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After the quake

Fabric mesh composites and epoxy give new life to damaged structures

It's now possible to repair buildings after an earthquake faster, with less mess, and at lower cost than ever before. In addition, the retrofitted walls are stronger than original and stronger than when repaired by traditional methods.

The new method, developed by CEEM researchers Mohammad R. Ehsani and Hamid Saadatmanesh has been field tested in Glendale, Calif. on a masonry wall, and on 32-foot-tall concrete walls damaged by LA's January 1994 earthquake.

It works this way: The wall is sandblasted, then a thin layer of epoxy is applied. Next comes a composite fabric mesh. Finally a little more epoxy is applied over it. After the epoxy hardens the wall is given a protective coating to reflect ultraviolet rays. This is done both inside and out to make a "plastic sandwich."

The improved wall supports loads several times its weight, making it highly resistant to future quakes. Building foundations don't have to be reinforced because, unlike conventional repairs, the composite mesh does not significantly increase the wall's weight. Finally, mesh repairs cost only 75 to 80 percent as much as traditional methods, such as strengthening walls by making them thicker and tying them together with rebar.

Composite mesh and epoxy also can be used to strengthen walls before earthquakes happen. In many communities — including San Diego, Calif. and Portland, Ore. — seismic codes have been tightened, and thousands of masonry and concrete buildings must be upgraded to meet them.

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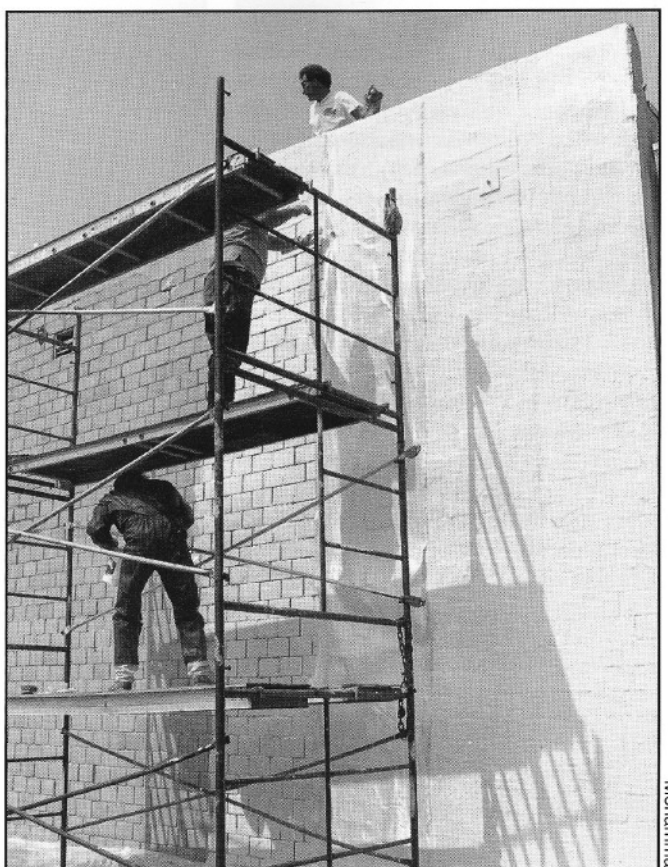

Construction workers use composite fiber mesh to repair an earthquake damaged masonry wall in Glendale, Calif.

'Crazy idea' proves its worth

"When we first proposed this work to NSF, some of the reviewers said, 'You guys are out of your minds, this will never work,' " said Associate Professor Mohammad R. Ehsani.

The idea: To extend the lives of concrete pillars, and masonry and concrete walls by wrapping them in composite fabric mesh after earthquake damage or years of exposure to the elements.

Ehsani and Associate Professor Hamid Saadatmanesh didn't get the NSF funding, but they didn't give up. "We said, 'If this is so crazy, we should qualify under another NSF program for small grants for exploratory research,' " Ehsani recalled. This argument sold, and they were on their way with a small grant of $35,000.

That was less than three years ago. Since then, they have tested hundreds of composite fabrics and epoxies, and worked with manufactures to develop new ones. And they have taken the idea from initial concept to use in the field — extremely rapid work for a small budget, academic research team.

The biggest problem was finding an epoxy that was strong enough but still safe for indoor use — one that was fire resistant and didn't give off toxic fumes. They worked with manufacturers to come up with the right mix.

After testing the materials in the lab, the researchers worked with a California engineering firm to repair earthquake damaged walls using composite mesh and epoxy.

"Now that NSF has seen the results and this has been used in the field, we hope they will fund the next step in our research — to subject test walls to earthquake-like loads in the laboratory," Ehsani said.

He added, "I think researchers should focus on studies that are of benefit and use to the engineering community and the public. Unfortunately, many research projects result only in publications that end up on someone's shelf and are rarely used."

Apparently NSF agrees. The researchers have been asked to present a talk on their work at an NSF workshop on technology transfer from basic idea to field application.

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