By **Greg Clark**
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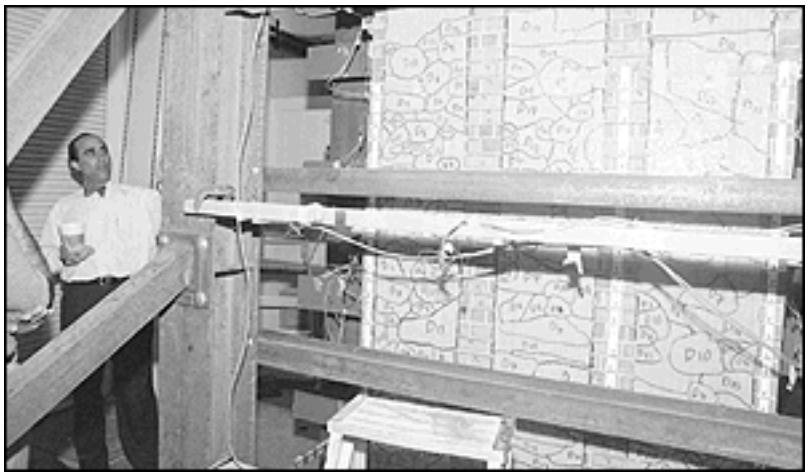
Two university researchers keep masonry walls from tumbling down



Adam F. Jarrold
Arizona Daily Wildcat

Mohammad Ehsani, professor of civil engineering and engineering mechanics, describes the purpose of a new fiber composite material he helped develop. The composite was designed to help prevent earthquake damage in older, masonry buildings.

Two UA researchers have developed a technique for reinforcing masonry buildings using the same composite glass and carbon fibers used to build advanced aircraft.

University of Arizona civil engineering professor Mohammad Ehsani and his colleague Hamid Saadatmanesh received a patent in June for their technique, which will allow buildings to be retrofitted to withstand earthquakes at a fraction of the cost of current reinforcement methods.

Ehsani estimates 90 percent of masonry buildings worldwide are made of brick without steel reinforcement. These buildings are very brittle and collapse in earthquakes, causing loss of life and property, he said.

"Most masonry and reinforced concrete buildings built in the United States prior to 1970 are not adequately reinforced" and could benefit from this process, Ehsani said.

In the process, which is similar to wall-papering a wall, a fabric woven out of fine fibers of composite material is saturated with a special epoxy adhesive and applied to walls, he said.

When the epoxy dries, the resulting layer of material is about one-eighth of an inch thick, but as strong as 6 inches of reinforced concrete, according to Ehsani and Saadatmanesh.

In building, the strength of walls is measured by the amount of deflection, or bending under pressure, the walls can withstand without breaking.

Exerting pressure on one side of a wall causes the wall to bulge, or "deflect."

"Under current building codes for seismic zones, a typical wall of this height would be acceptable if it could take deflection of a quarter of an inch," Ehsani said.

"Most un-reinforced masonry walls would not even take a fraction of that. Civil engineers would be amazed if they saw (an un-reinforced masonry) wall take a deflection of a quarter inch," he said.

"But in tests of masonry walls reinforced with this fiber, walls can withstand deflections of more than two and one-half inches," Ehsani said.

The newly patented technique is already being used to retrofit buildings in California, according to Saadatmanesh and Ehsani.

"Usually in civil engineering, everybody waits until a technique is well-established and specifications and requirements are written into codes before people begin using it," Saadatmanesh said. "But because this application is so economical and easy, builders are already using it."

Reinforcing masonry buildings with this new technique costs less than $10 per square foot, Saadatmanesh said, compared to about $20 per square foot for retrofitting with reinforced concrete.

The method currently used to retrofit old buildings is to erect six-inch-thick reinforced concrete walls against the interior side of old masonry walls.

This is time consuming, and can become especially expensive in industrial situations, requiring plant shut-downs and major overhauls of building infrastructure, he said.

Applying composite fibers with epoxy resin can be done with a minimum of one inch of clearance against a wall, Saadatmanesh said.

"This material can be cut with scissors, so if you have a pipe coming through a wall, you can simply cut around it and go," he said. "The beauty of this application is not only the strength, but also the versatility."

Apart from applications to reinforce masonry buildings, the material can also be used to reinforce bridges, Ehsani said. Currently, more than half of the Departments of Transportation in the United States are looking into using this process to retrofit existing highway bridges and overpasses, he said.

Ehsani and Saadatmanesh have been doing research into structural reinforcement for roughly 10 years.

Recent funding has come from several grants from the National Science Foundation, including more than $100,000 for research into using composite material to retrofit masonry walls and a $200,000 grant for studies into applying this technology in strengthening bridge columns, Ehsani said.

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