

Increase in tornado, hurricane damage brings call for more stringent building standards

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Researchers from a team funded by the National Science Foundation have examined some of last spring's massive tornado damage and conclude in a new report that more intensive engineering design and more rigorous, localized construction and inspection standards are needed to reduce property damage and loss of life.

As one of the nation's most destructive tornado seasons in history begins to wane, and [hurricane season](#) approaches its peak, experts are working to determine if old, tried-and-true approaches to residential and small building construction are still adequate, or if it's time to revisit these issues.

"Modern building codes are not what we would call inadequate, but they are kind of a bare minimum," said Rakesh Gupta, a professor of wood engineering and mechanics at Oregon State University, and one of the members of the NSF team that traveled to such sites as [Tuscaloosa](#), Ala., and Joplin, Mo. – where a massive EF5 tornado in May killed more than 150 people and caused damage approaching \$3 billion.

"Beyond that, in the actual construction process, buildings are often not built precisely to codes, due to inadequate construction work or code enforcement," he said. "We can do better. The damage didn't have to be as bad as it was. We can design and build structures more rigorously that could withstand wind forces up to 140-150 miles per hour, which would help them better resist both tornadoes and hurricanes."

In their research, the scientists and engineers found that even in the most catastrophic tornadoes, the path exposed to the most extreme winds is very narrow. In the Joplin example, buildings less than one-half mile away probably faced winds in the 130 mph range, which often destroyed them because they lacked appropriate fasteners, tie-downs, connectors, or adequate number of sheathing nails.

"Another thing we need to consider more in our building practices is the local risks and situation," said Arijit Sinha, an OSU professor in the Department of Wood Science and Engineering.

"Just as cities like San Francisco adapt their building codes to consider earthquake risks, many other towns and cities across the nation could be creating local codes to reflect their specific risks from hurricanes, tornadoes, high winds or other concerns," Sinha said. "A national building code may be convenient, but it isn't always the best for every single town in the country."

Among the findings of the new report:

- It's not possible to economically design wood-frame structures that could resist damage from the highest winds in extreme tornado events, such as EF4 or EF5, but irreparable damage from lesser winds could and should be reduced.
- Tornadoes and hurricanes apply different types of forces to buildings, and what will adequately protect from one type of storm event isn't identical to the other. Implementing hurricane-region construction practices in a tornado-prone region is a good start, but not an end solution.
- Vertical uplift, one of the special risks from tornadoes, is often not planned for in traditional construction approaches.
- Interior closets and bathrooms can provide some protection at lower wind speeds, but more consideration should be given to

construction of "safe rooms" that can save lives in major events.

Cost will always be an issue in either new construction or retrofitting of existing structures to better resist these violent storms, the researchers said, but in new construction some of the costs are fairly modest. Thicker plywood sheathing, closer stud spacing such as 12 inches on center, tighter nailing schedules, and more consistent use of inexpensive metal connectors such as "hurricane ties" and anchor bolts could accomplish much to improve safety and reduce damage, Gupta said.

Retrofitting of existing homes is much more costly, but still something many homeowners should consider, he said. And although tornadoes and hurricanes have different types of impacts on buildings, the wind speeds of a moderate tornado and major hurricane are similar.

Even where cities and towns don't have more stringent building codes, Sinha said, individuals can and probably should have their blueprints or structures reviewed by licensed engineers to plan adequately for damage from hurricanes, tornadoes, earthquakes or other extreme forces.

For reasons that are not clear, 2011 has been one of the most destructive tornado years in history, even in regions of the Midwest and South that experience these storms with regularity.

One of the largest outbreaks of severe weather in U.S. history occurred on April 27, including a tornado that hit Tuscaloosa County in Alabama, destroying or severely damaging 4,700 homes. The new report was based on lessons learned from that event.

Provided by Oregon State University

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