## Statewide Regional Evacuation Study Program


Following the destructive 2004 and 2005 hurricane seasons, the State of Florida's Legislature appropriated $29 million for the purpose of hurricane evacuation planning. House Bill 7121 - Disaster Preparedness Response and Recovery states, "The Legislature finds that hurricane evacuation planning is a critical task that must be completed in the most effective and efficient manner possible. Appropriated funds may be used to update current regional evacuation plans and shall incorporate current transportation networks, behavioral studies, and vulnerability studies. In addition, funds may be used to perform computer-modeling analysis on the effects of storm-surge events."

The **Statewide Regional Evacuation Study Program** (SRESP) began in 2006 as a direct result of this funding. The Legislature funded two inter-related and dependant projects – $24.5 million for Light Detection and Ranging data (LiDAR) and $4.5 million to update each Region's Evacuation Study.

The majority of funding went to the flight of LiDAR data, which is an optical remote sensing technology that can measure the properties of a target (elevation) with light, using pulses from a laser. This method was utilized to provide elevation data for the entire coastline of Florida with an elevation point every 6 inches. This data greatly improves the accuracy of the SLOSH (Sea, Lake and Overland Surge from Hurricanes) Model and Surge Inundation Model results. Use of such emerging technology sets this Study apart from those previously completed.

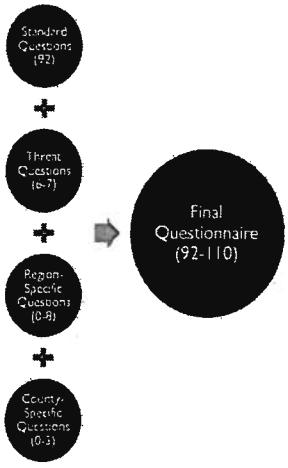
The additional $4.5 million was spent to design state-of-the-art products to advance the study of evacuation planning. The money was spent to utilize new technology in creating an Evacuation Study for each of Florida's eleven (11) regions. Most importantly, the same methodology was applied statewide. This was an unprecedented strategy, as no other State had approached evacuation planning in this way.

In order to achieve one of the primary project goals of a consistent methodology, the **Statewide Regional Evacuation Study Program** (SRESP) required the coordination of local, regional, State and Federal Agencies. As the program manager, the Northeast Florida Regional Council assumed this coordinating role. The Federal Emergency Management Agency (FEMA) and National Oceanic and Atmospheric Administration (NOAA) played key roles in the funding of the program and the modeling of the SLOSH basins. State agencies within Florida including the Division of Emergency Management, the Department of Transportation and the Department of Community Affairs worked tirelessly in order to achieve a methodology that was consistent and applicable across multiple disciplines. The Florida Department of Transportation was a partner from the onset and provided input that shaped many of the evacuation transportation modeling parameters used in the Study.

As Growth Management procedures and policies are also affected, the State Department of Community Affairs, specifically the Division of Community Planning was involved to provide the Growth Management expertise. The 2010 Regional Evacuation Study supersedes all other Hurricane Evacuation Studies; it is recognized as the best available data and is the professionally accepted analysis for comprehensive plan amendments for the State of Florida. This Study defines the Coastal High Hazard Area (CHHA), the Hurricane Vulnerability Zone and provides a benchmark to measure impacts development has on clearance times and shelter demand for the purposes of mitigation.

The level of Regional coordination and cooperation for a Study of this magnitude was overwhelming. Each of Florida's eleven (11) regions held quarterly work group meetings, often lasting two days. These meetings were used to determine the standard methodology for the State, while providing the flexibility to recognize the differences across each Region, from the largely rural Panhandle of Florida to highly urbanized South Florida. The meeting location was rotated each quarter, which allowed regional guests to attend each meeting and provide additional perspective to the group.

Not only did the Regions need to work together to function as a Statewide group, but each Region was also charged with representing their member Counties in this process. Regionally, each Planning Council worked through their counties to collect and analyze data to ensure that each Study reflected their specific Counties' vulnerabilities. Each of the eleven (11) Regions collected vast amounts of data on shelters, hazards, critical facilities, future land use and demographics; then analyzed the data and ultimately produced the final Study. These datasets are also valuable to the State Emergency Management Officials and to local Emergency Management Directors across the State for issues of planning, response and recovery.




