Florida university unveils new 'Wall of Wind' hurricane simulator

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Nearly 20 years after Hurricane Andrew, a Category 5 wind once again shredded roofs in Miami-Dade County.

Fortunately, there were only two test roofs involved and the wind was confined to a big steel hangar that is part of Florida International University's International Hurricane Research Center, which on Tuesday unveiled the nation's most powerful hurricane simulator - an $8 million facility that stands as a legacy of Andrew.

Dubbed the "Wall of Wind" for its towering double-decked stack of a dozen electric fans, each 6 feet in diameter, the facility was created to test and improve building designs and materials that failed miserably under Andrew's ferocious assault - everything from nails to shingles to roof-top air-conditioning units.

"The bottom line is the research we are doing here will not only save lives but also reduce property losses and therefore premiums," said Shahid Hamid, director of the research center's laboratory for insurance, economic and financial research.

To display the simulator's power, an FIU crew built two mock-up structures, each about the size of a garden shed and painted the school's signature blue and gold. One used pre-Andrew construction codes. The other was put together with stronger standards enacted after Andrew that demand stronger nails, thicker plywood sheathing, heavier roofing felt, thicker shingles and other changes.

The results were a bit surprising as video cameras captured the spiraling damage while Walter Conklin, the Wall of Wind's project manager, cranked up the massive fans. The 8,400-horsepower system howled like a jet engine on takeoff as it wound to 160 mph, at peak flow pumping as much air as - by the calculations of FIU's College of Engineering - 7,650 leaf blowers.

As expected, the first things to go were roof shingles but pre-Andrew designs, rated for just 60 mph, held up nearly as well as heavier products rated for 130 mph. Half of the supposedly stronger shingles began peeling away as the digital wind gauge hit 109 mph, just Cat 2 strength. But as the wind increased, there was no comparison between old and new. At Cat 3, the older design lost half the tar paper intended to keep out rain. At Cat 4, a whole section of thinner plywood sheathing began buckling furiously, then flew off in a flash.

Arindam Chowdhury, director of the wind engineering research at FIU's hurricane center, said the test confirmed the strength of the new codes. Both roofs certainly looked torn up but the new one mainly lost shingles. Its heavier tar paper and thicker plywood remained in place, which would keep out the wind-driven water that accounts for most hurricane damage. But the test also raised questions about the accuracy of current shingle wind rating claims, which are based on small-scale tests.

"Clearly, a 130-mph rating is not really a 130-mph shingle," he said. "This is what the Wall of Wind is going to bring, really putting products to the test."

He said no amount of computer analysis can duplicate the full-scale, real world results of the simulator, which is capable of topping 157 mph, nearly matching Andrew's estimated peak winds of 170 mph.

The storm, which struck on Aug. 24, 1992, caused an estimated $26.5

billion in damage, but only a small portion of South Miami-Dade County felt its strongest gusts. The storm exposed shoddy building practices that contributed to the losses but also showed engineers, along with home buyers and builders, that there was a lot to learn about construction of homes and offices capable of standing up to major hurricanes.

FIU's hurricane research center, originally established after Andrew with private funding from the We Will Rebuild campaign in Miami-Dade, has expanded over the years with state, federal and private support from the insurance and roofing industries. In addition to construction and insurance, the center also studies social and environmental impacts of hurricanes.

The system FIU unveiled is the third version of its Wall of Wind, improving on a two-fan system first constructed in 2005 and a six-fan system follow-up in 2007. Those designs, powered by gasoline engines and airboat props, could produce 120 mph Category 3 winds and helped researchers test new construction techniques such as the "ring-shank" roofing nail that dramatically increases holding power.

The 12-fan system is far more powerful and sophisticated and the only university-based facility capable of generating Cat 5 wind speeds. An additional new feature, a large turntable that will allow researchers to rotate structures and more closely mimic the shifting winds of a hurricane, wasn't used Tuesday.

Though researchers are still calibrating the system, Chowdhury said FIU has already used it to test some promising new construction designs. One using reinforced fiber and epoxy, much like fiberglass boat-building, to anchor trusses and beams proved stronger than metal hurricane clips, he said. The university is hoping to patent the technique and find a company to develop it.

Testing with the earlier versions of the Wall of Wind also helped develop metal screens that can cut wind pressures on rooftop equipment like air conditioners by 58 percent, a change quickly incorporated into Florida's latest building code, he said - the first statewide upgrade generated by Wall of Wind research.

Chowdhury hopes the new, more powerful tool can help ensure that products billed as "hurricane-resistant" really perform that way under real-world conditions.

"What we are doing here is more like holistic testing," he said. "You're not just testing individual components; you're testing the entire system. That's very important."