First-Ever Building Code Requires Tornado-Resistant Garage Doors

Mayor Is "Fixated on Garage Doors"

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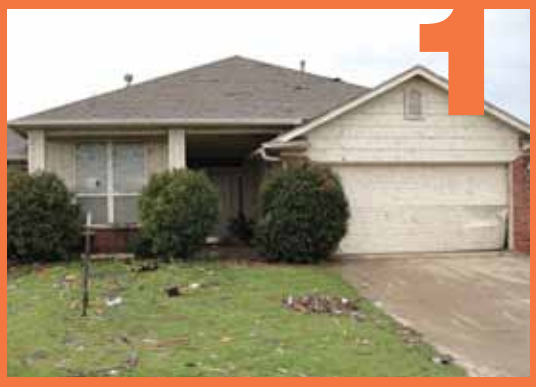
Editor, Door + Access Systems

The Progression of Collapse

In a special presentation to the Moore City Council on Feb. 18, Chris Ramseyer used the following images to display how the progressive deconstruction of a home starts with the garage door. *All photos and captions were provided by Chris Ramseyer.*



"Failure starts with the garage door."

"Then the garage door fails."

DEVASTATION: In the May 20, 2013, tornado, the hardest-hit areas of Moore were completely destroyed, and many homes were swept clean, down to the concrete slab. *Photo by Andrea Booher, courtesy of FEMA*

On March 17, 2014, the city of Moore, Okla., became the "first city in the nation to address tornado impact on homes," according to a city press release issued immediately after the city council approved a historic new building code.

A key focus in the new code is the requirement that "garage doors shall be rated to 135 mph wind or above," far above the 90-mph rating commonly required throughout the non-coastal United States.

From this city of 55,000 in metropolitan Oklahoma City, the news has spread across the country, and garage doors have been a primary topic of conversation.

"The mayor of Moore … is fixated on garage doors, knowing they are a key to protecting the city," reported Heide Brandes in an April 6 story distributed by Reuters, the world's largest international multimedia news agency.

In that story, Moore Mayor Glenn Lewis is quoted as saying, "Garage doors are the first to come off during a tornado. Once the garage door comes off, the roof comes off."

Says Who?

The unanimous approval of the code by the Moore City Council was based on research presented by civil engineers Chris Ramseyer and Lisa Holliday. After Moore's devastating EF5 tornado on May 20, 2013, the National Science Foundation Rapid Response team of 35 researchers from five universities, including Ramseyer and Holliday, quickly descended on Moore and closely evaluated residential structural damage. In March 2014 the team issued its 133-page report.

"A home is deconstructed by a tornado, starting with the breaching of the garage door," said Ramseyer.

As a professional engineer with a Ph.D., Chris Ramseyer is highly qualified to make such a statement. He was a key member of the NSF team, and he serves as associate professor at the University of Oklahoma and as director of the Fears Structural Engineering Laboratory at the university.

The Gateway to Deconstruction

Ramseyer also served on a special committee set up by the Moore City Council after the 2013 tornado to develop an enhanced residential building code for tornado resistance. He convincingly demonstrated how the garage door buckling led to the different stages of failure, from door failure to roof failure, then outer wall failure. With the garage and roof gone, the attic is open to wind and failure of the roof rafter system and lateral bracing.

Ramseyer is well aware that any home has little chance of survival against the 200+ mph winds of an EF5 tornado. Thus, his research focused on minimizing damage to homes on the periphery of the tornado's path, which might be only 70 feet away from the heaviest damage.

By building better homes, Ramseyer told the city council, the damage area can be narrowed, and more people can survive closer to a major tornado.

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"… which results in the roof falling next."

"… followed by a wall."

"… and the total removal of the garage. This now leaves the attic as an opening to create internal pressure and continue the process. In essence the building is deconstructed by the tornado."

This aerial photo of Moore, taken on May 21, 2013, shows that lesser winds cover a larger area than the hardest-hit area. The NSF report says, "EF0 to EF2 winds cover approximately 85 percent of a damage area that is produced by strong EF4 and EF5 tornadoes." *Credit: Photo by Jocelyn Augustino, courtesy of FEMA*

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The new building code for Moore includes 12 specific code changes, and a stronger garage door is one of them.

