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RESEARCH SUMMARY

Development of A Traffic Simulator for I-695, the Baltimore Beltway, for Traffic Operations and Incident Management

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Problem

Due to rapid traffic growth in recent years, the Baltimore Beltway (I-695) is experiencing considerable congestion even after the normal peak periods. Hence, identifying effective tools for contending with worsening congestion on I-695 has emerged as a priority task for the Maryland State Highway Administration (SHA).

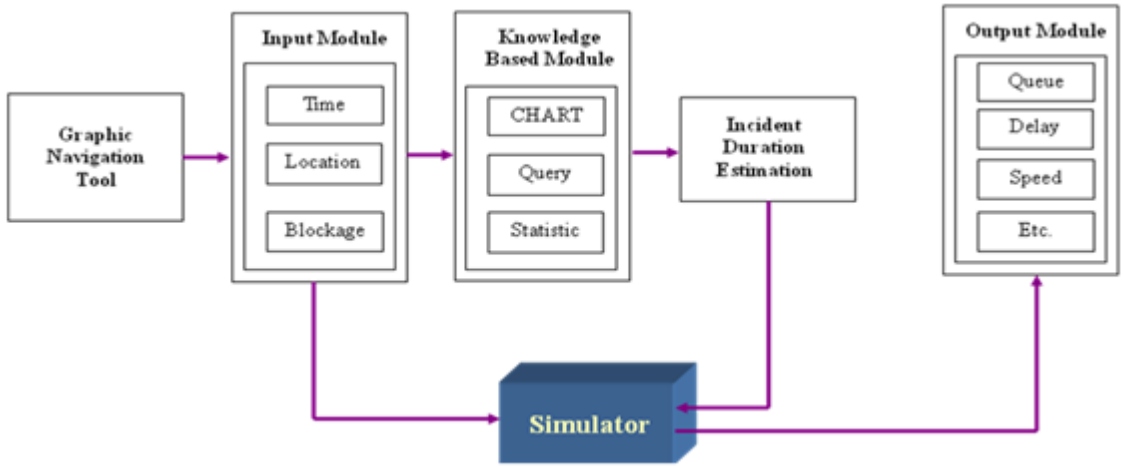
Description

This study expanded the current traffic simulation laboratory developed by SHA and the University of Maryland College Park (which includes simulators for I-495, I-270, and I-95), and began the construction of the I-695 simulator for use by SHA engineers in performing Baltimore area traffic studies. The simulator system contains the following principal components: (1) an intelligent system interface for input, output, and potential applications; (2) a GIS database for key information related to all network geometric features, driver characteristics, and traffic volume distributions; (3) a microscopic simulation database to model traffic behavior and the daily evolution of traffic patterns; and (4) a knowledge-based expert system module to project the durations of detected incidents. The completed I-695 traffic simulator will be part of the Traffic Simulator System sponsored by SHA, which can be used independently by traffic engineers for the Baltimore area or integrated with other existing simulators (e.g., I-495, I-270) to analyze the regionwide traffic conditions between the Washington and Baltimore metropolises.

Key Module Features

Input Module

This module is GIS-based and users can first directly identify from the map the approximate location of the target freeway segment affected by the incident and then input any related information through subsequent interactive questions.



Simulation module

The simulation module, the core of the I-695 simulator, has the ability to simulate actual traffic conditions over the period of incident operations and to assess the effectiveness of various candidate incident management

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strategies. Since the traffic simulator is mainly for incident impact analysis, its database contains all essential information for simulation execution, including network geometric features, traffic demand distribution, and available control strategies.

Knowledge-Based Module

This module is designed to take advantage of information and operational experience accumulated from managing previous incidents by SHA's traffic incident management program, Coordinated Highways Action Response Team (CHART). The CHART database keeps detailed records of response times, incident durations, lane-blockage conditions, incident locations, and incident natures for each incident response across the State of Maryland. The research team developed a set of discrete choice models for estimating incident durations and embedded them in this module to help users predict incident durations based on historical information. This module also serves to approximate the maximum possible queue length, based on the estimated incident duration. All such information will enable traffic operators to first assess the approximate impacts of a detected incident on the traffic network, and then to execute the simulator to compute the resulting delay, based on the real-time traffic volume and the implemented incident response strategies.

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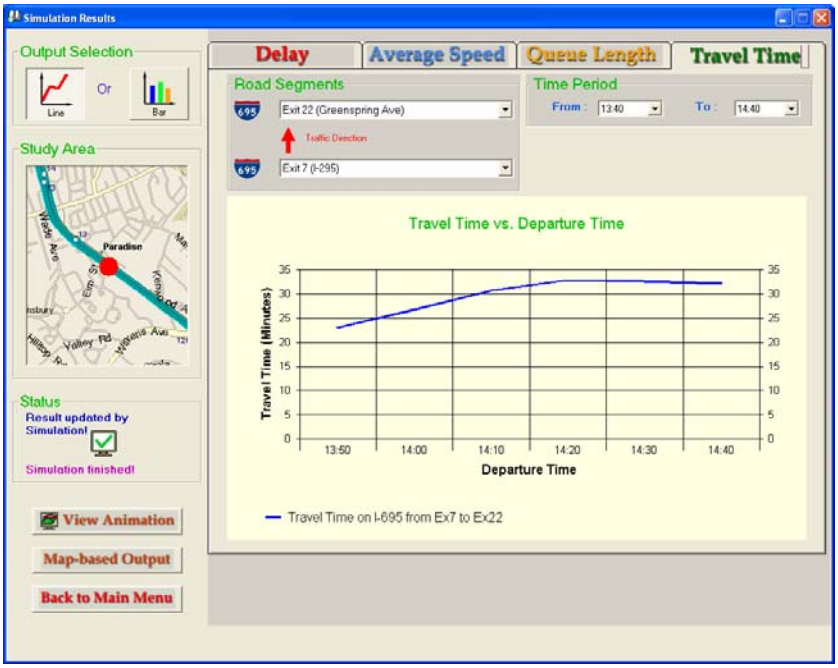
Output Module

While executing the incorporated CORSIM simulator, this module will first yield the projected traffic conditions from the knowledge-based module in response to the request of traffic operators. After successful execution of the simulator, this module will display the estimated delay, average speed, travel time, and queue information. Responsible traffic agencies can then act early, as necessary, to minimize the impact of detected incident on congestion.



Report Information

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