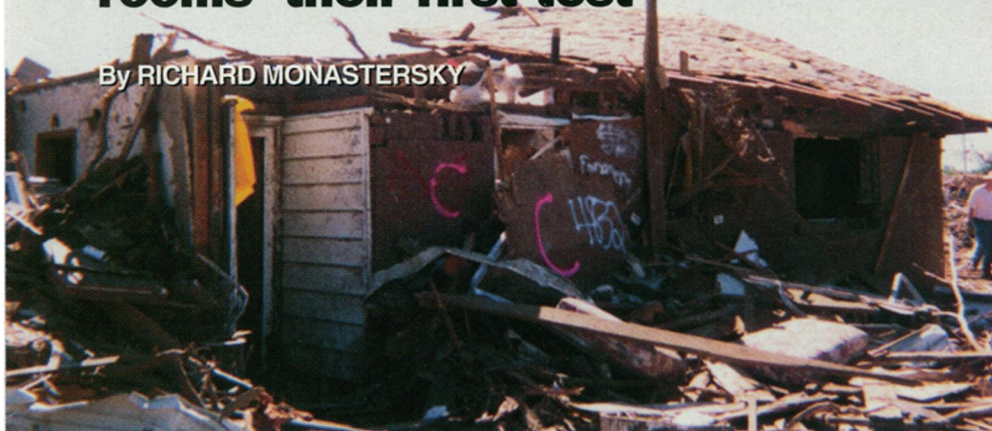


A Shelter in the Storm

Oklahoma tornadoes give 'strong rooms' their first test

By RICHARD MONASTERSKY



Ruins of Bartlett's house surround her shelter.

Texas Tech Wind Engineering Research Center

The whole concept is gaining widespread recognition," says Ernst W. Kiesling, professor of civil engineering at Texas Tech. "We're seeing a number of manufacturers getting into the shelter business. We'll see a plethora of choices out there pretty soon."

The shelters in the FEMA booklet use either concrete blocks and reinforcing steel bar or plywood and steel sheeting. Texas Tech engineers have checked the safety of these rooms by bombarding them with 15-pound sections of 2-by-4-inch timber, fired out of a cannon at 100 mph. This simulates the force of debris carried by a 250-mph wind.

"We knew all along from our research that they would hold up. But until you actually get one tested in nature's laboratory, there are always some skeptics out there," says Larry J. Tanner, a Texas Tech engineer who assessed the damage in Oklahoma. "Some people just say you're only going to be safe under the ground, and we've been saying for nearly 30 years that's just not the case."

Underground shelters would provide the most protection during tornadoes, says Oliver, but because most houses in tornado alley lack basements, these havens are often located outside. A family hearing the roar of an approaching tornado would have to run through flying debris to reach such a shelter. "We think you ought to be able to get to your shelter without going outside," he says.

The housing industry has mixed feelings about aboveground shelters, says Jay Crandell, an engineer at the National Association of Home Builders Research Center in Upper Marlboro, Md. Crandell, who contributed to the FEMA document, has concerns that reinforced rooms will drive up the cost of housing. Some jurisdictions, for instance, have considered making such shelters mandatory.

Increased house prices could actually have a negative effect by forcing people to buy older homes, which are less safe overall, Crandell says.

Strong tornadoes are so rare that an average homeowner even in Oklahoma would have to wait several hundred thousand years for an F-4 or F-5 tornado to strike his house. "We're talking about a small risk compared with other types of risks that we are exposed to. As a matter of fact, there are more people killed by lightning every year than by tornadoes."

If he lived in a tornado-prone region, Crandell says, he would probably not put in a shelter. "If I had limited dollars, I would probably opt to buy a new car that had better safety features."

Oliver agrees that a person stands a greater chance of dying in a car crash than in a twister, but he says that fact doesn't deflate the fears of people in tornado-prone areas. "This isn't a cost-benefit issue. This is about people who find it difficult to sleep in their own homes without a shelter." □

When Beth Bartlett renovated her home in Del City, Okla., last year, she asked the contractor to build a walk-in closet in her bedroom. Unlike a typical wardrobe, though, Bartlett's could withstand a bomb blast. The contractor fashioned a room with 12-inch concrete walls, a steel door, and a concrete roof.

That room may well have saved the lives of Bartlett, her mother, and their pets on May 3 when a killer tornado ripped through their neighborhood south of Oklahoma City. "The pressure was incredible. It felt like my head was going to pop. We basically just sat there listening to our whole house get torn apart," says Bartlett.

The storm stripped much of the roof off her house and flattened some walls, yet the closet weathered the storm without damage, say investigators who have examined the structure.

Storm shelters in tornado-prone areas are traditionally located below ground, either away from the main house or inside a basement. In the past 25 years, though, a few builders have begun to construct hardened rooms above ground in bedrooms or bathrooms. While engineers have tested such designs in laboratories, no aboveground shelter had ever passed a trial by tornado until this month, says Clifford Oliver of the Federal Emergency Management Agency (FEMA), who surveyed the tornado damage last week.

"As far as we know, it's the closest that a shelter has been to being near an F-5," says Oliver, referring to the strongest type of tornado. "It's as good as we've ever gotten, and it may be the best we get for many years."

The rarest of tornadoes, F-5 storms have wind speeds in excess of 260 miles per hour and can send a car flying the length of a football field or more. One of these tornadoes ravaged Bartlett's neighborhood, splintering houses and killing two neigh-

bors. The twister came within 50 to 100 feet of Bartlett's house, says Oliver.

Chuck Doswell of the National Severe Storms Laboratory in Norman, Okla., estimates that winds in the upper-F-2 or F-3 range, roughly 150 to 160 mph, hit Bartlett's house.

The FEMA crew also surveyed another site near Oklahoma City where a specially designed shelter inside a house withstood winds of more than 100 mph. The owner of this new home had the builder add the hardened room for \$5,000 during construction of the house, which has concrete outer walls and includes other safety features such as extra-strong roof ties.

When Oliver asked the homeowner why he took such unusual precautions, "he just looked at me kind of strange and said, 'Because we're in tornado alley,'" Oliver reports. "In other words, he perceived his risk differently than everyone else."

FEMA officials want others also to consider the tornado hazard. "We want people to understand the risks and make a decision on their own whether they want a shelter or not," he says.

The tornadoes earlier this month have given these shelters their best advertising yet. In a postdisaster speech in Del City, President Bill Clinton urged people rebuilding from the disaster to put in shelters. "We know that lives can be saved under almost all conditions if there is at least one room properly encased and protected with concrete in a house," he said.

In October 1998, FEMA issued a booklet giving detailed construction plans for these shelters, which cost from \$2,000 to \$5,000, depending on the construction method and the house. The booklet presents designs developed at Texas Tech University in Lubbock, where engineers have been testing such structures since 1975.