"The garage door was an issue from day one," said Stan Drake, Moore's assistant city manager, who served on the new building code committee. His background includes 40 years of working for the city, with experience in the building department.

A Door Dealer on the City Council

Another key player in Moore's new building code was Terry Cavnar, owner of Moore Overhead Door and a member of the Moore City Council. As city councilman, Cavnar fully supported Ramseyer's statements about the garage door.

"Chris Ramseyer was able to confirm what we thought we knew about the garage door being a critical part of the integrity of the home," Cavnar told us.

Back in 1999, Moore was ravaged by another EF5 tornado. "We could tell then if the garage door failed, the home was badly damaged," he said.

Cavnar is not only a door dealer, but he has also been a State Farm insurance agent for 31 years. In that role he has examined many homes damaged by tornadoes over the years.

"Consistently," he said, "if the garage door was blown in, the home was badly damaged."

All new homes must be built to withstand winds up to 135 mph.

Why Moore? Why Now?

In the last 15 years, Moore has been hit three times by devastating tornadoes: in 1999, 2003, and 2013. All occurred in the month of May.

The 2013 monster tornado is reported to have killed 24 people, injured hundreds, and caused more than $2 billion in damage to some 2,400 buildings. The deadly 1999 tornado killed more than 35 people and destroyed thousands of homes, leaving $1 billion in damage.

"So, for us to do nothing and say it isn't going to happen again was unacceptable," Cavnar told us.

The Price of Protection

Besides wind-resistant garage doors, Moore's new residential building code requires enhanced roof sheathing, hurricane clips or framing anchors, and continuous plywood bracing. All new homes must be built to withstand winds up to 135 mph. The code applies only to residential buildings and to new construction.

A key factor that sped acceptance of the new building code was Ramseyer's estimate that the cost to build a code-compliant home was only about one dollar per square foot more than usual.

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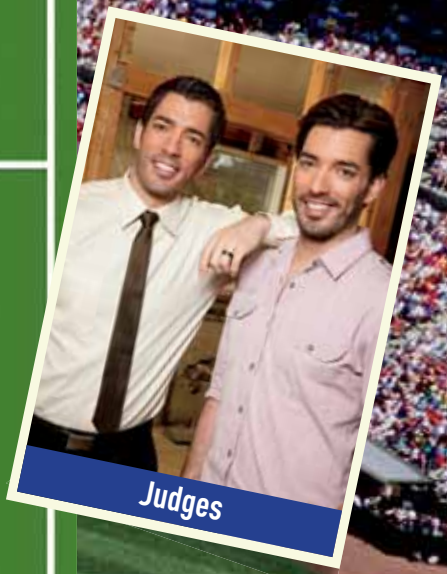

Judges

GRAND PRIZE

tickets	game	cash
2	4	$1,500

Two tickets to see a championship baseball game in October (yes, that one – we just can't say the name), plus two nights' hotel accommodations and a $1500 travel voucher.

2nd PLACE

Two runners-up each receive a $1000 gift card.

winners	gift cards	cash
2	2	$1,000

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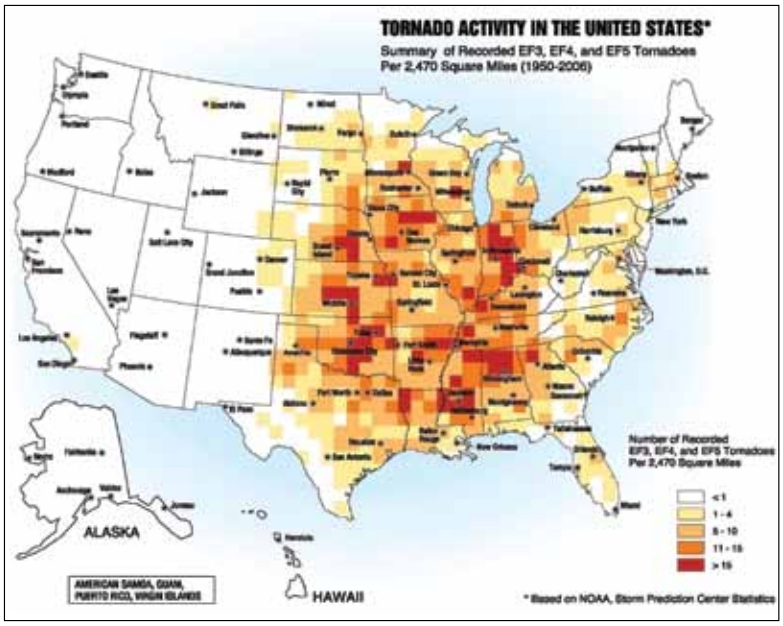
"The proposal was … easy to buy into, especially when we found out the overall additional cost was minimal," said Terry Cavnar.

