RESEARCH in Progress

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

High-Wind Research Structure

One common cause of costly damage to buildings is high-force winds, such as those present during hurricanes or tornados. In 2005, hurricanes caused hundreds of billions of dollars in damage in the United States, with Hurricane Katrina on record as the costliest natural disaster in U.S. history. Although damage does not result solely from high winds, these storms demonstrate the necessity of improving structures to better protect them from these forces of nature.

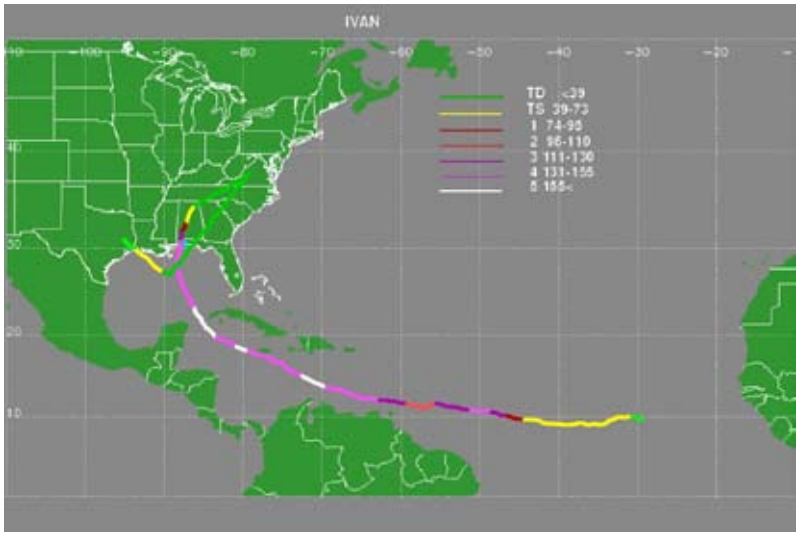
Background

Film records of Hurricane Iniki's 1992 assault on Hawaii show an entire roof system being blown off a building while the roof itself remained intact. This graphic demonstration of a construction weakness at the roof–wall interface proved the need for a better way to connect building components at the critical point where roof meets walls.

How wind affects structures is not a new area of research, but past research has relied primarily on models, not real-world data. Wind tunnels are used to simulate high-wind events, but they cannot duplicate other factors such as rain and random gusts.

Objective

The objective of this research program is to evaluate the effects of high winds on buildings—particularly the roof and roof–wall interface—using a full-scale, real-world structure.



The eye of Hurricane Ivan passed directly west of the high-wind research structure in 2004.

Approach

Forest Products Laboratory (FPL) researchers designed and built the high-wind research structure in Gulf Breeze, Florida (6 miles southeast of Pensacola). Located at the Gulf Islands National Seashore, this 28- by 44-foot structure is fitted with sensors that measure the effects of wind on the roof itself: 68 load cells measure vertical load on the roof system, and 78 differential pressure transducers measure differences in pressure on roof sheathing at various points. Wind speed and direction data are synchronized with roof pressure and uplift load data.

Data are collected from these sensors continuously, with measurements being recorded every 5 minutes and transmitted to researchers at FPL. Measurements can be recorded every second, if needed. Data from the

Advanced Housing Research Center
Forest Products Laboratory Madison, Wisconsin

USDA

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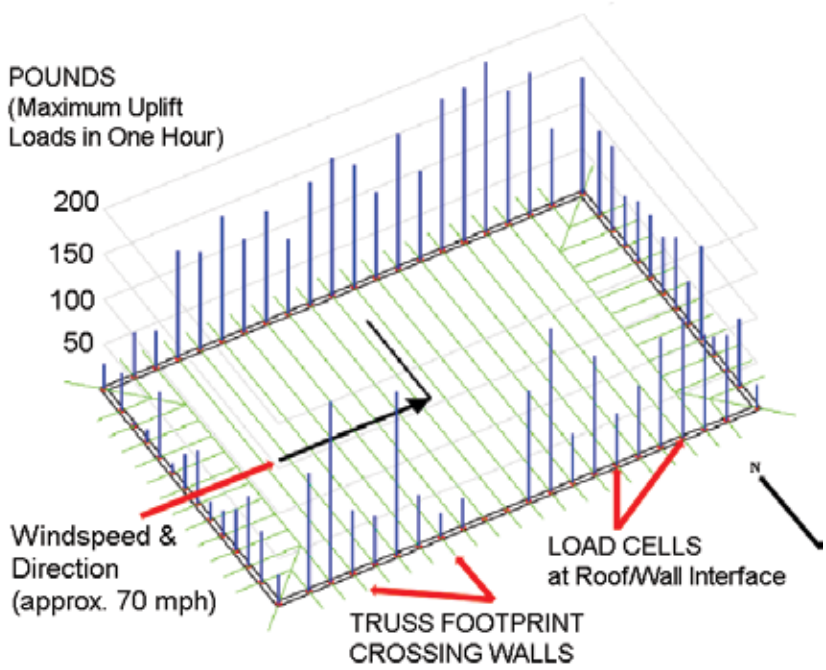

Data collected from the structure can provide graphic information on how the roof is affected by high winds. This graph shows the highest readings of uplift force recorded over 1 hour during Hurricane Ivan.

structure have been collected during many well-known hurricanes, including Hurricane Ivan in 2004 and Hurricanes Dennis and Katrina in 2005.

Expected Outcomes

Results of this ongoing study will help validate and fine-tune existing models. Accurate and reliable models will lead to general rules and considerations for safe design of wood structures. Roof designs that seem most at risk will be built and tested.

Timeline

Collection of data from the high-wind structure will continue indefinitely—each high-wind event produces new and useful data. Data will periodically be compared with current building codes and used to support suggested adjustments, as necessary. The structure is currently in use by the National Park Service and therefore serves a dual purpose.

Cooperators

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