

Inside Tucson Business

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This product rocks
Earthquake
prompts professor

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Diagnosing Business health

Tucson employers find meaning in largest-ever survey of health benefits.

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Dust of the past

Tucson builder recasts ancient dirt to raise Presidio's walls for Tucson Origins project.

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Shadow of doubt

While city praises Presidio Terrace, neighbors express dread at living in shade of the residential-retail tower.

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Tucson reaches Magic number

For the first time, four million people flew into or out of Tucson in the last 12 months, setting one of several records for Tucson International Airport.

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Action!

Arizona chases TV, motion picture production dollars

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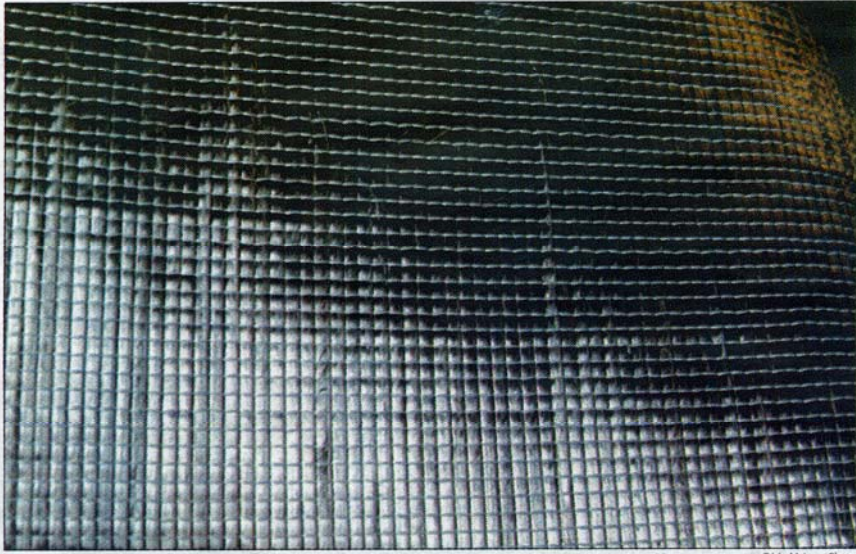
Actors Steven Weber and Annabeth Gish during last year's filming of the ABC feature "Desperation."

Courtesy Metropolitan Tucson Convention and Visitors Bureau

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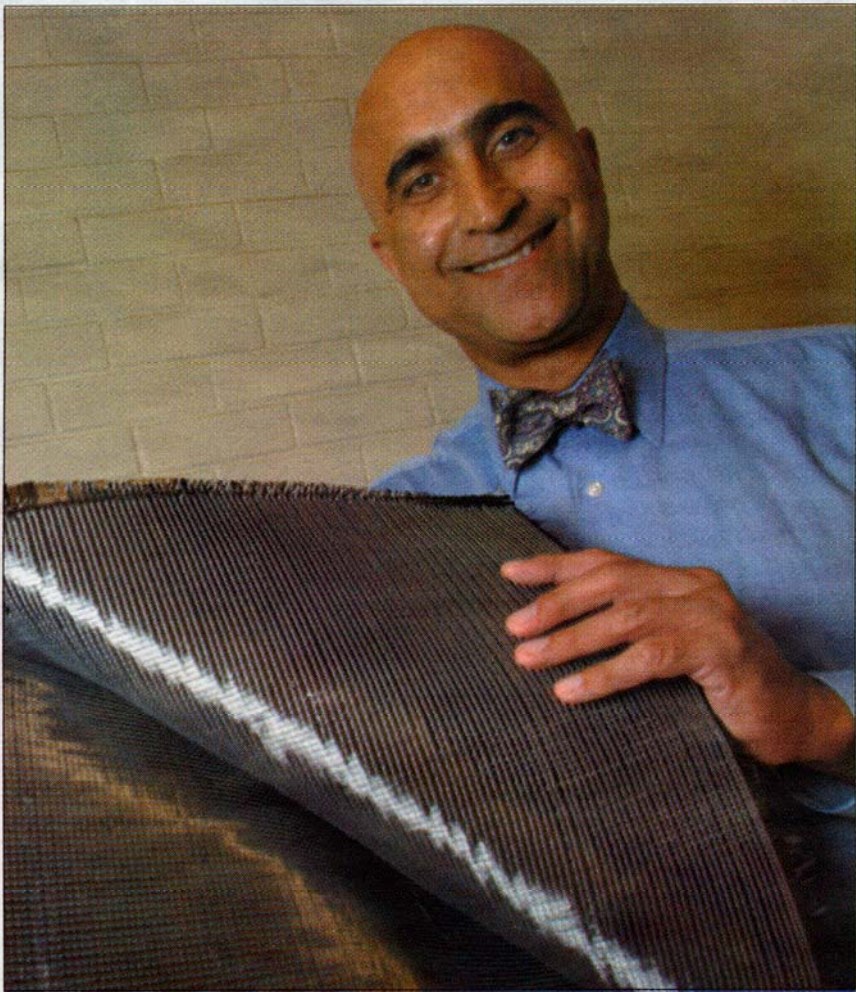
Tricia McIntroy Photo

