UTC Spotlight

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This month: Institute for Multimodal Transportation, Jackson State University

Wm. Moore, RITA

This monthly report from the University Transportation Centers Program highlights some of the recent accomplishments and products from one of the University Transportation Centers (UTCs). The UTC Program is administered by the U.S. Department of Transportation's Research and Innovative Technology Administration.

U.S. Department of Transportation
Research and Innovative Technology Administration

Jackson State University's Institute for Multimodal Transportation Develops Impact Study for Urban Highway Evacuation

The successful mass evacuation of populations endangered by natural and man-made disasters requires establishment of mass-exit and operational strategies that maximize the proficiency and capacity of multimodal transportation networks. A workable emergency evacuation calls for cautious planning from an integrated system level perspective. Strategies for a variety of scenarios, employing dynamic traffic assignment (DTA), accurate data inputs, and state-of-the-art analytical software that allow an accurate simulation-based analysis of the transportation network, are required. This article examines emergency mass-evacuation strategies for the Greater Jackson Mississippi area, using two DTA models: DYNASMART-P and DynUST.

Lareka Washington

Charles Stokes, senior civil engineering student and Chao Li, visiting scholar, study research results.

Research results showed that operational strategies developed for an emergency evacuation have potential for cost reduction and could significantly reduce highway congestion during emergency situations. Although demonstrated in Jackson, Mississippi, the project has implications at the regional and national levels in helping to develop effective emergency evacuation strategies using highway networks.

For each DTA program, data was prepared and input, and emergency scenarios executed for the selected highway network. Operational traffic control strategies, such as lane closure and contraflow of traffic, intelligent transportation systems (ITS) implemented via dynamic message signs, and vehicle detectors to provide real-time traveler information for emergency evacuation, were examined in the study.

Data Collection

Data used in the study include geographic, hourly traffic volume, and origin-destination demand matrix information. Geographic data in shape file format for 4,607 nodes, 10,288 links, and 691 traffic analysis zones in the study area were provided by the Mississippi Department of Transportation (MDOT) and used to create the highway network model. Hourly traffic volume was collected to adjust the traffic demand data and calibrate the traffic flow model in the DTA programs. The origin-destination demand data in normal condition is provided by MDOT and is necessary for the DTA programs.

Network Model Building

The program Nexta was used to build the network model in DYNASMART-P and DynUST. Figure 1 shows the highway networks. Figure 2 depicts a simulated evacuation of southeast Louisiana, used to analyze the potential impact of varying traffic levels on the Greater Jackson, MS, highway network.

Demand during an evacuation may be divided into two portions: background demand and evacuation demand. Background demand is demand not related to the zones in the hazard area, but which occurs under normal travel situations. Evacuation demand is demand generated within an area around the disaster and consists of a set of traffic analysis zones.

Based on previous studies on estimation and the number of potential evacuating vehicles entering Mississippi, the evacuating production was determined (from zones located on the study area boundary, including main evacuating routes). These are shown as blue arrow lines in figure 2. The evacuation attraction to the location of shelters, hotels, or others (symbolized by a red triangle highlighted with a blue circle) is determined by their capacities. Next, the classic gravity model was applied to distribute the evacuation trips on the network model by the software of TransCAD 5.0. Finally, the combined demands are assigned to highway networks dynamically by DYNASMART-P and DynUST programs to assess the influence of the evacuation traffic on individual highways, streets, and intersections.

Analysis and Results

In the first simulation, when a base evacuation traffic demand was applied, the greatest impact was at Hwy-469NB from White Blvd to East Main St. The congestion lasted 25 minutes in a 4-hour simulation period. In the second simulation, when evacuation demand doubled, congestion occurred at the same place and lasted for about 35 minutes. Five other locations were also congested:

1. the off ramp from I-55NB to eastbound Gluckstadt Rd.;
2. County Line Rd. eastbound from I-55NB off Ramp to S. Wheatley St.;
3. College St. northbound from Hwy-468 to US-80;
4. Madison St. northbound from Access Rd. to Frontage Rd.; and
5. US-49NB where it interchanges with I-20.

Their duration times were 80, 25, 25, 10, and 15 minutes, respectively. The simulation results also showed the effectiveness of traffic control and ITS deployment.

Figure 1: Highway Network Under Study

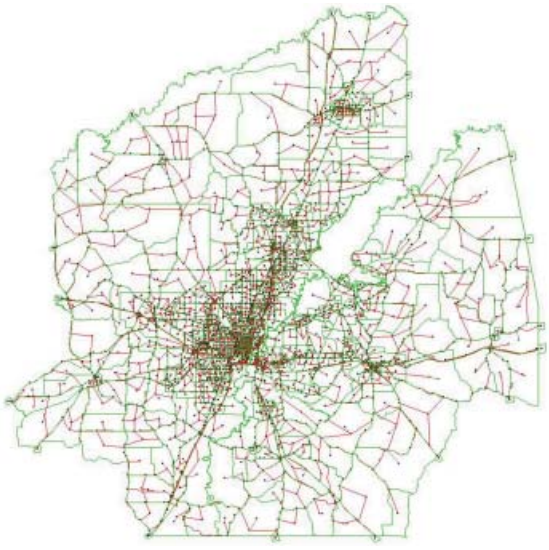
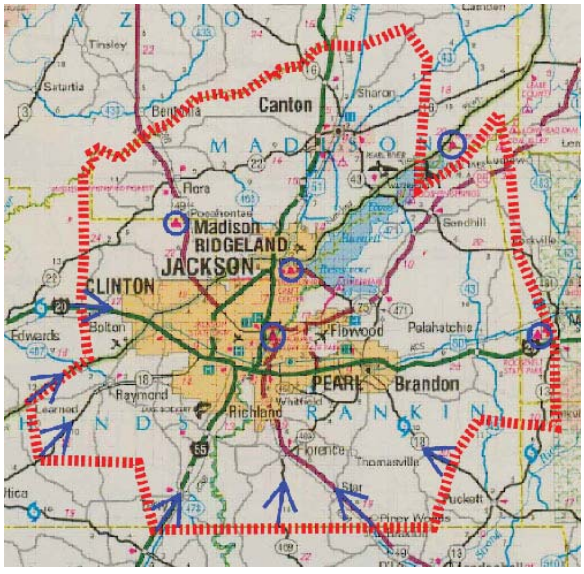


Figure 2: Map of Evacuation Scenario



About This Project

Dr. Feng Wang, PE, (feng.wang@jsums.edu) is the Director of the Institute for Multimodal Transportation (IMTRANS), Title III UTC at Jackson State University, MS. With strong support from the Traffic Division and Planning Division of MDOT, the research team conducted an emergency evacuation study for the Greater Jackson metropolitan area. MDOT supported the research with a similar project and additional funding. Mr. Acey Roberts, ITS Engineer for MDOT, and Mr. James Watkins, State Research Engineer for MDOT, are serving as the Technical Advisory Committee (TAC) to the MDOT project. The lead researcher was Chao Li, a visiting scholar and Ph.D. student from Beijing University of Technology. Charles Stokes and Samson Bulti, Civil Engineering senior students at JSU and Andrew Li, high school student from Jackson Preparatory School, also worked on this project. The study was conducted from July 2008 to August 2009 and resulted in operational assessment and enhanced preparedness for emergency evacuation events.