



FOR IMMEDIATE RELEASE:

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Steel Roofs are Safest in Earthquakes

Structural and civil engineers in Southern California say home builders and homeowners should increase their use of lighter weight roofing products.

“When you put a heavy mass on your home, like a concrete roof versus lightweight steel or cedar shake, it causes problems when the ground shakes,” said **James A. Bihr**, a structural engineer and co-author of a study on the effects of the 6.8 Northridge earthquake on residential roofs.

In the study, conducted immediately after the quake by The McMullen Company, lightweight materials “tended to withstand shaking and appeared to not contribute to other structural damage.” Yet hundreds of heavy tile roofs were damaged “where no other significant structural damage was obvious.”

The study authors found many cases in which identical structures had different roofing products and, thus, differing levels of damage. They surveyed 122 structures, mostly homes, of which 93 were roofed with concrete or clay tiles, 17 with stone-coated steel, 8 with wood shake/shingles and 4 with asphalt shingles.

“The photos accompanying this report indicate that buildings which appear to be identical performed in a significantly different manner based on the type of roof covering,” Bihr wrote. “Light weight roofs such as stone-coated steel or wood shakes and shingles appeared to perform far better than concrete tiles.”

He concluded, “California has a large inventory of (homes) with heavy concrete roofing tiles. If the foregoing observations are true, their re-inspection and retrofitting, if needed, may be a prudent course of action to avoid repetition of the damage and losses incurred in the San Fernando Valley.”

Sydney Chai, a State Board certified and licensed civil engineer who specializes in structural seismic retrofit design, said homeowners need to consider the material dead load, which is the permanent weight of the roofing material.

“The walls in most homes have enough surplus capacity to carry the additional roof load (of heavy roofs), but the surplus is only for gravity loads, not seismic (earthquake) loads,” Chai said. “Think of it this way: Place your elbow on a table and hold a baseball in your hand. If you swing your arm around, it is easy to stop the baseball from moving. Now

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replace the baseball with a bowling ball. Huge difference! That may be the difference between your house surviving an earthquake or collapsing.”

The National Information Service for Earthquake Engineering at UC Berkeley published in 1997 a paper by Professor **V.V. Bertero** of the Department of Civil Engineering and Earthquake Engineering Research Center. The paper was designed to teach students of structural and architectural engineering problems and solutions for building earthquake-resistant structures.

The paper's first basic guideline of seismic-resistant design is that a structure “should be light (weight) and avoid unnecessary masses.”

Bertero studied structures affected by major earthquakes in Alaska, Argentina, Algeria, California (San Fernando, 1971), Guatemala, Japan, Nicaragua and Venezuela. After the San Fernando earthquake, he noted particular damage to wooden houses and the Olive View Hospital from their heavy tile roofs falling into the structures.

“All of these old buildings suffered significant damage and were subsequently demolished,” Bertero wrote. “The lessons from such damage are *clearly to avoid the use of unnecessarily heavy roofs* and unreinforced masonry.”

Stone-Coated Steel roof products are among the lightest roofs available. Their installed weight is about 2 pounds per square foot compared with 9-12 pounds per square foot for clay and concrete tile roofs, according to the Metal Roof Alliance. Composition, or asphalt, shingle roofs weigh about twice as much when installed.

“Homeowners can make themselves safer in the event of an earthquake by having a lighter and better-constructed roof,” said **Tom Black**, executive director of the Metal Roof Alliance. “Stone-Coated Steel roofs not only are safe, they are durable and enhance the looks and value of a home.”

Building codes require roofing products to pass 80 mph wind tests. Many roofing products fail the test, yet they are allowed to be installed under a “grandfather” clause.

Repeated Results

What Engineers and Homeowners Say

James Bihl, structural engineer and former ICBO member: “Buildings which appear to be identical performed in a significantly different manner based on the type of roof covering (in the 1994 Northridge earthquake). Light weight roofs such as stone-coated steel or wood shakes and shingles appeared to perform far better than concrete tiles.”

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Sydney Chai, civil engineer: “The walls in most homes have enough surplus capacity to carry the additional roof load (of heavy roofs), but the surplus is only for gravity loads, not seismic (earthquake) loads. Think of it this way: Place your elbow on a table and hold a baseball in your hand. If you swing your arm around, it is easy to stop the baseball from moving. Now replace the baseball with a bowling ball. Huge difference! That may be the difference between your house surviving an earthquake or collapsing.”

V. V. Bertero, professor of civil engineering, UC Berkeley: “The lessons from such damage are clearly to avoid the use of unnecessarily heavy roofs and unreinforced masonry.”

Northridge homeowner: “We had a perfectly good 4-year-old concrete tile roof that suffered damage during the earthquake. We selected the Stone-Coated Steel shake because it would reduce the load on our roof by 46,000 pounds and make it much safer for us inside the house.”

Chatsworth homeowner: “After hearing and seeing what even a ‘lite’ concrete roof can do to a home in an earthquake, I never considered concrete again as a choice in roofing.”

Who Re-roofs with Stone-Coated Steel?

Engineers

Sydney Chai, Structural Engineer

James E. Bihl, Structural Engineer and co-author of 1994 Northridge Earthquake roof performance study

Natu Patel, Structural Engineer

Meredith Osterfeld, former Regional Director of the CA Alliance for Mathematics and Science

Dennis Bashaw, Civil Engineer

Eric Gobbler, Civil Engineer

Firefighters

Mike Ryan, Concord, CA

Robert A. Pingle, Newport Beach, CA

Kim Raddatz, El Cajon, CA

Santa Monica/Claremont guy

Gary Parks, San Jose, CA

Larry Hutchinson, Julian, CA

Lennie Orr, Castro Valley, CA

Don McClanahan, Richmond, CA

Ted Dang, Oakland, CA

Builders and Contractors

The Turners of Turner Construction Co.

Al Hayes, CA Dept. of Consumer Affairs, Contractors State License Board

Bob Storchheim, ICBO Evaluation Committee and former City of Irvine Building Official

Glen Kossin, former Vice President of Sears Home Improvement

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Apple Computer headquarters
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Fire Station, American River Fire Protection District
Fire Station, City of Brea
Fire Station, City of Irvine
Santa Ana Library-McFadden Branch
Spring Valley Lake Country Club-Victor Valley
Atascadero Lake Park Pavilion
Palmdale Air Force Administration Building
El Toro Marine Corps Air Station Base Housing (closed)
Twenty-nine Palms Air Force Base Housing
Fort Irwin Air Force Base Housing

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