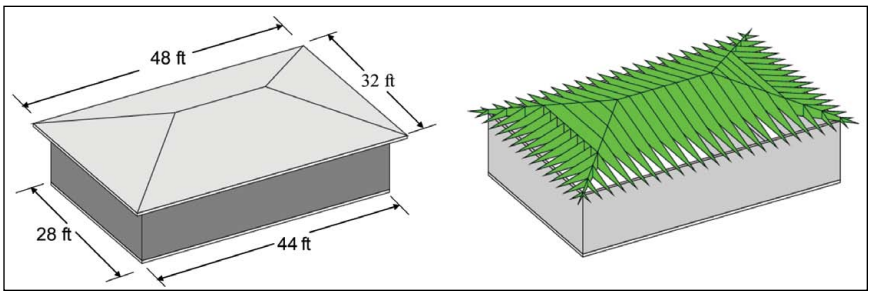
RESEARCH in Progress

Coalition for Advanced Wood Structures
a university, industry, government partnership

Analysis of Wind-Loading Data Collected During Hurricane Katrina

Most structural wind damage in the United States occurs to roofs of residential timber frame structures during hurricanes. To investigate the response of a timber frame structure to hurricane wind loads, FPL researchers designed and built a test house in Pensacola, Florida, with a roof that is extensively instrumented with load cells and pressure gauges. This project focuses on analysis of data collected from the roof of the test house during hurricane Katrina in 2005.



Schematic of the test house with and without roof sheathing.

Background

Researchers in the past have studied responses of residential structures subjected to wind loads. An important aspect of the current project is that it attempts to correlate results from an analytical study with actual data recorded on the roof of the test house. Since its construction, the test house has been subjected to three hurricanes; wind speed near the structure was recorded at 56.2 mph during hurricane Katrina.

Objective

The objectives of this project are to (1) develop an analytical model for the roof of the test house that will adequately describe the measured gravity load distribution, (2) correlate measured peak loads with analytical values calculated from measured wind pressure, and (3) compare data recorded during Katrina with respect to recommended design values in the American Society of Civil Engineers (ASCE) 7-02 code.

Approach

A theoretical model of the roof is developed using the ANSYS finite element program. Material properties in the model are based on those recommended in the design codes. A constant factor is added to increase gravity load to match measured total load to account for the contributions of other elements, such as nails, ceiling, and gusset plates. The analysis is performed using an equivalent static load method, with wind pressure recorded at peak wind speed and during a short time interval. Load reactions are typically compared with those monitored over a short time frame. The ASCE 7-02 code is used to define minimum design wind loads to calculate pressure distributions that an engineer would utilize in designing a house similar to that used in the field.

Expected Outcomes

Expected outcomes of this project include the following:

- Analytical model for the roof of the test house

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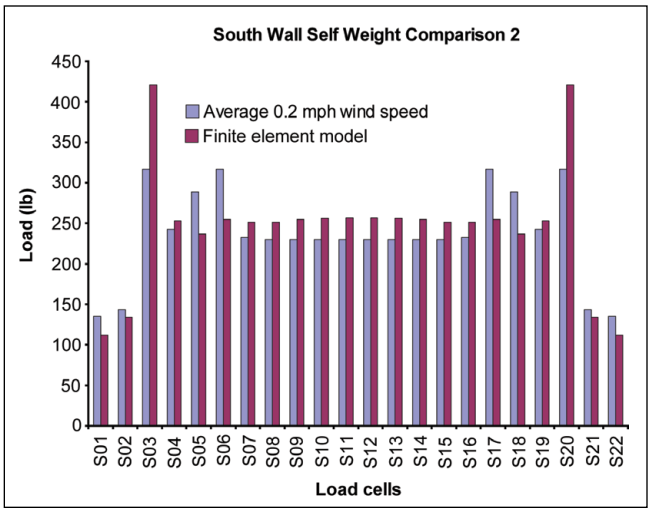
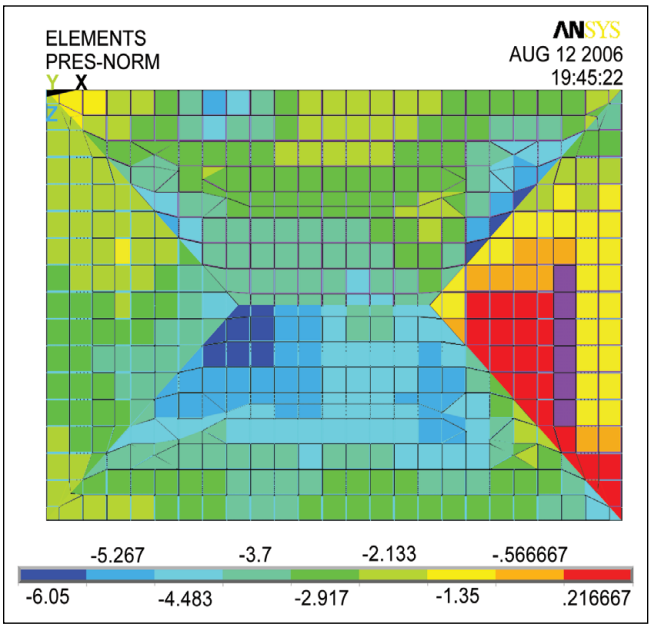


Comparison of calculated and measured gravity load distribution along the major axis of the building.

- Comparison of measured and calculated gravity load distribution
- Understanding of wind load effects on a residential roof during Katrina
- Prediction of roof response at high wind speed (such as 140 mph)
- Evaluation of wind load prescribed by ASCE 7-02 for designing roofs of timber frame houses

Timeline

Development of the roof model has been completed. Wind analysis of data captured during Katrina and evaluation of the ASCE code approach are expected by the end of fall 2006 and spring 2007, respectively. The work is expected to be completed by December 2007.



Representation of wind pressure distribution on the finite element model of the roof.

Cooperators

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