Each subsequent phase of the project included experts from each field. A statewide behavioral survey was undertaken (the largest of its kind in Florida) to collect data from every County in Florida on the subject of evacuation. Nearly 400,000 calls were placed, with over 18,800 interviews conducted. The questionnaire had over 90 general questions with additional questions relating to specific threats and County specific information. Over 21,000 hours were spent on completing this survey effort. The data was then analyzed by Dr. Jay Baker, who developed the behavioral assumptions (how people will react to an evacuation order) used in the transportation model.

An updated SLOSH model was utilized for each Region as well, completed by NOAA and the National Hurricane Center (NHC). The SLOSH model is developed for each specific geographic coastal area individually, incorporating the unique local bay and river configuration, water depths, bridges, roads and other physical features. In addition to open coastline heights, one of

the most valuable outputs of the SLOSH model for evacuation planning is its predictions of surge heights over land, thus predicting the degree of propagation or run-up of the surge into inland areas.

This SLOSH information was then used in the Surge Inundation Modeling (SIM) Process. The Surge Inundation Model actually uses the SLOSH output to create surge zones in each category of storm (1-5). These surge zones represent the Maximum of Maximums (MOMs) from the SLOSH modeling runs. The Surge Inundation Modeling takes the theoretical envelope of water and produces a topographic representation using the newly acquired LiDAR data that we can relate to over the physical landscape. This is done within the GIS realm, with a majority of the process using raster cell-based mathematics (Spatial Analyst in ESRI's ArcGIS). The surge zones represent where inundation will occur in the "worst-case" scenario for each category storm.

The information on surge zones is utilized by the Emergency Management office in each County as the basis for creating the evacuation zones used in public safety planning. The evacuation zones created define the areas that will evacuate during a storm threat. This information is one of the many data inputs into the evacuation transportation model that estimates the vulnerable population and clearance times in an evacuation scenario.

A majority of the data collected during the Study are variables in the Evacuation Transportation Model: the behavioral assumptions, demographics, shelters, evacuation routes and evacuation zones. The model structure, based on the Cube Voyager Platform, is consistent with the Florida Department of Transportation (FDOT) and all the Metropolitan Planning Organizations (MPO) in Florida. The model uses dynamic traffic assignment to determine the number of trips and distribute and load those trips on the highway network. The model output provides data on shelter demand, the evacuating population as well as the clearance times for each County and the Region.

The result of this process is an Evacuation Study for each Region in Florida that while unique to its Region, was completed using the same methodology as the other Regions across the State. The Study itself is made up of eight (8) Volumes. Volume 1 is the Technical Data Report which is a summary of all volumes in the Study. Volumes 2 and 3 are Behavioral Survey Data and the resulting Analysis. Volumes 4 and 5 are the Evacuation Transportation Analysis and the Supplemental Data Report, which detail the analysis, methodologies and inputs and outputs of the transportation model runs. Additional volumes include Storm Tide Atlases for each county, an Emergency Managers Toolkit as well as an additional volume on transportation modeling documentation. In total, there are over 140 (140) volumes with over 30,000 pages in the completed Study for the State of Florida.


New, cutting-edge tools were created during the program, including the Storm Surge Inundation Modeling (SIM) tool, which utilizes an ArcGIS platform with Spatial Analyst to produce storm

surge zones for Category one (1) through five (5) storms. TIME (Transportation Interface for Modeling Evacuations) is another tool developed as part of the Study, which provides a user-friendly way for emergency management and growth management staff to model evacuations using their own set of parameters (roadway improvement, new housing development, etc.) and determine the effects on evacuation within a County and throughout the Region. These groundbreaking modeling efforts will forever change the methodology used for evacuation analysis.

While the SRES Program came to a close in December 2010, work continues. The data and resulting analysis of the Study impacted Emergency Management operations in all sixty seven counties within the State of Florida. However, due to the nature of the data and its complexities, it is anticipated that operational changes may take from several months to well over a year to implement. The Regional Councils across the State continue to work with Emergency Managers to ensure that this information is fully explained and is available to them however it is needed whenever questions arise.

Additionally, training curriculum is in development to educate users on the overall methodologies of the Study and the data and findings. A key component to training is application of the information in various agencies – including emergency management, growth management and transportation. Further instruction is also underway for the newly developed tools, including the TIME modeling interface as well as the surge modeling tool.

With a newly released Regional Evacuation Study available in each Region of the State, Florida is better prepared for the upcoming Hurricane Season than ever before.