Ramseyer's original cost analysis put the upcharge on a 135-mph garage door as $600. That cost was exceeded only by the $1,200 estimate for changing to 16" on-center rafters.

Cavnar believes that $600 is probably too high for the garage door project. "We are projecting the increase on a 16' x 7' door to be about $400, including additional labor." The exact upcharge amount depends on the door size, style, and other factors.



Widely Available

The events in Moore have been closely followed by several garage door manufacturers, including Mid-America Door, a regional manufacturer in Ponca City, Okla., only 100 miles north of Moore. Like most major manufacturers, "Mid-America Door is ready and currently supplying wind-load-rated product in Moore," said Brandon Rutz, vice president of manufacturing at Mid-America.

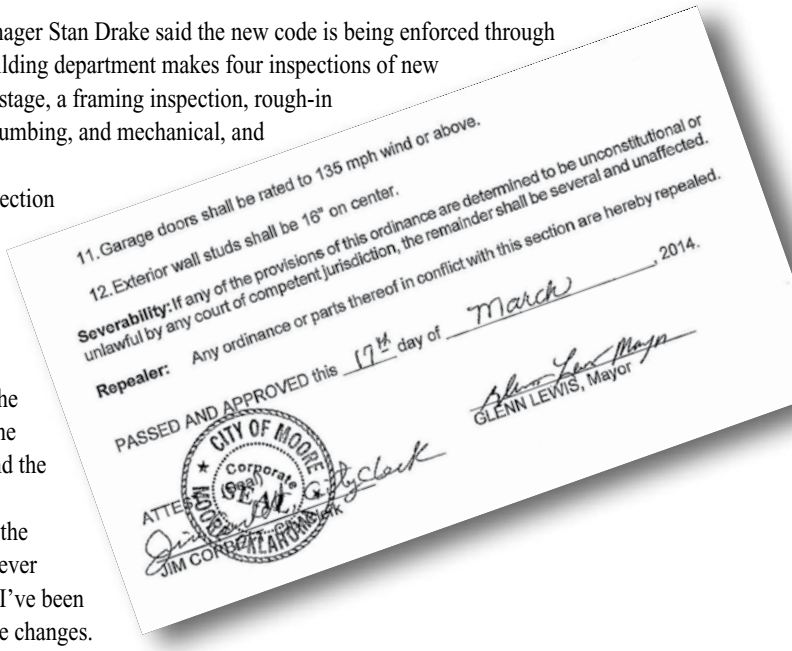
Rutz generally described the newly required doors as horizontally reinforced doors mounted to a 2x6 jamb, similar to the garage doors that are typically required in Florida. Mid-America is the primary door supplier for Moore Overhead Door.

"We are now able to offer a full line of wind-loaded doors, from standard raised-panel doors all the way to decorative carriage-style doors," said Pam Roat, manager at Moore Overhead Door.

Another key dealer in the Moore area is Calvin Bauer of Overhead Door of Oklahoma City. He said he is also prepared with wind-loaded doors that meet the new code. Janet Thompson, Overhead Door's product manager for wind-load products, added that Overhead Door has a wide array of doors that qualify.

