

# Arizona Civil View

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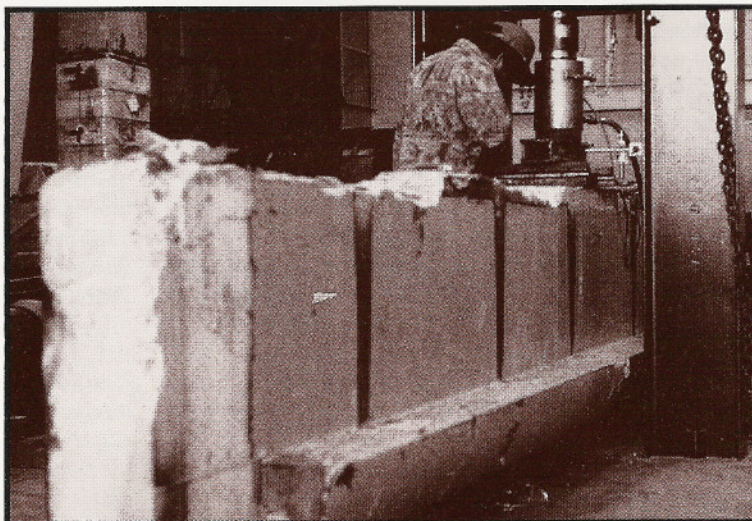
**M**asonry walls are the first to fall during earthquakes because they can't take the cyclical loading.

But when wrapped with composite materials similar to fiberglass, masonry walls have enough muscle to withstand some heavy-duty shaking.

Two UA civil engineering researchers already have proven this. Now, in a collaborative project with colleagues at the University of Michigan, they're refining the technique by building a device to simulate quakes.

They want to use this equipment to find the best way to retrofit masonry at the least cost.

Hamid Saadatmanesh and Mohammad R. Ehsani say the retrofitting works this way: The wall is sandblasted and a thin layer of epoxy is applied. A layer of composite fabric mesh follows, and then a little more epoxy is applied over that. This is done on both sides of the wall, creating a "plastic sandwich" filled with bricks and mortar.



*Concrete beams are tested before and after retrofitting with composite laminates.*

## MASONRY GETS SOME MUSCLE

*Composite materials help walls stand up to quakes*

They are building models of various sized masonry sandwiches and testing them in a device that looks like a couple of giant air mattresses. One mattress goes on each side of the wall; as one is filled with air, the other deflates. Every point on the wall is subjected to the same load as the mattresses cycle back and forth, creating an analog of earthquake forces.

Ehsani and Saadatmanesh want to de-

termine the minimal percentage of wall surface that needs to be covered by composites to achieve the desired strength. They plan to test different patterns and widths of fiber mesh.

In a related project (photo at left), they are testing concrete beams from a chemical plant that have been weakened by corrosion caused by plant processes. Plant officials want to find out the extent of the deterioration and whether to retrofit existing beams with composites. When beams are replaced, there may be advantages in using fiberglass rebar in new construction.

Composites have many advantages for retrofitting. They are light, corrosion resistant, and extremely strong in tension. When walls are retrofitted with lightweight composites, foundations don't have to be strengthened. And composites are ideal when a crane can't lift heavy steel plate into a tight spot.

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# Wanted: old masonry walls

*They just don't make them like they used to*

Are you renovating a building that has masonry walls? If so, CEEM faculty members Hamid Saadatmanesh and Mohammad R. Ehsani would like to hear from you.

"A lot of the bricks and mortars used in the old days are different from those used today," says Ehsani. "We could gain a lot of information by studying walls that are earmarked for demolition."

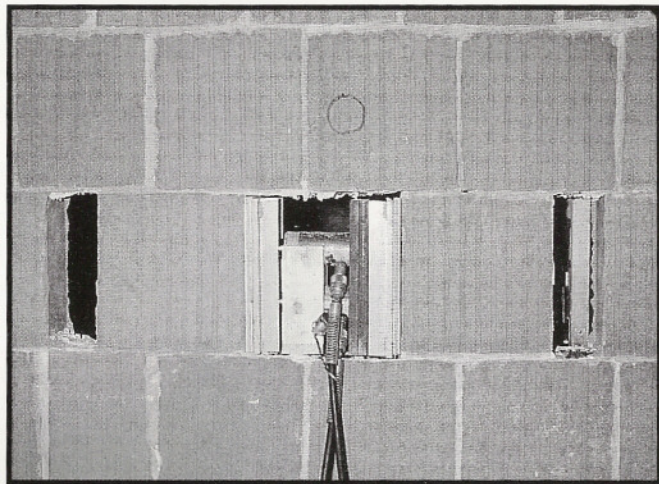
Ehsani and Saadatmanesh are developing ways to retrofit old walls with composites to strengthen them against earthquakes. But they need to know more about the proper-

ties of the materials used to make these older walls.

Recently, they found a wall in the basement of San Francisco's city hall that was made of hollow clay tiles. Since the building was undergoing seismic retrofitting, they were able to set up equipment and collect data on the tiles.

"These tiles are fairly common in older buildings, but nobody makes them anymore," Ehsani says. "So we never had specimens to test in the laboratory."

Such tiles constitute a major hazard in earthquake areas because they are brittle and



*This hollow clay tile wall was tested in San Francisco's city hall.*

crumble quickly, causing property damage and loss of life. "So we are looking for some masonry walls or hollow clay walls where we can

collect data and develop profiles of these older building materials," he says.

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