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UA process adds strength to old walls

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TUCSON — A material that goes on like wallpaper and dries stronger than steel could revolutionize the way older buildings are reinforced to withstand earthquakes, University of Arizona researchers say.

Civil engineering professors Mohammad Ehsani and Hamid Saadatmanesh have patented the process for reinforcing masonry walls.

Their technique involves using a thin film of a lightweight but very strong fiber composite material applied with epoxy to the outer surface of a wall.

The material comes in rolls and is composed of fine threads of glass, sometimes woven with either fibers of carbon or Kevlar, the material used in bulletproof vests.

Saadatmanesh and Ehsani say a wall reinforced this way can resist loads as high as 24 times the weight of the wall. Most building codes require masonry walls to withstand loads only up to 40 percent the weight of the wall.

But it's been an uphill battle to convince people it can work, Saadatmanesh said.

In a demonstration, the professors used air bags to subject the wall to the pull-and-push cycles that would be experienced in an earthquake.

The nine-foot red-brick wall being tested would be able to deflect or bend only 0.2 inches without

reinforcement, Ehsani said. But reinforced with strips of the composite material, the wall was able to go to 2.5 inches without collapsing.

In many older buildings, they said, the masonry is not enforced with steel; no reinforcing rods were placed inside the walls during original construction.

"When the earthquake comes, these walls crumble like a deck of cards," Ehsani said.

Retrofitting is done primarily by adding steel frames or thickening walls by six to eight inches with a spray form of concrete on reinforcement bars.

Ehsani and Saadatmanesh said

their method has several advantages over traditional ways.

One is cost. Other methods cost an estimated \$25 to \$30 per square foot, compared to \$8 to \$9 per square foot for the method using composite material.

The material strengthens without adding a lot of weight, which is important because heavier buildings experience a larger earthquake force, Ehsani said.

In addition, the method does not reduce usable floor space as thickening the walls does and doesn't disrupt the activity in a building while it's being reinforced, Ehsani said.