**Scope of Work**

**Hurricane Michael Data Enhancement (Phase II), Performance of Modular Houses and Review of FEMA Recovery Advisory**

The State of Florida Department of Business and Professional Regulation

Florida Building Commission

And

University of Florida, Engineering School of Sustainable Infrastructure and Environment

(ESSIE)

Project Leader: David O. Prevatt, PhD Civil Eng., F. ASCE, Univ. of Florida

# Introduction

The University of Florida, Engineering School of Sustainable Infrastructure and Environment (ESSIE) shall continue Data Enhancement and data base augmentation for about another 400 to 450 houses over next fiscal year. Ultimately this phase will yield approximately 600 data sets that are augmented and categorized for the construction affected by Hurricane Michael which can support any questions received from the Legislature on the performance of single family Florida Houses. The project will be led by David O. Prevatt, Associate Professor of Civil Engineering, in collaboration with Dr. David Roueche of Auburn University (sub-contract).

# Relevant Sections of the Code

* 2017 Florida Building Code- Residential, Sixth Edition Chapter 6- Wall Construction (FBC, 2017)
* 2017 Florida Building Code- Residential, Sixth Edition Chapter 7- Wall Covering
* 2017 Florida Building Code- Residential, Sixth Edition Chapter 8- Roof Ceiling Construction all Covering (FBC, 2017)
* 2017 Florida Building Code- Residential, Sixth Edition Chapter 9- Roof Assemblies (FBC, 2017)
* 2017 Florida Building Code- Building, Sixth Edition, Chapter 14 “Exterior wall”
(FBC, 2017)
* 2017 Florida Building Code- Building, Sixth Edition, Chapter 17 “Special installations and test”

# Scope of Work

1. Data Processing and Information Extraction

Following on the previous report “Survey and Investigation of Hurricane Michael Project Phase I (Prevatt & Roueche, 2019), which collected and analyzed data from around 220 houses, we propose to extend the study to incorporate an additional 400 building structures affected by Hurricane Michael.

* + Using the procedures developed for quality control and quality assurance and data augmentation this scope will use the Fulcrum Software to complete the enhanced database, using information from UAV imagery (collected by UF) and where feasible using the other available resources (ConnectExplorer Pictometry, UAV Imagery (Pix4D)) to precisely quantify the percentage damage to the roof cover, percentage damage to the wall cladding etc.
	+ We will identify the performance of various exterior building roofing and siding systems including vinyl siding and vinyl soffits by analyzing the collected data over 400 buildings.
	+ Identify and add pertinent information extracted from County Appraiser’s website to identify the built-in- year of the houses, permitting information, porch area, type of wall cladding, type of roof cover etc.
1. Modular Single-Family Homes - FBC

Report on the relative performance and structural details of modular houses versus site-built houses during the recent Hurricanes Irma (2017) and Michael (2018). It is possible using post-hurricane studies to identify structures defined as modular homes - which are manufactured off-site and transported to its final location. These structures fall within the jurisdiction of the FBC.

This study seeks to determine the relative performance of modular homes versus other site-built constructed single-family houses during recent hurricanes. UF proposes the following scope:

* + Research key identifiers for modular homes from FBC regulations. Identify the identification plates and serial numbers, if any.
	+ Extract from the existing UF data set of structures observed during the post-hurricane damage observations all and any modular homes. Document the wind speeds, orientation of structures and extent of damage occurring.
	+ Develop additional metadata such as permitting and structural plans, manufacturer and date of installation of the modular houses using publicly available Building Appraisers Website and with the assistance of the Staff at the Florida Building Commission.
	+ Evaluate and compare the performance of the modular residential structures as against the total database of houses.
1. Research outcomes from FEMA’s MAT reports

FEMA recently released a [Recovery Advisory 2](https://www.fema.gov/media-library-data/1560174739479-8856110e0c3fa30e750370dc5129348a/MichaelRA2_060719_508_FNALforposting.pdf) for Hurricane Michael that outlines best practices for minimizing wind and water infiltration into residential buildings. Many of the recommendations may already be included into the FBC and others that have not been. The scope of work is:

* + We will review the recently published documents and identify the differences between the current Building Code and the additional recommendations presented.
	+ Report the findings to the FBC, prioritizing the modifications for code changes for consideration in future codes.

The Hurricane Michael [Recovery Advisory 1](https://www.fema.gov/media-library-data/1562097832608-445339dbb60e88e86fdf40314a62dffd/MichaelRA1_070119_508.pdf) discusses Successfully Retrofitting Buildings for wind resistance and it is focused on the effective retrofit strategies for critical facilities. The details here are also pertinent to both residential and on-residential structures.

* + We will review this publication and extract relevant practices that ought to be considered by the Florida Building Commission.

# Method of Payment

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# A purchase order will be issued to the University of Florida/ Engineering School of Sustainable Infrastructure and Environment (ESSIE). This project shall start on the date of execution of the purchase order and end at midnight on June 30, 2020, shall not exceed $90,241, and shall cover all costs for labor, materials, and overhead. Payment will be made for the study after the Contract Manager, Program Manager and the Commission’s Structural Technical Advisory Committee (TAC) have approved the final report.

