Required Engineering

Isn't it enough to have stringent building codes, demand special materials, and judiciously inspect new homes?

No, according to some Florida officials. The two counties with the nation's strongest hurricane protections say they need yet another tool to ensure that single-family homes have all the right storm safeguards: a structural engineering review.

In response to a study that found sometimes serious structural deficiencies in the blueprints for new homes, Florida's Broward County late last year hired a structural engineer to spot-check plans. Broward joins neighboring Miami-Dade, where a staff of structural engineers has double-checked all home plans for flaws since 1994, two years after Hurricane Andrew convinced policymakers of the need for the review.

"I personally think that of all the reviews we do, the most important is the structural review," explains Charles Danger, director of Miami-Dade County's building department.

Structural engineers typically concentrate on motels, skyscrapers, and other large buildings, with designers of single-family homes rarely invoking their expertise. But Miami-Dade's and Broward's review policies are challenging that tradition.

One result has been the renewal of an old debate between architects and engineers about their respective roles — with each profession complaining of the other's poaching on its territory. Adding fuel to the debate is the 2002 Florida Building Code, which requires an architect or engineer to sign and seal new home plans but doesn't specify one profession over the other.

"My strongest comment about this is that if the engineers are going to be doing all the structural work for essentially any project, then they need to lay off the design of any habitable space, because it is not correct on their part to be designing houses," notes Kaizer Talib, principal architect for Urbanform Design Group Inc. and past president of the Fort Lauderdale chapter of the American Institute of Architects.

FEMA PHOTO/DAVE SAVILLE

In plan reviews by structural engineers, which are so far required only in Miami-Dade and Broward Counties in Florida, wind design has been the most prevalent problem. Officials argue that regular reviews in all hurricane zones might have prevented this type of wind damage, which was typical of damage found across Pensacola Beach after Hurricane Ivan in 2004.

COMPLICATED CALCULATIONS

The only counties in Florida's so-called High Velocity Hurricane Wind Zone, Broward and Miami-Dade are widely acknowledged to have the nation's toughest hurricane building codes. For example, new homes in the counties must resist gusts of 140 and 146 miles per hour, respectively, with doors and windows remaining intact.

Broward and Miami-Dade building officials say the result is that architects or engineers must complete more complicated calculations — accentuated by today's penchant for bigger, more architecturally intricate homes.

The evidence is that many don't get the numbers right, officials say.

Three years ago, a *Miami Herald* investigation of 10 homes in a Miramar subdivision found that all had structural flaws, including wall-to-roof connections not designed to withstand top wind gusts. In early 2003, the Broward County Board of Rules and Appeals launched its own study of 25 home plans. The review found problems in all of the homes,

FEMA PHOTO/MARK WOLFE

One architecturally designed home that did receive an engineering review prior to construction survived the storm surge from Hurricane Ivan. With the exception of a staircase designed to break away, this Pensacola Beach home remained intact.

including "at least one or two of the roofs in the sample that would come off," says Jim DiPietro, board staff director.

As a result, the board decided last year to hire a structural engineer to spot-check plans countywide and consult on those that raised red flags with reviewers. The county also required designers to submit calculations up front showing that their plans satisfied the wind requirements, explains Bill Dumbaugh, Broward's chief structural code compliance officer.

Structural engineer Mark Scala's first report was due in mid-April. But according to Dumbaugh, his initial findings were mixed. "He found plans that are just so excellent you wouldn't believe it," Dumbaugh notes, "and some that are on the other end of the scale."

In Miami-Dade, Charles Danger says plans with incomplete or botched structural engineering provisions are the norm rather than the exception. The county's 10 licensed structural engineers reject from 50% to 55% of submitted plans on first review, which exceeds the overall rejection of 46%, he explains.

"The wind design is the main problem," says Flavio Gomez, county building division director. "Determination of the wind loads, the design of the members for the wind loads, and the connections for the members — those are the main things we reject."

TOUGHER POLICIES TO COME?

Miami-Dade and Broward Counties have a history as early adopters of hurricane protection measures that wind up becoming commonplace elsewhere. Structural engineering reviews, meanwhile, are not unheard of outside Florida. In California, for example, some municipalities use engineers to ensure that homes are protected against earthquakes. Los Angeles County has a staff of 35 plan-check engineers. Their most-oft-cited problems

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Currents

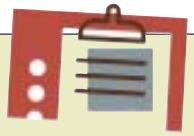
2005 HURRICANE FORECAST

Following one of the most destructive hurricane seasons in recorded history, Dr. William Gray — the nation's most acclaimed hurricane forecaster — predicts the upcoming hurricane season will be busier than usual in the Atlantic Basin. Dr. Gray's report (available online at http://hurricane.atmos.colostate.edu/Forecasts/) indicates that 2005 will see 13 named storms, seven of which would turn into hurricanes. Three of these hurricanes are likely to include winds exceeding 111 mph.

PROBABILITIES FOR AT LEAST ONE MAJOR (CATEGORY 3-4-5) HURRICANE LANDFALL ON EACH OF THE FOLLOWING COASTAL AREAS:

- Entire U.S. coastline: 73% (average for last century is 52%)
- U.S. East Coast including the Florida Peninsula: 53% (average for last century is 31%)
- Gulf Coast from the Florida Panhandle westward to Brownsville: 41% (average for last century is 30%)
- Expected above-average major hurricane landfall risk in the Caribbean

In another prediction issued by the Weather Research Center in Houston, Texas, the sections of the Atlantic coast with the highest probability of a landfalling tropical storm or hurricane in 2005 is the Texas coast and the west coast of Florida, which both have a 70% chance of experiencing a tropical system this year. The section of the coast from Georgia to North Carolina has the second highest risk with a 60% chance of experiencing a landfalling tropical storm or hurricane.



