An Aging Population Focused Evaluation of Evacuation Operations with a GIS-based Application in Florida

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Introduction

Satisfying the needs of aging victims during emergency evacuations becomes critical and requires extra attention in the presence of highly uncertain disaster conditions. During Katrina, it was very hard to manage the evacuation of aging people who had disabilities and mobility restrictions, who did not have a vehicle or could not evacuate without any assistance. This clearly indicates the need for emergency evacuation plans to have a multi-modal transportation assessment component that specifically focuses on aging people. This paper presents a timely evaluation and assessment of multi-modal evacuation operations with a focus on the needs of an aging population in the aftermath of disasters. The main consideration in the paper is to provide safe and accessible emergency evacuation to an aging population that should be robust with respect to disruptions that may occur due to disasters such as hurricanes. After a thorough review of the existing literature, operational data needs will be identified in order to evacuate an aging population based on the sustainability of the transportation infrastructure and availability of data points. This will be followed by a case study application on District 3 (Florida), as identified by FDOT, which emphasizes the use of GIS-based maps and modeling scenarios in support of emergency evacuation operations, in order to both satisfy the needs of aging people and account for real-world disruptions such as road closures.

Methodology

A large domain of knowledge between literature and practice is surveyed with a focus on the needs of the aging population during evacuations.

The next step is to determine the number and location of aging people living in the affected area using available resources such as state agency databases, and CENSUS data including surveys.

Then, the available transportation network databases are processed to identify the following: (a) available roadway and railway transportation networks, (b) location and accessibility attributes for multi-modal origins (airports, water ports, railway terminals, and intermodal connection terminals) and destinations (staging areas, distribution centers, shelters) in the affected region.

This information is presented as compatible GIS-based visual illustrations using the ArcGIS tool.

Finally, evacuation scenarios are created focusing on the transportation of aging victims safely out of the affected region.

Knowledge Representation for FDOT District 3

GIS-based Evaluation: Bay County of FDOT District 3

DTA-based Scenarios: Panama City of Bay County

DTA-based Scenarios: Panama City of Bay County

Conclusions

This study presents an extensive evaluation of evacuation operations that can help planners/emergency personnel decide how to transport aging people in the aftermath of a disaster.

Results of the analysis indicate that the roadway network in District 3 is vital in facilitating the optimal transportation of aging people which would significantly contribute to emergency plans.

The proposed evaluation methodology will help emergency officials identify these unexpected disruptions that can have high impact on the traffic movement during emergency evacuation operations.

This, in turn, can help identifying the best possible strategy, that can help reducing the delays and queues (critical for aging evacuee health and safety) among the following alternatives: (a) routing evacuees to another roadway, (b) one-way (also called reverse-laning or contraflow) operations, (c) converting shoulders for evacuation operations, and (d) staged evacuations where aging people living independently are given priority.

For a state like Florida, where aging population that live independently and in urban areas comprise a high percentage of the total population, dynamic assignment-based models should be used in order to evaluate the time-varying effects of traffic volume, delays and queues on the evacuations. From an aging-focused evacuation traffic control perspective, this type of analysis will especially be appropriate for slow-on-set disasters such as hurricane Katrina, where emergency officials can decide on an advanced notice and staged evacuation based on the spatial distribution of aging populations, transportation network conditions, and disaster characteristics.