# Deliverables

1. An interim report shall be prepared and delivered to the FBC on March 17, 2020. The interim report will summarize the results of task a and the current status of task b. These tasks include Quality control and quality assurance of the data, augmentation of the data extracted from various sources and also identifying the percentage of damages.
2. A final report shall be prepared and delivered no later than June 15, 2020. The final report will summarize the complete set of results from the homeowner online interview and comparison of performance of the buildings Pre- and Post FBC buildings.

# Performance Measures and Financial Consequences

ESSIE is solely and uniquely responsible for the satisfactory performance of the tasks and completion of the deliverables as described in this Scope of work.

Failure to complete the task and deliverables in the time and manner specified in Sections 3 and 5 shall result in a non-payment of invoice until corrective action is completed as prescribed by the program manager or contract manager.

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# Contract Manager and Program Manager

The Contract Manager for this purchase order is Barbara Bryant and the Program Manager is Mo Madani.

# Goals

The goals of this research are the following:

* To analyze the performance of the exterior and interior components of buildings from the data collected from another 400-450 houses and identify the interior and exterior damage of the buildings, including an assessment of the damage due to the wind, storm surge for the Pre- and Post FBC buildings by comparing the gust wind speeds on the various areas.
* Identify modular houses in the existing dataset by working with the Staff of the Florida Building Commission. Determine the relative performance of modular homes versus other near-by and comparable site-built single-family houses during recent hurricanes. UF proposes the following scope.
* Review and analyze observations and recommendations in the recently published Recovery Advisory reports prepared by FEMA and identify the differences between provisions in the current Florida Building Code versus those recommendations. Report the findings to the FBC, prioritizing the modifications for code changes for consideration in future codes.

# Background

Hurricane Michael (October 10, 2018) caused landfall in the south of Panama City, FL with the National Hurricane Centre reported that a minimum pressure 919 MB and maximum sustained winds of 150 mph. The measured peak wind gust observed near the eyewall of at least 130 mph and 10 m height, but gusts may have been higher as several observation stations damaged and stopped reporting. It was estimated that the design wind speeds for many structures were exceeded for a sizable region near Mexico Beach and further inland. The hurricane particularly affected the Mexico Beach and Panama City and nearby coastal towns as well as interior areas, such as Blountstown and Marianna FL located north of the I-10 Interstate highway.

The University of Florida conducted two damage surveys immediately following the landfall of the hurricane and revealed that structural performance of the buildings. As a result of the survey, it was suggested that the age of structure has a greater influence on whether it was just damaged or completely destroyed.

The University of Florida in coordination with Auburn University were able to compare the performance of the Houses in Cedar’s Crossing, Magnolia Hills, Brentwood’s, Gulf Aire and Beacon Hill during the Hurricane Michael based on the built year before and after Florida Building Code and also presented the building performance based on the wind and storm hazard was updated in Survey and Investigation of Buildings Damaged by Hurricane Michael Project Phase I (Prevatt & Roueche, 2019). The Second Phase of this project will continue the data enhancement of the remaining areas (400-450 buildings) and compared the performance of the Pre- and Post FBC buildings.

# Motivation and Purpose

The motivation of this research is to analyze the data collected from the Hurricane Michael and estimate the exterior and interior damage of the buildings. There are different factors affecting the damage to the components of the buildings. In order to compare the performance of the Pre- and Post FBC buildings, it is better to analyze the data in large areas. In Phase I of this project (Prevatt & Roueche, 2019), we were able to do data enhancement of approximately 200 buildings in Cedar’s Crossing area. In the Phase II of this project we will do data enhancement of other (400-450) buildings.

# Anticipated Budget and Justification

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# Budget (To be Completed after receiving budget directive from FBC Staff)

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| UF Budget Breakdown |
| **UF Civil & Coastal Eng.Budget** | **FY2020** |
| Faculty salary & fringe | $ |
| TEAM Personnel | $ |
| Grad Student-Salary | $ |
| Student-Tuition | $ |
| Student OPS | $ |
| Materials & Supplies | $ |
| Lab Services | $ |
| Travel | $ |
| F & A @ 10% | $ |
| Auburn Sub Award | $ |
| Subtotal | $ |
| UF Total Contract | $ |

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| --- |
| Auburn University Budget |
| **Category** | **FY2020** |
| Labor | $ |
| Materials &Supplies | $ |
| Travel | $ |
| Subcontract | $ |
| Overhead | $ |
| Subtotal | $ |
| Grand Total | $ |

# UF Budget Breakdown by Labor Hours

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| --- | --- | --- | --- | --- | --- | --- |
| **Person** | **Hours** | **Hourly Rate** | **Fringe** | **Tuition** | **IDC** | **Total** |
| D. Prevatt |  | $ | $ | $ | $ | $ |
| Admin Assistant |  | $ | $ | $ | $ | $ |
| Grad Student |  | $ | $ | $ | $ | $ |
| Undergraduate Students |  | $ | $ | $ | $ | $ |

# References

FBC. (2017). *Florida Building Code* (Sixth Edition ed., Vol. Building). Florida.

FEMA. (2019). *Successfully Retrofitting Buildings for Wind Resistance. Hurricane Michael in Florida.* Recovery Advisory.

Prevatt, D. O., & Roueche, D. B. (2019). *Survey and Investigation of Buildings Damaged by Category-III, IV & V Hurricanes in FY 2018-2019 - Hurricane Michael.* Tallahassee, Florida: Florida Department of Business and Professional Regulation.