Currents

COASTAL POPULATION BOOMS

According to a report by the National Oceanic and Atmospheric Administration (NOAA) released this year, the narrow U.S. coastline makes up only 17% of the nation's land area yet is home to more than half of its population. In 2003, approximately 153 million people (53% of the nation's population) lived in the 673 U.S. coastal counties, an increase of 33 million people since 1980.

The updated population report (available online at http://oceanservice.noaa.gov/programs/mb/pdfs/coastal_pop_trends_complete.pdf) also noted that:

- In 2003, 23 of the 25 most densely populated U.S. counties were coastal.
- Almost one quarter of the nation's seasonal homes are found in the coastal areas of Florida.
- The most populated coastal counties are found in Texas and along Florida's central Gulf Coast.
- Between 2003 and 2008, coastal population in the Southeast is expected to grow by 1.1 million people — 8% of the 14 million people in 2003. This is the largest percentage of all U.S regions.
- The Gulf of Mexico's coastal population (just over 19.1 million in 2003) is expected to grow by just over 1.2 million people (7%) by 2008. This is the second-highest rate of growth for this period, just behind the Southeast.

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include inadequate steel reinforcement for foundation footings and improper shear transfer, notes spokesman Ken Pellman.

That said, the policies of Miami-Dade and Broward Counties won't necessarily spur other counties to hire their own structural engineers. Although Talib, the Fort Lauderdale architect, says he welcomes it, some architects and engineers oppose the structural reviews.

"The architects are more vociferous in telling us their displeasure," Danger notes. "They claim that structural engineering limits the artistic part of their design."

Building officials in other counties, meanwhile, aren't convinced structural reviews will toughen homes. Just north of Broward, Palm Beach County's chief building officer Roland Holt is the only licensed engineer on his staff. He says he's taught plan reviewers what to look for — and the problem isn't with his review process but with engineers and architects who repeatedly fail their due diligence.

"My greatest disappointment is how poorly the design professionals do in preventing the repetitive mistakes that my plan examiners tell them about," he explains. — *Aaron Hoover*

Hurricane Academy

Behind the scenes, university research quietly advances hurricane defense technology

The forecasters get most of the TV time. But behind the scenes, the work of another group of professionals could also prove key to coastal hurricane defense.

Supported by a deepening pool of public dollars, a loose coalition of research engineers and finance and construction experts are taking a second look at traditional notions about everything from how hurricanes take down homes to how to calculate dollar losses to affected communities. Their research could spur better building codes, more equitable insurance rates, and other changes — although politics, among other factors, could slow progress.

Academic research on hurricanes is not new. But what was once a small specialty focused on meteorology is morphing into a diverse field. Web of Science, a citation index that scans 8,700 science journals, in 2004 listed 200 articles with the keyword "hurricane," compared with 112 in 1994 and

FCMP

Dr. Tim Reinhold of the Institute for Business & Home Safety leads a team of university engineering students outfitting 32 Florida coastal homes with pressure sensors at corners and roof-wall connections. The initiative is one of many programs designed to evaluate the forces that low-altitude hurricane winds exert on homes.

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26 in 1984.

While meteorology still dominates, building science titles like "Hurricane damage prediction model for residential structures" pop up repeatedly in the latest list.

"I think Hurricane Andrew was a wakeup call in the U.S.," says Shahid Hamid, a Florida International University associate professor of finance. "More damage has been done through hurricanes than earthquakes over the last 50 years."

Hamid is one of the lead researchers on a nearly $3 million project, funded by the Florida Office of Insurance Regulation, to create a public computer model capable of predicting hurricane insurance losses. Insurers rely on such models, but they are largely secret. That leaves regulators at a disadvantage when mulling over arguments for hikes.

The open nature of academic research is just one of its values, proponents say. Another is scientific rigor.

In one ongoing project led by the University of Florida, research engineers are analyzing the performance of the 2002 Florida Building Code following the 2004 storms. Anecdotally, most agree post-code homes stood up better. But the engineers are using surveys, interviews with homeowners, and more than 100 visits to damaged homes to systematically determine whether that's correct.

"When you have industry running these things, it's biased," because the sponsor may have an agenda or because the study may not be based on scientific principles, says Forrest Masters, one of the engineers involved and director of the laboratory for wind engineering research at FIU's International Hurricane Research Center.

While previous research relied on lab work, new computer and communications technologies have shifted the emphasis to the field. Research engineers seeking to learn more about the forces that low-altitude hurricane winds exert on homes, for example, have outfitted 32 Florida coastal homes with pressure sensors at corners and roof-wall connections. Following the 2004 storms, they collected data from 16 of the homes. They'll use the data to check the accuracy of ASCE-7, the hurricane wind standard, which is currently based on tests involving miniaturized homes in wind tunnels in thunderstorm conditions.

"We can find out based on these comparisons whether the [code] is conservative, not conservative, or in line with where it should be," says Kurt Gurley, a University of Florida associate professor of civil engineering.

How much solid science will count toward actual code or other improvements is hard to know. Florida Building Commission officials started discussing possible changes to the state's code in December of last year, but the earliest effective date for a new code is July 2006, notes Rick Dixon, executive director. In the interim, the law provides for ample opportunities for input from insurers, manufactures, builders, and other groups.

"Usually it winds up coming down to a reasonable compromise," Gurley says. "That's the hope, anyway." — *A.H.*