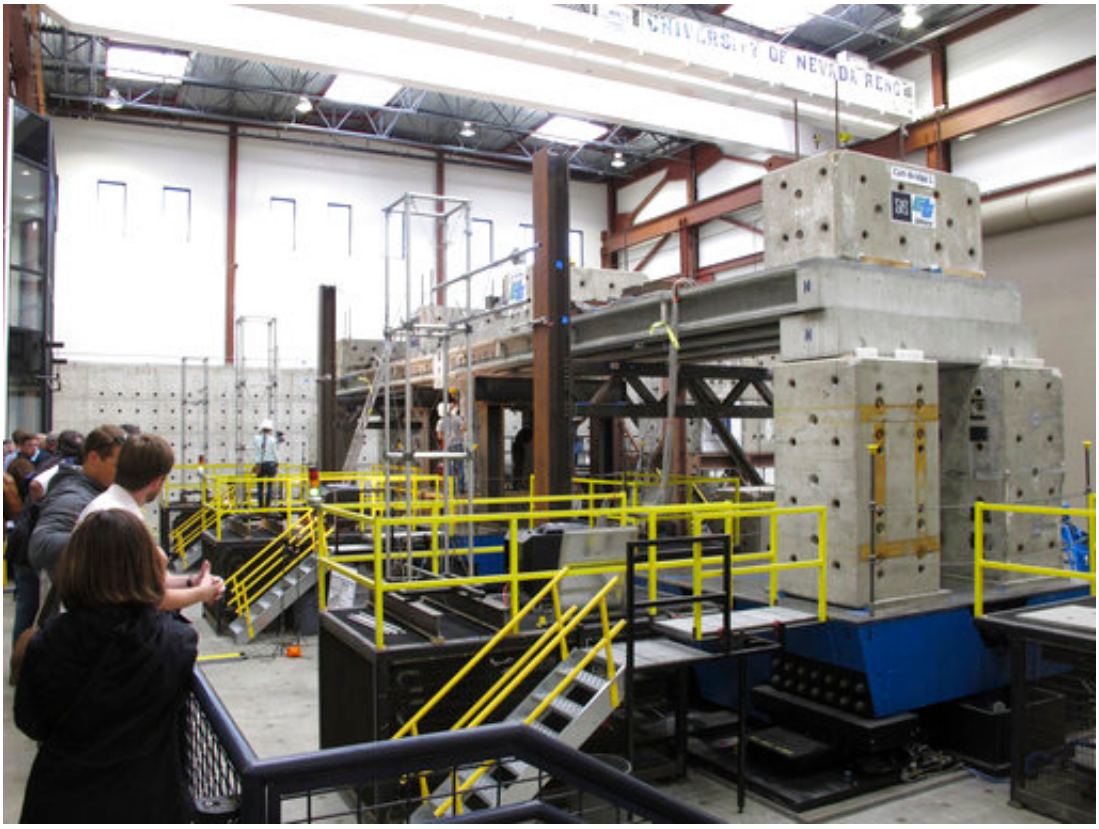
Nevada quake lab tests new bridge design after Mexico quake

September 21 2017, by Scott Sonner



Researchers and invited dignitaries watch gathered at the University of Nevada, Reno's new Earthquake Engineering Laboratory in Reno, Nev., on Wednesday, Sept. 20, 2017, before a series of tests on new bridge designs intended to better withstand violent temblors. Scientists say the 100-ton, 70-foot-long concrete bridge subjected to violent motions on a giant "shake table" held up better than expected using new innovations to connect prefabricated pieces with ultra-high performance concrete and could prove pivotal in earthquake-prone places like Mexico and the western U.S. (AP Photo/Scott Sonner)

Scientists at a Nevada earthquake lab on Wednesday tested new bridge designs with connectors they say are innovative and created to better withstand violent temblors and speed reconstruction efforts after major quake damage.

University of Nevada, Reno engineers performed the experiments on a giant "shake table" to simulate violent motions of an earthquake to rattle a 100-ton (91-metric ton), 70 foot (21-meter) bridge model to determine how well it would hold up.

