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POST-DISASTER DYNAMIC ROUTING OF EMERGENCY VEHICLES

PROBLEM STATEMENT

Traffic simulation is a powerful tool for assessing the benefits and impacts of transportation projects. Simulation is less expensive and safer than on-line tests. Moreover, simulation provides transportation engineers not only with the ability to test the feasibility and performance of a system before it is implemented, but with a tool that can be used to optimize the proposed system.

Simulation tools are becoming more attractive for use in studying traffic issues. With the advances in computers and simulation techniques, it is now possible to model any transportation network and to simulate traffic flow on its roads in a very realistic fashion. This capability enables traffic engineers and planners to investigate the effects of hypothetical changes in the network geometry and traffic control strategies on traffic performance. Also, simulation tools allow for the evaluation of several scenarios, such as building a new highway, adding new lanes to an existing highway, testing the use of Variable Message Sign (VMS), and other Intelligent Transportation Systems (ITS) applications.

The September 11th disaster has raised the consciousness of the transportation industry regarding the need for improved crisis management, disaster planning, and response capabilities in the event of an emergency. The present goal, with regard to the transportation system, not only is to move people and goods safely and efficiently, but to be well prepared for and protected against attacks, to be able to respond rapidly and effectively to natural and human-caused threats and disasters, and to be able to restore normalcy quickly and efficiently.

Advances in the traffic simulation technology can be used to model and test disaster management strategies. This technology is cost-effective for preparing for an emergency. It can also be useful for testing various available alternatives that cannot be tested in the field. Traffic simulation may be used to conduct more security-oriented transportation planning and to study the interactions among the various sectors that are essential for effective disaster management.

OBJECTIVES

The main objective of this study was to use the micro-simulation capabilities of traffic simulation and to develop a methodology for modeling transportation networks in order to determine the fastest and most effective routing strategy of emergency vehicles to Orlando International Airport (OIA) in the event of a disaster.

FINDINGS AND CONCLUSIONS

The network around the Orlando International Airport was coded into PARAMICS (an advanced traffic simulation suite of software tools) with 50 signalized intersections, 7 fire stations, and 66 zones. The study assessed the routes to be taken, from the fire stations to the airport for quick response, in case of an emergency at the airport.

Roadway network and travel demand data are the two main inputs required for building the model. Roadway network data consists of geometric layout of the network, number of lanes, and intersection description including the turning bays, signal timings, phasing sequence, and so forth. The travel demand data includes the vehicle counts in each link of the network. Since the vehicle counts data are not directly used by the PARAMICS model, travel demand modeling was needed to estimate the demand from one zone to another within the network. To address this need, two approaches were used for estimating the origin-destination matrix between the zones; the gravity model and a heuristic approach.

The road network was calibrated and validated for the peak hour by comparing the simulated link counts with actual link counts from different locations on the network. Then the network was simulated under peak hour, off-peak hour, and free-flow conditions. The time taken by the vehicles from the fire stations' zones to the airport was collected. These data were used as measures of effectiveness and to determine which fire station should respond first and how much time is needed for dispatch. Different scenarios were considered with incidents on the links that are used by the fire stations under normal conditions. Alternative routes under incident conditions were determined, and the sequence in which the fire stations are to route their vehicles for faster emergency response were proposed.

BENEFITS

This project has developed a methodology for improving transportation and public safety planning in urban areas, and it has contributed to subsequent developments in this subject area. In developing the methodology, actual recommendations were made for improvements to the transportation and public safety in the Orlando area.

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