MarTREC UTC Project Information Form
USDOT Tier 1 University Transportation Center
Agency ID or Contract Number DTRT13-G-UTC50

Project Title: Evaluating Coastal and River Valley Communities Evacuation Network Performance Using Macroscopic Productivity

Project Abstract (Brief Description): The ever-increasing processing speed and computational power of computers and simulation systems has led to correspondingly larger, more sophisticated representations of evacuation traffic processes. Today, micro-level analyses can be conducted for megaregion-level hurricane evacuations spanning multiple states over several days and include the intermodal exchange of evacuees, millions of vehicles, and thousands of miles of roadway. However, the effort required to build such models and the volume of output data they produce also present difficulties for analysts; as they code networks, generate demand, model control elements and then calibrate results and interpret output. The goal of this research is to quantify and describe the operational conditions of evacuation traffic "network productivity." The concepts suggest that maximum production and therefore trip completion, is realized when the network achieves the highest rate of vehicles-miles traveled in a time interval. Here, a megaregion evacuation model of a coastal community is used to quantify the average network velocity, demand and network length necessary to estimate the network productivity. This research is likely to find that the network productivity exhibits a peaking characteristic. This would suggest network productivity can be maximized on a macroscopic scale as a function of demand. Research Objective(s): To better understand evacuation productivity of coastal and River Valley communities to assist in the planning, mitigation, response, and recovery of these areas from disasters.

Describe Implementation of Research Outcomes By building on the work of Geroliminis and Daganzo (2007), this research has defined a functional form for evacuation network productivity and illustrated its peaking nature as a function of demand. With knowledge of the optimal network demand, emergency planners can develop evacuation management plans which reach and maintain traffic at an optimal demand level. The results of this research indicate that when this optimal demand level is exceeded, evacuees are likely to experience inordinately lengthy delays such as those observed during the Hurricane Rita evacuation of Houston in 2005. Conversely this research suggests that demand levels that are below the optimal level will result in reduced overall network productivity and fewer trips completed per time interval. All combined, these finding suggest light to medium congestion produces the highest trip completion rate (and evacuation clearance) during an emergency, indicating that free flow conditions are not optimal from an overall network productivity viewpoint.

Impacts/Benefits of Implementation The findings of this research are significant in several respects. Most notably, they demonstrate the application of a novel performance and computational technique to assess the operation of traffic networks, system-wide, independent of their size or duration of analysis. This technique is ideal for evacuation planning and alternative comparison in megaregions. By estimating a function for "network productivity," emergency management and transportation decision-makers can use "trip completion" as a measure of evacuee departures out of a threat area. This permits a systematic and qualitative basis for assessing evacuee demand management (staged evacuations, route closures, etc), traffic control/management (contraflow, turn restrictions, ramp closures, etc.) measures that can improve regional mass evacuations.

Web Links: http://evaccenter.lsu.edu

Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs): 189,695(USDOT) + 49,706 (Match) = 239,401
Project Start and End Dates: 05/01/2015-04/30/2017. Project complete
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