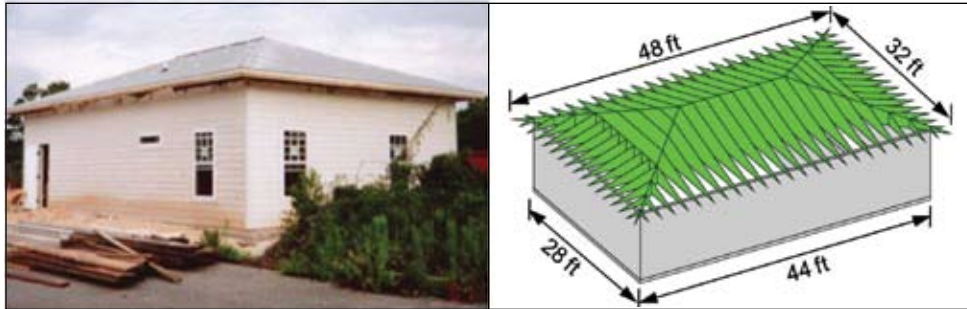


Evaluation of Wind Pressure Measurement Techniques for Test Structures

Recognizing the need to better understand the behavior of roofs on residential timber frame structures subjected to hurricane winds, FPL researchers designed and built a test house in Pensacola, Florida. The roof of the house was extensively instrumented with load cells and pressure gauges. A second test house is expected to be completed at Opal Beach, Florida, in 2008 which will also include an instrumentation scheme to monitor wall uplift and sliding forces. This project investigates the accuracy of the wind pressure measurements and how the data collected at selective points should be interpolated in analyses.

Background

In an earlier Coalition for Advanced Wood Structures (CAWS) project, Iowa State University researchers analyzed the roof response of the test house in Pensacola using a finite element model subjected to gravity loads and measured wind pressures during hurricane Katrina, in which the maximum wind speed recorded near the structure was 56.2 mph. Although the gravity load analysis showed good correlation between the measured and calculated reactions, this comparison was generally poor for the wind load analysis. A part of the reason for the poor wind analysis correlation may be that the wind pressures induced at the peak wind speed were relatively low. However, it was also concluded that the accuracy of the analysis depends on the accuracy of the



The residential test house located in Pensacola, Florida.

wind pressure gauges and how the data measured at selective points are interpreted to represent the wind load on the roof.

Objective

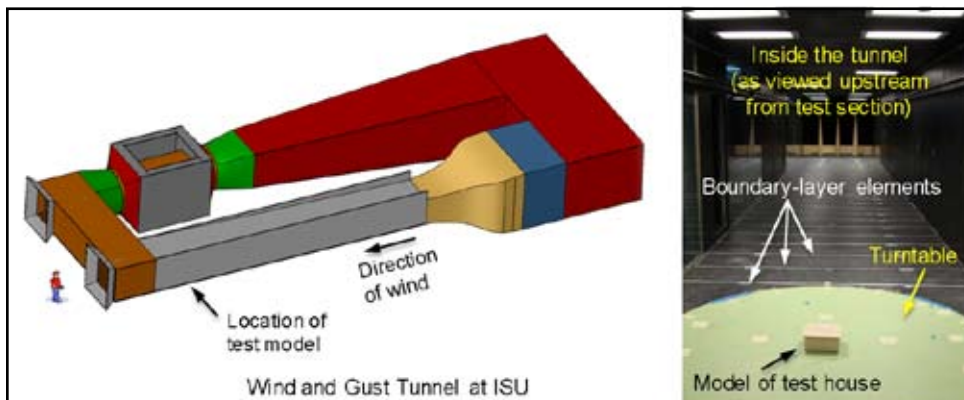
The objectives of the current project are to (1) complete a literature review on measurements of wind load effects on field structures; (2) perform wind tunnel tests and evaluate accuracy of data from pressure gauges; (3) examine suitable interpretation of wind pressure measured at selective points; and (4) make recommendations for suitable locations for pressure gauges for the second test house.

Approach

Following a literature review of investigations related to the project, wind tunnel tests will be used to accomplish the remaining objectives. These tests will be performed in three phases using two small-scale wind tunnel models and a small portion of the roof of a test structure at full-scale. The first model will be a one-story flat roofed building where the focus will be



Typical instruments used on the roof of a test house.



Planned test on a wind tunnel model of a test house.

on characterizing wind pressure measurements on the windward wall and flat roof surface. The second model will replicate one of the test houses. The first model will be used in the first two phases of the wind tunnel tests and will be subjected to normal (along building axes) and angled (oblique to building axes) winds. In the third phase, similar tests will be performed on the second wind tunnel model and on the full-scale portion of the test structure.

Expected Outcomes

Expected outcomes of this project include the following:

- evaluation of accuracy of pressure gauges mounted on test structures;
- recommendations to optimize the locations of pressure gauges; and
- recommendations to interpolate wind pressures between selective gauge locations

Timeline

About 50% of the literature review has been completed. The first model has been constructed and the first phase of testing of this model under loading uniform wind will be completed by April 2008. The tests on both models and on the full-scale portion will be performed in atmospheric boundary layer wind by June 2008. Following interpretation of experimental data, an analysis of the test roof will be performed to demonstrate the impact of this study. The final report of the project is expected to be completed by December 2008.

Cooperators

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