The tests, conducted a day after a big quake struck Mexico, shook large concrete columns and beams back and forth for about 30 seconds at a time, displacing some nearly a foot before returning largely to their original spot.

Graduate students measured and marked indications of tiny fractures but no major structural damage was observed in the initial review of the experiments.

"The bridge has done better than we expected," said Saiid Saiidi, a professor of civil and environmental engineering who served as the project leader. He's done related research for more than 30 years.

Bridges are already designed not to collapse in earthquakes but often are unsafe for travel after big quakes. He said the designs that were tested employed special types of connectors to link prefabricated bridge parts, including ultra-high performance concrete.

Graduate students at the University of Nevada, Reno's College of Engineering inspect a bridge model for damage after tests on a giant shake table intended to simulate violent earthquake activity at the school's new Earthquake Engineering Building in Reno, Nev., Wednesday, Sept. 20, 2017. Scientists say the 100-ton, 70-foot-long concrete bridge held up better than expected using new innovations to connect prefabricated pieces with ultra-high performance concrete and could prove pivotal in earthquake-prone places like Mexico and the western U.S. (AP Photo/Scott Sonner)

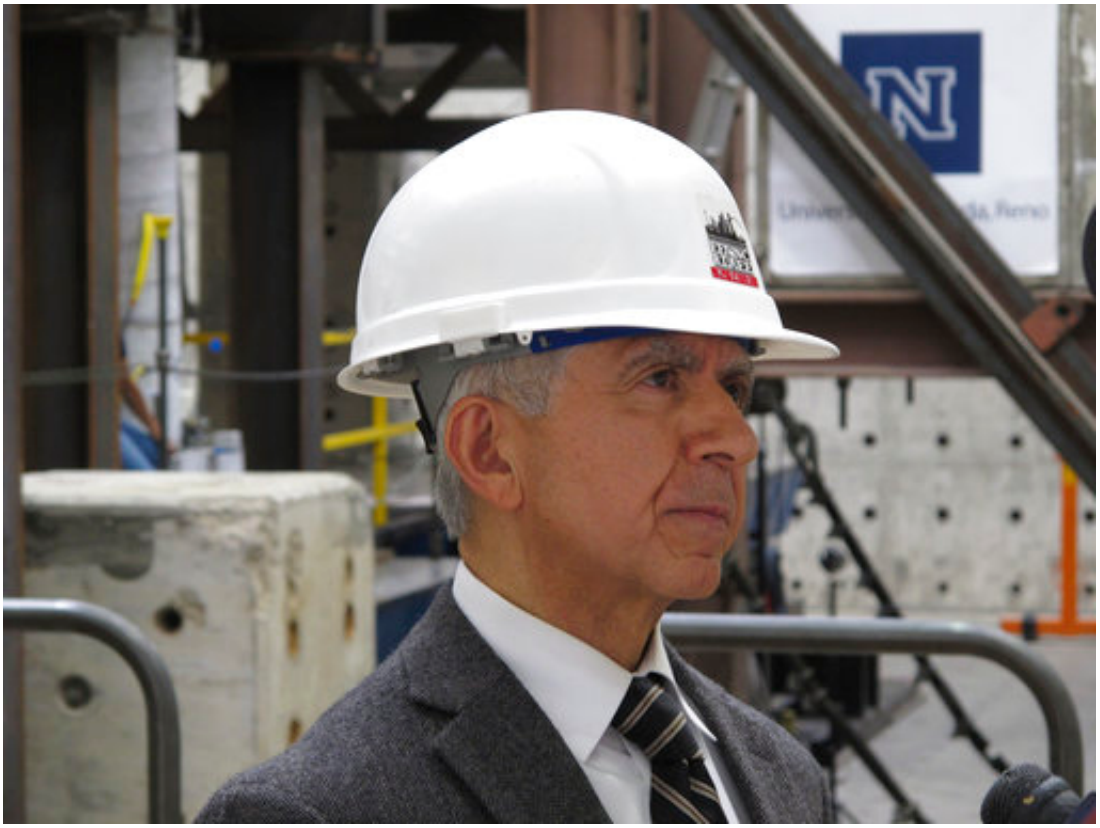
"Earthquakes by themselves don't kill people—it's the structures," Saiidi said.

