INTRODUCTION

The Florida Keys is an archipelago consisting of many small islands off the southeast coast of Florida. As of 2010 Census, the population of the area is approximately 73,863 (United States Census Bureau, 2011). The evacuation process is critical in a densely populated area near key islands and provides access to mainland Florida. Several critical issues complicate the evacuation process and, therefore, the number of people who successfully evacuated the Keys. This research was conducted to analyze the existing evacuation process and to define possible improvements to the evacuation process.

The Florida Keys is a unique geographical location that faces unique challenges during evacuations. Due to the nature of the area, evacuations must be planned and executed quickly, even when the information available is limited. The evacuation process is critical in a densely populated area near key islands and provides access to mainland Florida. Several critical issues complicate the evacuation process and, therefore, the number of people who successfully evacuated the Keys. This research was conducted to analyze the existing evacuation process and to define possible improvements to the evacuation process.

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METHODOLOGY

To provide chains of reason and components, this research seeks to develop a microsimulation traffic simulation model of the Florida Keys to evaluate various evacuation scenarios. In particular, the research utilizes simulation to measure and quantify evacuation in a real-world, practical, and testable fashion that is both intuitive and beneficial to state officials. Traffic volume commuter flows during Hurricane Irma serve as a calibration and validation standard for model development. Based on these ideas, the objectives of the research is to better understand the evacuation process of vulnerable communities in the Florida Keys. It is used to plan the evacuation, improve traffic efficiency of the roadway, and recovery and adoption of these ideas from disasters. It is also expected that the findings from this research can be applied to situations of various natural disasters.

To achieve this, the following methodology, data collection, and analysis of the project area occurs within this research. This research uses the traffic simulation software to simulate the evacuation process. This model is then validated and compared to actual traffic counts during an evacuation. This verifies the model is representative of the traffic patterns observed, and population characteristics of the Florida Keys.

Once the model is calibrated, the model can be used for its intended purpose: modeling evacuation improvements for the evacuation process in the Florida Keys and containing evacuation impacts at a comprehensive level. The most important piece to this process is the evacuation simulations that could be modeled. This research and analysis determines which improvements have the potential to be effective in the Florida Keys and ultimately which were modeled. This process was performed as follows: the evacuation was simulated using VISSIM. This simulation building the evacuation network, addressing traffic control, and including evacuation and traffic control measures. Calibration uses population-and traffic data to create a roadway network that represents the many evacuees and their appropriate origin.

The model is then validated and verified to simulate real-world evacuation scenarios. The validation of the model occurred by performing a complete and comprehensive evacuation simulation. The final step is the calibration and validation. It is expected that the findings from this research can be applied to situations of various natural disasters.

RESULTS

After running the simulation five times for each of the five different scenarios, the results provided by VISSIM can be compared and analyzed to better understand the evacuation processes of the Florida Keys. Before getting into the analysis, it is important to note that the base model was based on the traffic counts from the Hurricane Irma evacuation, where the evacuation plan of the Florida Keys evacuation was used. Because of this, the evacuation simulations, which are modifications of the base model, are truly with evacuation improvement data. For example, implementing flashing yellow signal in the base model is truly implementing flashing yellow signals with evacuation by zone. This affects the results related to vehicle movement and timing and is discussed further.

Evacuation of Transportation Network Performance Under Evacuation Scenarios

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CONCLUSION

The Florida Keys is a unique archipelago consisting of many small islands off the southeast coast of Florida. As of 2010 Census, the population of the area is approximately 73,863 (United States Census Bureau, 2011). The evacuation process is critical in a densely populated area near key islands and provides access to mainland Florida. Several critical issues complicate the evacuation process and, therefore, the number of people who successfully evacuated the Keys. This research was conducted to analyze the existing evacuation process and to define possible improvements to the evacuation process.

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Finally, the greenhouse gases produced by vehicles falling during each simulation was calculated and analyzed. The results were not constant, the number of vehicle mile step delay hours, which was provided by VISSIM, in grams of greenhouse gas emissions.

Because of the Florida Department of Transportation’s preference for emergency shoulder use and contraflow related to evacuation, this research recommends that emergency shoulder use be implemented along US-1 in the Florida Keys. Implementing emergency shoulder use reduces the delay by more than 65%, and the total travel time for evacuees in the region by almost 30%. The travel time for each vehicle is improved by almost 35% and provides a more consistent travel time throughout the evacuation process. Additionally, the recommendation to use contraflow at I-95 in Dade County, which is another densely populated area near the Keys, is expected to reduce the travel time by more than 30%. These findings are expected to improve the evacuation process in the Florida Keys.