Hurricanes pose a severe threat in the state of Florida every year and Floridians prepare for the worse when there’s something on the horizon, since it has a history with massive and powerful hurricanes since the 90s when hurricane Andrew destroyed most of South Florida as a Category 5. Learning from the history of hurricanes in Florida, Floridians evacuated earlier for hurricane Irma. This evacuation is the biggest evacuation the state has ever been in, with the data collected we can prove such things in specific interstates as shown in Figure 1.

Last year, the preparations were very significant in the whole state, through the data center from the Florida Department of Transportation (FDOT) we were able to obtain data points of the evacuation. This specific analysis is done for the major interstates in Florida, I-95, I-4, I-75. Comparing these three routes by volume data and level of service (LOS), we are able to make several adjustments for future evacuations.

**INTRODUCTION**

SunGuide program was used to gather data from all the sensory equipment that are on all roads around the state. With this equipment we were able to acquire all the data needed to analyze where the highest volume rate took place in these three evacuation routes. All of the state of Florida is assigned to different evacuation routes and zones. Figure 3 is an example of how the sections within a county is divided by evacuation zones and routes close to those specific zones.

The specific data shows the volume of residents evacuating from every county in different evacuation routes. The analysis done in this study will be only of I-95, I-4, and I-75. These data points are very consistent and crucial in the state of Florida, since it is used by the emergency management for evacuations routes and zones as shown in Figure 3. Also these three routes make their way North to South and East to West.

**BACKGROUND**

As seen in Figure 2, the storm started approaching South Florida the morning of September 9th and it made its way up the west coast of the state. Earlier in the forecast, the hurricane was said to be hitting Florida’s east coast and within 24 hours, the hurricane changed course. The evacuation movement started going down from Key West, since in the past it has been the most devastating location in Florida after a hurricane. The evacuation started as early as Tuesday, September 5th of last year. Florida was completely shut down for five days. The data shows the incredible evacuation in many areas across the state.

**METHODOLOGIES –** Intelligent Transportation System (ITS)

There are two methodologies that will be considered in this project: Achieved Data Management Subsystem (ADMS) is when a data is collected and formatted with qualities that define the data source and conditions to interpret the data. The subsystem prepares data products that can serve as inputs to state and local data reporting systems especially during hurricane evacuations. The data that was collected, was from all the different sensors in many different areas of the state of Florida, but our focus is on the three major interstates stated above, which provides a general data warehouse service for a region.

The Traffic Management Subsystem (TMS) keeps track of and controls traffic and road network by communicating with the roadway subsystem to monitor and manage traffic flow and monitor the conditions of the roadway. That in which coordinates and adapts to maintenance activities, closures, and detours, in this case, of the evacuation. This subsystem also manages traffic and transportation flows. It also adapts to support allied agencies (FDOT; among others) in responding to, and recovering from, incidents ranging from minor traffic incidents through major disasters.

**ANALYSIS & CALCULATIONS**

When looking for the quality of a roadway or high way depending of the area of where it is, it’s gets to be defined as “A” for the highest to “F” for the lowest quality (called Level of Service - shown in Table 1). To define these routes at different days and times, it is required to know the volume, speed, and number of lanes. The following calculation was done to all 8,668 data points, which includes I-95, I-4, and I-75:

\[
\text{LOS} = \frac{\text{Current Average Volume} \times \text{Current Average Speed}}{\text{Number of Lanes}}
\]

Placing all the data points into a graph to show where we could find the highest volume capacity and the worst quality route between I-95, I-4, and I-75. Figures 4 shown below is a sample. The quality of the three routes vary in locations, whether is rural or urban. For example, if the highway/roadway is sited in an urban area, studies from the Katrina hurricane event in Louisiana have shown that it tends to have a higher LOS than these evacuations.

<table>
<thead>
<tr>
<th>Number of Lanes</th>
<th>LOS Density Range (pcu/mi/ln)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
</tr>
</tbody>
</table>

I-59 has the highest capacity level after I-75, this route is stretched all the way from Key West to the Georgia-Florida border line. The evacuation on this route starts Tuesday, September 5th, by the Key West residents. Many of the high capacity volume is not from those specific evacuees, but those who evacuated Thursday, September 7th. The LOS for that Thursday reached to more than 45 with poor quality. This tells us that at those Floridians who evacuated late backed up the traffic going North.

As stated in the previous section, I-75 had the highest volume capacity for people trying to leave the state. With a poor quality of LOS, FDOT can educate residents to take other routes to be able to have a nice flow rate of cars evacuating. This will decrease the travel time and accidents during an evacuation.

**RESULTS**

Hurricane Irma had major impacts in the state of Florida since hurricane Andrew. This analysis will help the FDOT as well as educate Floridians how traffic works, especially how the preparations for selecting evacuation routes along the state. These evacuation routes are always done to accommodate the amount of residents in each area for any case of emergency.

I-75 starts from central Florida all the way to the border with Georgia. From Figure 4, the LOS on I-75 is about 65, which is a quality of category “F.” The storm hit Columbia county around September 13th and this LOS was two days before the storm. In Figure 5, the LOS is presented by the amount of cars on a highway.

When comparing these three evacuation routes we can see that many Floridians evacuated North instead of East and West. Table 2 displays that many people stayed in their houses on the East coast of the state from the I-4 data and graph as well. I-4 graphs show that there was no low quality LOS, all of the sites along I-4 were below LOS 40. This concludes that the I-4 is capable of accommodating that amount of volume during a threat hurricane evacuation.

**REFERENCES**


Florida Department of Transportation (FDOT) - Database | [Online]. Available: http://www.fdot.gov/


Wolohan, B., Ph.D., PE, & McAuley, B., A.M-ASCE | Traffic Impacts and Dispersal Patterns on Secondary Roadways during Regional Evacuations | [Case Study Paper]

**ACKNOWLEDGEMENTS**

Administrative Assistant Rosa Criado for assisting in layout and logistics for the project.

Visiting professor, Scott Parr, Ph.D. for getting the data from FDOT and analyzing it with Hongyun Chen, Ph.D.

Embry-Riddle Aeronautical University, Department of Civil Engineering for providing the necessary resources for the project.