RESEARCH PROJECT CAPSULE [14-3SS]

April 2016

TECHNOLOGY TRANSFER PROGRAM

Development of a Mode Choice Model to Estimate Evacuation Transit Demand

JUST THE FACTS:

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24 months

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

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PROBLEM

Over the last decade, the Louisiana Transportation Research Center (LTRC) has developed hurricane evacuation demand models that estimate, in two- to six-hourly discrete time intervals, if and when a household will evacuate, where the household will evacuate to, and which route they will choose if they evacuate in a private vehicle. Coupled with a dynamic traffic assignment program, these models produce time-dependent estimates of dynamic traffic conditions on an evacuation network for households evacuating by private vehicle.

Currently missing from the set of LTRC hurricane evacuation models is the ability to estimate evacuation by modes of transportation other than private vehicle. These other modes (e.g., bus, taxi, motorcycle, bicycle, walking, rail, and air) may serve a significant portion of the population depending on the characteristics of the population, the level of service provided, and the location of shelters. Even if evacuees who rely on transit service are few, the service is still required and the ability to anticipate and plan for such service is important.

With the development of an evacuation mode choice model, LTRC would have a complete set of models capable of estimating the entire evacuation process. The models would be capable of predicting the time-dependent flow of evacuation traffic, aiding management decisions regarding evacuation and/or contraflow orders. At any time interval, the models could estimate the number of households that have evacuated, average travel time to reach a destination, queue lengths, and bottleneck locations. Being able to test alternative management policies and assess their consequences will provide opportunities for emergency managers to make more-informed decisions.

OBJECTIVE

The objectives of the research in this study are to develop a mode choice model of hurricane evacuation behavior and to demonstrate its use in New Orleans, Louisiana.

METHODOLOGY

A literature review will be conducted to determine if any models currently exist for estimating evacuation mode choice and/or refuge type (e.g., shelter). Besides reviewing current practice in general, the research team will give specific attention to literature regarding social factors that affect evacuation behavior. Behavioral variables that influence evacuation mode choice/refuge type will be identified.

Hurricane evacuation behavioral studies that collectively represent a range of conditions (socio-economic makeup of affected communities, level of transit service provided, storm characteristics, actions taken by emergency managers) will be identified. Data from multiple studies will be collected so that a joint file of evacuation response data can be established.

Using data from multiple sources to estimate urban transportation demand models is relatively unusual primarily because of modeler perceptions that unique features (physical, cultural, and social) that influence behavior are not captured. On the contrary, the use of a joint data set from multiple storms allows the influence of these features to be detected.

A mode choice/refuge type model will be developed from the joint data set. Mode choice may be categorized as "own vehicle," "ride with other," "transit," and "other." Refuge type may be categorized as "friends/relatives," "hotels/motels," "public shelters," and "other." Joint modeling of the two categories will be considered, resulting in 4 x 4 joint choices. The final form of the model will be determined based on estimates using the joint data set. Figure 1 illustrates an example framework for the model.

Using data from a past storm in New Orleans, the model can be used to estimate expected transit ridership based on transit's level of service (frequency, number of pickup points, handicap/elderly accommodation).

IMPLEMENTATION POTENTIAL

The model proposed for development in this study is the last model required to complete the package of models for estimating hurricane evacuation demand from the initial decision of a household to evacuate through the estimation of traffic flow on links of the transportation network.

The ultimate goal is to have an easy-to-use package in which all of the models function together to produce estimates of dynamic traffic conditions resulting from alternative scenarios of storm conditions, management decisions, and local response. This goal is the basis of a future study.

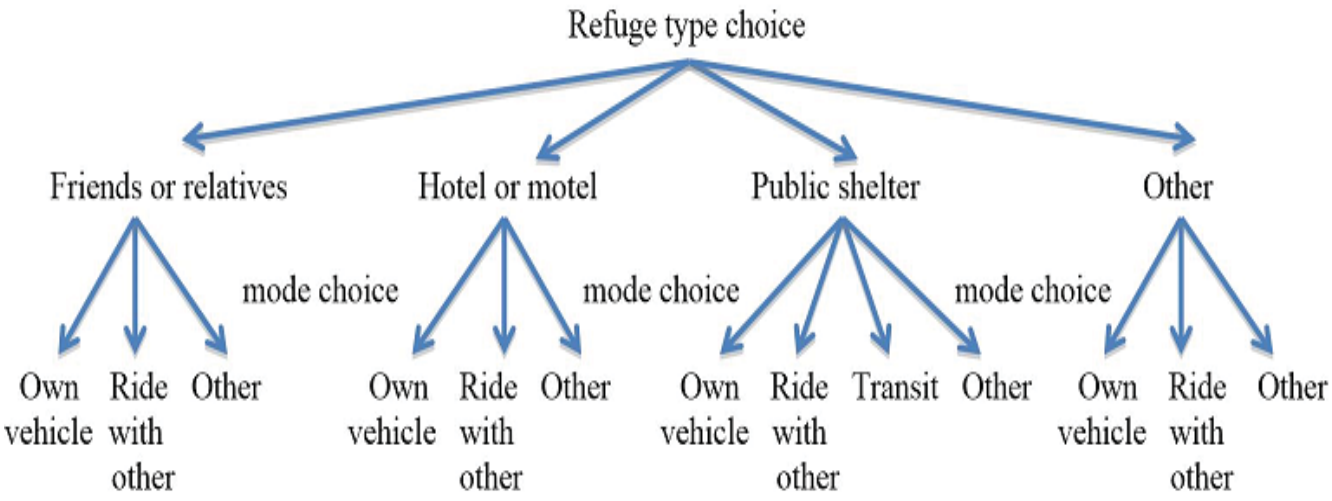

Figure 1
Nested Logit Mode Choice/Refuge Type Choice Model