS.htm>. For more information, contact Elizabeth Birriel, Project Manager, at (850) 410-5606, elizabeth.birriel@dot.state.fl.us.