The elements have been tested on their own but never before combined in a bridge model subjected to realistic earthquake motions, like the 1994 Northridge, California quake. Wednesday's test inside the

University of Nevada's Earthquake Engineering Laboratory simulated activity of a quake as large as magnitude 7.5.

Some design work by the engineers has been incorporated into a highway off-ramp under construction in Seattle. It's the first bridge in the world that uses flexible columns and reinforcement bars made out of a metal alloy with titanium that bends and then springs back into shape when quakes hit.

Among other things, the innovative connectors allow for prefabricated concrete and other materials to be attached to an existing bridge foundation so as to speed repair and reconstruction



Saiid Saiidi, a world-renowned professor of civil and environmental engineering at the University of Nevada, Reno, is pictured Wednesday, Sept. 20, 2017, after conducting a series of tests on a giant shake table intended to simulate violent

earthquake activity at the school's new Earthquake Engineering Building. Saiidi, the project leader, said the 100-ton, 70-foot-long concrete bridge held up better than expected using new innovations to connect prefabricated pieces with ultra-high performance concrete and could prove pivotal in earthquake-prone places like Mexico and the western U.S. (AP Photo/Scott Sonner)

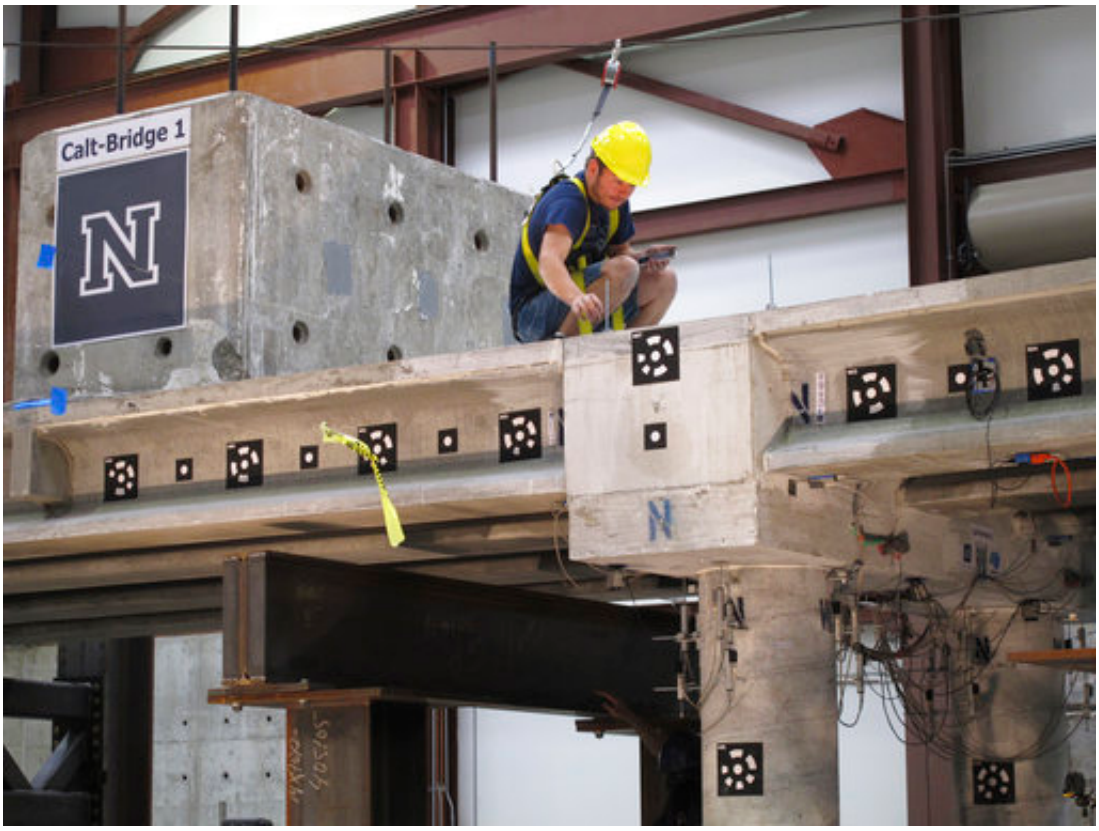
Part of the research centers on a so-called "pipe pin" connection developed by the California Department of Transportation's bridge designers for use in connecting certain beam interfaces in bridge construction.