Enforcing the Code

Moore Assistant City Manager Stan Drake said the new code is being enforced through inspections. The city's building department makes four inspections of new homes: one at the footing stage, a framing inspection, rough-in inspection of electrical, plumbing, and mechanical, and one final inspection.


11. Garage doors shall be rated to 135 mph wind or above.
12. Exterior wall studs shall be 16" on center.
Severability: If any of the provisions of this ordinance are determined to be unconstitutional or unlawful by any court of competent jurisdiction, the remainder shall be several and unaffected.
Repealer: Any ordinance or parts thereof in conflict with this section are hereby repealed.
PASSED AND APPROVED this 17th day of March, 2014.
GLENN LEWIS, Mayor
CITY OF MOORE
Corporate Seal
ATTEST:
CITY CLERK
OKLAHOMA

"The garage door inspection is a new inspection," he said. "The homebuilder will determine when that inspection takes place. But the door will be inspected before they do the Sheetrock so we can see the structural members (around the door frame)."

"This has been one of the easiest code changes I've ever seen," added Drake, "and I've been involved in numerous code changes. There was some phone call opposition from a couple of older homebuilders, but they never made a stand."

Joe Hetzel Comes to Town

The largest potential battle came on April 11, when Joe Hetzel, DASMA technical director, came to town only six days before the new code took effect. He was invited to speak in the city council

chambers at a special meeting to discuss garage doors and the new code.

"Our chambers seat about 60-75, but we had standing room only," said Drake. "I was shocked at the number of people who were there. It was a packed house."

Many homebuilders attended, along with door dealers, three representatives from garage door manufacturers, city administration officials, and Chris Ramseyer, widely recognized as the brains behind the new code.

"I was concerned (about Hetzel's presentation)," said Ramseyer, "because rumors about the meeting seemed to suggest that (DASMA) may not support the idea of wind-rated doors."

"But Joe hit the right note with the builders when he mentioned up front that your industry was ready for this and had prepared, knowing that it would happen," said Ramseyer. "Joe knows his stuff."

"That man was very knowledgeable," added Drake. "I learned a lot."

Hetzel spoke for a full hour. "The main message we gave," said Hetzel, "is that the garage door industry has been prepared for increases in wind-load requirements across the country and that we have products that will meet the requirements."

"I believe we instilled a sense of confidence in our industry's products," he added.

More Than Moore?

The looming question for the garage door industry is, "Will this new code spread to other cities or states?"

As the Reuters story stated, "The (Moore) council hopes the standards will serve as a model for other cities, particularly those vulnerable to tornadoes."

"We can learn from this devastating event to build stronger homes and neighborhoods across the United States—and it starts in Moore," said Mayor Glenn Lewis.

Ramseyer sees that interest is indeed building elsewhere. By mid-May he had given about 20 talks on the subject to audiences in Oklahoma City, Norman, Purcell, and elsewhere. He reported that Habitat for Humanity is adopting the new code system-wide in central Oklahoma, even when outside Moore.

Regardless of whether other cities adopt the new code, the city of Moore seems to be proud of their aggressive action to protect people and property.

"These code changes will save lives," said Terry Cavnar, "and they will limit the amount of damage caused by tornadoes."

"This is certainly a new chapter in the life of Moore Overhead Door," added Pam Roat. "We look forward to working with our homebuilders to build a safer product and a safer community in the beautiful city of Moore, which we are proud to call home." ■

Expert Conclusions About Garage Doors

The following statements come from the March 2014 report, titled "Tornado Damage Assessment in the Aftermath of the May 20th 2013 Moore Oklahoma Tornado." Funded by the National Science Foundation, 13 doctorate-level researchers authored the 133-page report.

- "Residential structures in lower wind-speed areas were examined and found to fail at garage door openings and at connections." (p. 2)
- "Though slight in terms of property damage, the consequences of losing the garage door were frequently severe." (p. 51)
- "Loss of the garage door ruptures the building envelope and allows the inside of the garage to be pressurized by tornado winds." (p. 51)
- "Garages that protruded from the main footprint of the house seemed to be especially vulnerable." (p. 51)
- "Residential structure damage patterns were examined and it was found that damage often initiated at garage doors …" (p. 127)