WRAPING UP

UA Professor transforms research into earthquake solution

By Philip S. Moore, *Inside Tucson Business*

EARTHQUAKES



Tricia McIntroy Photo

Mo Ehsani, president of QuakeWrap and professor of civil engineering at the University of Arizona, displays a sample of carbon fabric that is used in QuakeWrap projects.

What started as an idea by a University of Arizona professor of civil and structural engineering has, over the last 18 years, turned into a company offering solutions for everything from Fox Theatre restoration to copper mine operations in Morenci.

QuakeWrap Inc., a Tucson-based company, is a leading designer, supplier and installer of products that offer a relatively inexpensive and easy way to reinforce concrete and masonry against corrosion and earthquake damage. The material and technique is an outgrowth of the defense and aerospace industry, where carbon fiber reinforced polymer fabrics were developed and used to manufacture high-strength and light-weight components.

Founder and chief executive Mo Ehsani said research into the use of the material goes back to 1987, but it took the 1989 Loma Prieta earthquake, near San Francisco, to give birth to the idea of a company.

Earthquakes are nearly commonplace in California, as are efforts to reinforce against them. However, Ehsani said the techniques used, at the time, were usually expensive and difficult to work with in retrofitting older structures, which is why so many collapsed during the quake, causing catastrophic damage.

"For new construction, the challenge of earthquake proofing isn't so much, since it's easy to design something that meets modern building codes. However, a lot of existing building were built at a time when then codes weren't addressing these issues," he said. "They had major deficiencies because nobody knew how to design for seismic loads. Also, there was the problem with the changing use of buildings. "A residential building might be converted into an office tower or a warehouse might become an apartment," he said.

"Everyone knew the strength and flexibility of fiber reinforced polymers. However, they were too expensive, so nothing like this had been conceived before," he said. That's why this earthquake was different. "We were at the end of the Cold war when there was a glut of carbon fiber materials as the aerospace and defense industries slowed down, and prices started to drop."

Since he already knew from his previous research that it would work in strengthening columns, Ehsani said, "It was time to be looking at using it to provide protection against earthquake damage."

With \$235,000 in funding from the National Science Foundation, Ehsani said he went to work, experimenting with the material and finding ways to effectively bond it to concrete and masonry surfaces.

"There were some challenges and a lot of people though this was a crazy idea. However the crazy idea really worked and then started to be used. So, the crazy idea wasn't so crazy, after all," he said. "I find that the most rewarding part of this process."

PROFILE



Ehsani's company was incorporated in 1994 to use the patented techniques he developed to strengthen two buildings in Southern California. Since then, "Projects all over the world have used our product, retrofitting a building in a matter of hours, using strips of carbon fiber to strengthen columns, walls and other vulnerable areas."

In 2003 Ehsani's company obtained a contractors license in Arizona and California to offer design, material and installation services, it provided a demonstration project for the Tucson Fox Theatre in downtown Tucson and, in 2004, the company was recipient of the Award of Excellence in Retrofit from the Structural Engineering Association of Arizona for work on the Coolidge High School gymnasium.

