

WORKING GROUP LAUNCH Hurricane Evacuation Study



2022-2024



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About the HES

Hurricane Evacuation Studies (HES) serve as the root of state hurricane plans. Historically, the HES has been completed by FEMA's National Hurricane Program with various federal, state, and local partners such as the USACE, NWS, and state emergency management agencies.

The research outcomes of an HES allow emergency management officials to determine who is likely to evacuate, where individuals are most likely to go when evacuating from a storm, and when they need to leave to safely reach their destination. The studies aid in the development of evacuation zones and identify vulnerable populations and probable impacts from hurricane-related hazards such as storm surge and high wind. Key insights are provided from surveying the public to anticipate potential hurricane behaviors. Evacuation routes are analyzed and estimated evacuation clearance times are modeled. Lastly, sheltering resources are planned and audited to better estimate the state's capacity for handling an event.

Each of the aforementioned components of the HES fall into one of the sections listed below:

- Hazards Analysis
- Vulnerability Analysis
- Behavioral Analysis
- Sheltering Analysis
- Transportation Analysis

This research combines GIS, social science, meteorology, and emergency management to develop a full understanding of the complex scenarios that are present prior to and during a hurricane evacuation. In the past, the project culminated in a PDF document known as a Technical Data Report that was used as a reference for state emergency managers in the drafting of their state hurricane plans. Currently, the National Hurricane Program is completing an analysis of the Hurricane Evacuation Study system to look at options for modernization of the methodology and deliverables.

SC's Last HES

Funding

The last HES for South Carolina was completed in 2013 by the US Army Corps of Engineers (USACE) and FEMA. Our evacuation clearance times were updated more recently in 2020. Due to funding limitations at the federal level, South Carolina will be moving forward with support from FEMA to complete an internal HES.

Key Findings and Products

The most significant product from the last HES was the reinvention of South Carolina's evacuation zones, which were last completely redone in 2012. The evacuation timelines used in actual tropical events were also built out from HES evacuation clearance time results.



The survey conducted for the behavioral analysis portion of the previous HES had several interesting findings:

- 35% of the vulnerable population does not know if they live in an evacuation zone
- 42% of the vulnerable population stated that they would evacuate for a Category 1 or 2 hurricane, while 83% indicated that they would evacuate for a Category 3, 4, or 5 hurricane
- 11% of respondents said that they would go to a shelter during evacuation



HES Outline

Sections

Detailed descriptions of each of the key portions of the HES are found on the following pages.

The sections are as follows:

- Introduction
- Hazards Analysis
- Vulnerability Analysis
- Behavioral Analysis
- Shelter Analysis
- Transportation Analysis

The graphic on the right side of this page provides simple descriptions of each section of the HES.

SARICANE STUDA HURRICANE **EVACUATION** ROUTE

The results of this new Hurricane Evacuation Study will directly inform for and responds

HI L

Introduction

SCEMD is starting

This study is set

to be completed

by June 2024.

Other than introducing each section of the HES, this section reviews the tropical climatology and event history within the state. This sets the foundation for the HES research.

Vulnerability Analysis

The purpose of this section is to identify areas, populations, and critical infrastructure that is exposed to the hazards discussed in the previous section.

Shelter Analysis

The Shelter Analysis allows the State to anticipate our needs by providing a shelter inventory and predicting shelter demand.

Putting it all Together

For this new HES, relevant results will be available to County & SERT partners as well as the public. Having a more public facing HES will increase awareness about hurricane vulnerability, behaviors, and evacuations across the State.



Hazards Analysis

This portion of the HES will provide context for a community's physical vulnerability to hurricanerelated hazards, such as storm surge, inland flooding, and high winds.

Behavioral Analysis

This section utilizes surveying methods to improve our understanding of SC residents' past and potential behavior related to hurricane evacuation.

Transportation Analysis

Using all of the information from the previous sections, evacuation clearance times are modeled for our planning purposes.

HES Outline

Introduction

- States the key purpose of the study: to evaluate the major factors that must be considered in planning for and making decisions during a hurricane event
- Describes the study area's topography, geography, geology, demographics, and more
- Explores historical hurricane activity and explains tropical climatology as it pertains to South Carolina
- Expands on the scope of each section contained within the HES

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Hazards Analysis

- The key scope of the hazards analysis is to investigate the significant hazards that can be expected from hurricanes of various categories, tracks, and forward speeds
 - Most notably, storm surge models are explored within this section
 - In addition to this exploration of storm surge model runs, hazards such as wind, inland flooding, and tornadoes are reviewed
- Creates a foundational understanding of South Carolina's general exposure to each of the aforementioned hazards
- Provides details on forecast accuracy and factors affecting the magnitude of each hazard
- Outlines modeled worst-case storm surge heights for various locations along the coast of South Carolina