The pin consists of a steel pipe that is anchored in the column and extended into a steel can embedded in the beam. A gap between the steel pipe and the can enables the extended segment to freely rotate inside the steel can and prevents bending of the protruded segment inside the can.

The University of Nevada's Earthquake Engineering Lab is the largest of its kind in the United States.

The latest project is funded by the California Department of Transportation, which currently is developing plans for 10 pilot projects based on the developing bridge connector technology.

"This study today is going to allow them to make observations of those designs," Saiidi said.



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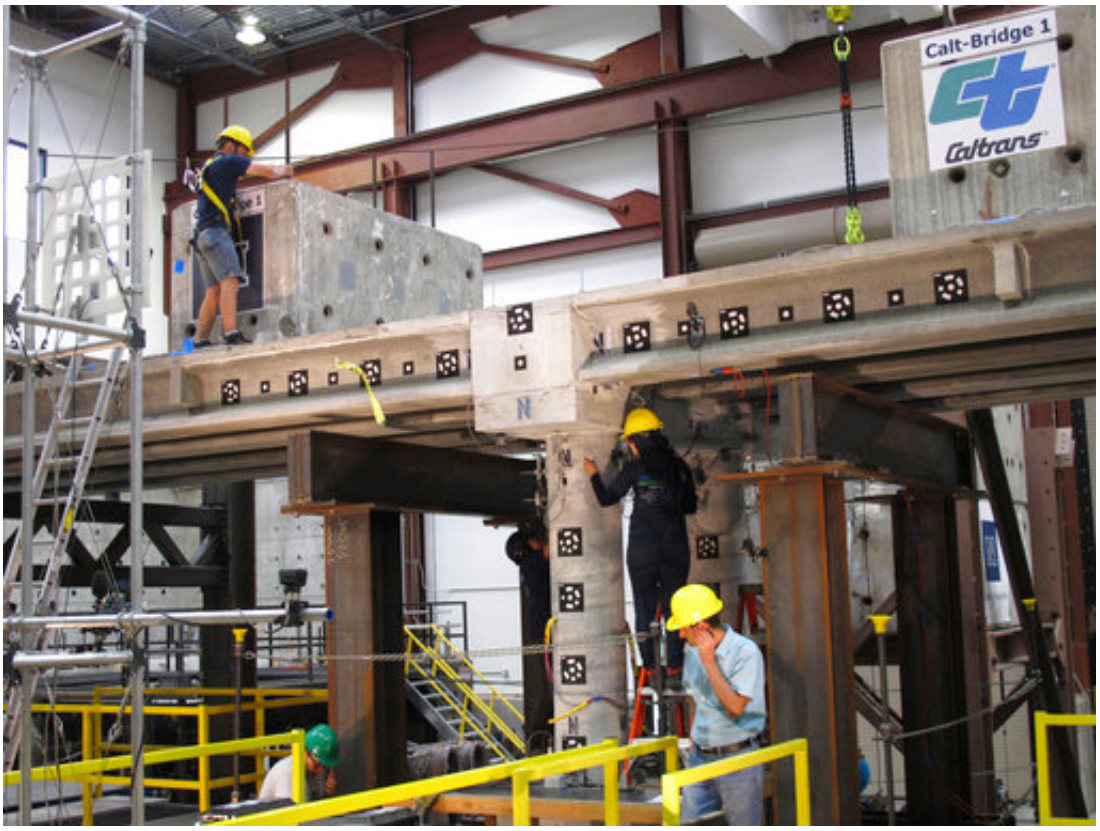