Beyond protecting buildings from earthquake damage, Ehsani said the QuakeWrap technique was used to strengthen the floor of St. Joseph's Hospital and Medical Center in Phoenix to handle extra weight, and it was used to reinforce critical structures at the Palo Verde Nuclear Generating Station, also near Phoenix.

It was QuakeWrap's work on the nuclear plant that brought it to the attention of Stacy MacDonald, sales manager for B&W Commercial Contracting in Morenci. "I saw what they did with the material at Palo Verde and though this might be a good material for mining applications."

He said part of the process of mining and refining ore at the Phelps-Dodge copper mine involves use of giant electrolyte-cathode tank houses, built up of cells, four-feet wide, six-feet deep and 20-feet long. "These cells are typically balanced on concrete beams, held up by columns. Because the atmosphere is corrosive, the concrete erodes, exposing the rebar, which is also corroded

Biz Facts:

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Established: 1994

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by the air."

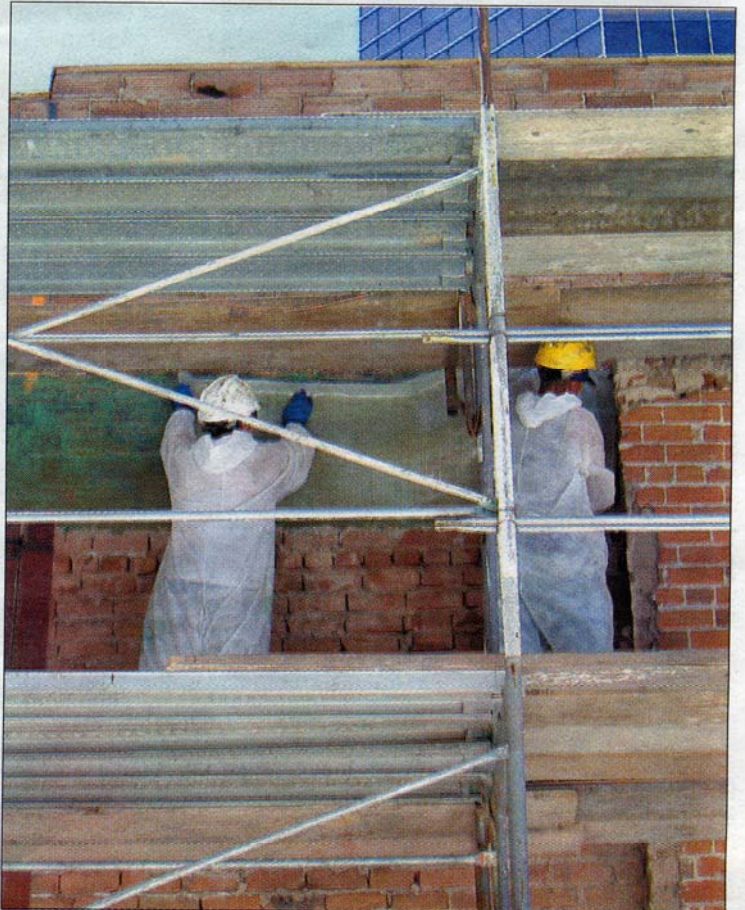
MacDonald said by wrapping the outside of the columns and beams, the fiber-reinforced material not only protected them from the atmosphere, "by strengthening them from the outside, it provided a quick fix that saved a lot of time and money."

For the future, he said, "We've got other development going on and are developing different applications for use in mines. We think we're going to be in a situation where we can say, 'You have these problems, but we have the solution.'"

Ehsani said, "There are a lot of construction errors out there, too, where builders leave out reinforcing or put it in the wrong place. It's a very expensive process to go back and fix. There are also buildings damaged by Hurricane Katrina that could benefit, considerably, from this. The possibilities continue to expand as time goes on."

He said, "We'll continue to see applications in different areas as time goes on. Professors are often accused of doing nothing but sitting in ivory towers. I hope that, through the work QuakeWrap is doing, people will see there's something practical to what we do here at the university that continues to make life better for everyone."

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Courtesy QuakeWrap

Above and below: Binding carbon fiber reinforced fabric to masonry walls and pillars provides protection from earthquake damage, which is why University of Arizona Professor Mo Ehsani developed the process, now used by his company, QuakeWrap, Shown here at the Fox Tucson Theatre.