HES Outline



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Vulnerability Analysis

- This section builds on the hazards analysis to identify areas, populations, and facilities that may be exposed to various hurricane hazards, primarily focusing on inundation
- Using this information, various evacuation scenarios are developed
 - Under these scenarios, major medical, institutional, and other critical facilities that may experience inundation are identified
- Vulnerable populations are identified, explored, and mapped in order to plan for and better understand areas that may have specific needs during a hurricane
 - The new HES will contain a Hurricane Vulnerability Index, which will consider both physical and social variables that impact a community's ability to cope with and recover from a hurricane
- Other evacuation planning components, such as potential staging areas for resources, are identified in this section

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Behavioral Analysis

- The key component of this section is a survey of the public. This survey provides insights into the past behavior, current perceptions, and potential anticipated actions of the populations that may be impacted by a hurricane event
- From these survey results, we are able to discern the percentage of the population that can be expected to evacuate, their anticipated public shelter use, vehicle availability, and much more
- This information is used in conjunction with the vulnerability analysis in order to create evacuation scenarios and estimates of evacuation timing (in the Transportation Analysis section)

HES Section Descriptions

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Shelter Analysis

- The shelter analysis completes an inventory with estimates of the number of people expected to seek public shelter, the spaces available to serve them, the capacity of each shelter, and each shelters' exposure to hazards
 - These shelter locations and capacities are used in the Transportation Analysis section to model evacuation timing
- This section also hosts a discussion of the other locations populations may choose to evacuate to, such as hotels, and explores their capacities

Transportation Analysis

- Various pieces of background information from the other sections are culminated into a transportation analysis within this portion of the HES
- RtePM software is used to model evacuation clearance timing for various scenarios determined by the user
- In addition to the determined evacuation clearance times, an evaluation of traffic control measures is elaborated on within this section
- Other factors that may impact evacuation timing, such as tourism estimates and those with critical transportation needs, are expanded upon as well

Project Plan

One key idea for this HES is to broaden the audience for the study's deliverables and therefore broaden the impact of the research. There will be three key levels of deliverables completed: a document that is internal to EMD, a data dashboard for County and SERT partners, and a story map that will be available to the public.

Internal

This Comprehensive Report will contain highly detailed data, narrative background, and cartographic context to serve as the foundation for hurricane planning within the State. The document will be housed within SCEMD.

County/SERT Partners

An interactive informational dashboard will be available at the County and State levels for all EM partners to utilize. Data will include exposure to hazards, social vulnerability, behavioral survey results, sheltering, and transportation.

External

This resource will be openly available to the public. It will feature streamlined narratives regarding each section of the HES and interactive maps and graphics with information that is relevant to the public.



Anticipated Changes

The methodology for the previous HES was clearly documented and allows for an update. Several changes will be made according to new capabilities and research.

- Hazards Analysis
 - More significant expansion on hurricane-related hazards
 - Addition of a section about climate change
- Vulnerability Analysis
 - More detailed vulnerability analysis and cartography
 - Larger emphasis on social vulnerability and equity
 - Data will be culminated into a Hurricane Vulnerability Index, measuring an area's overall vulnerability to a hurricane event



- Behavioral Analysis
 - Dissemination of an online survey to the public and in-depth statistical analysis of results
 - More results will be available to help County and SERT partners
- Shelter Analysis
 - Many pieces are already moving for an update of the Shelter Analysis, such as designating primary shelters that will always be the first to open in a hurricane. These changes will impact response in an event
 - This analysis will be expanded inland through the endpoints of evacuation routes
- Transportation Analysis
 - While previously a private software during the last HES, RtePM is now hosted on Hurrevac and available for SCEMD to use for analysis. This opens doors for analysis of additional evacuation scenarios, such as varying evacuation participation rates, phased evacuation, tourism dynamics and more
- Deliverables
 - As mentioned on the previous page, the deliverables for this HES will consist of a Comprehensive Report, a data dashboard, and a public-facing story map



Project Timeline

TASK	DELIVERABLE	COMPLETION DATE
Introduction	Comprehensive Report	5/1/2023
Hazards Analysis	Comprehensive Report	11/1/2023
Vulnerability Analysis	Comprehensive Report	3/1/2024
Behavioral Survey: Drafting & Testing	Behavioral Analysis	3/1/2023
Behavioral Survey: Response Gathering & Analysis	Behavioral Analysis	12/1/2023
Behavioral Analysis	Comprehensive Report	4/1/2024
Shelter Analysis	Comprehensive Report	8/1/2023
Transportation Analysis	Comprehensive Report	6/1/2024
Story Map Drafting, Design, & Publication	Story Map	6/1/2024
Dashboard Data Finalization, Design, & Publication	Dashboard	6/1/2024