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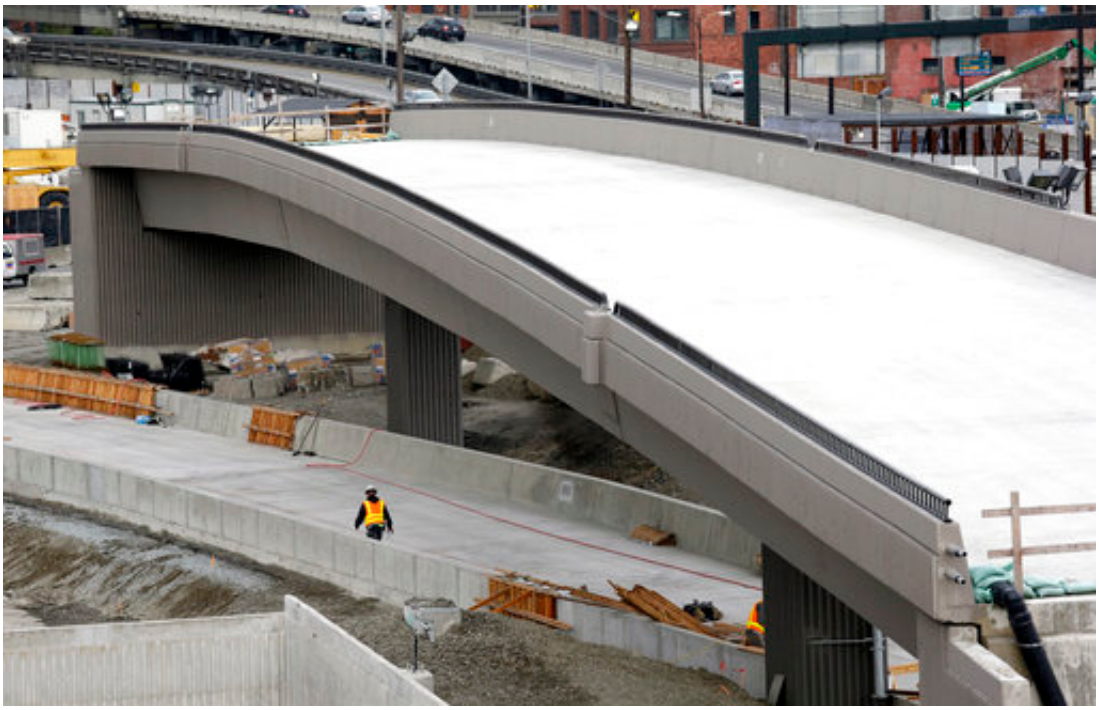
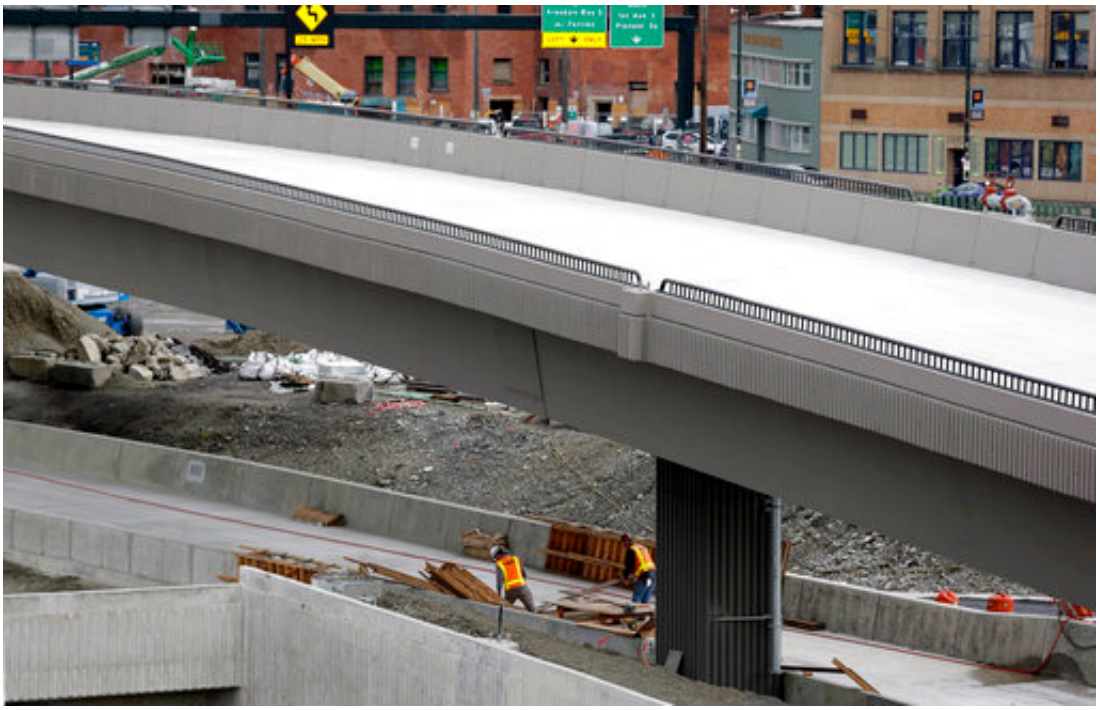
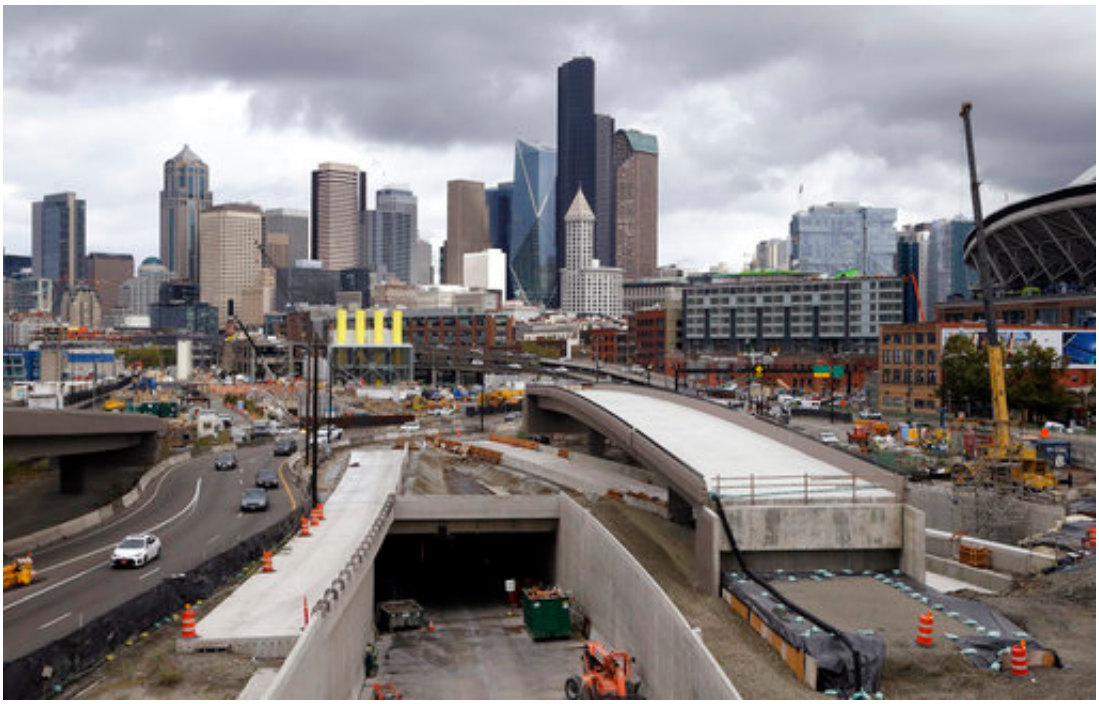


In this photo taken Tuesday, Sept. 19, 2017, a worker walks under a portion of a new offramp for Highway 99 where a tunnel for the roadway is still being constructed in Seattle. The offramp has a new type of column that flexes when the ground shakes in an earthquake, then snaps back to its original position so that the structure not only survives a quake without collapsing but also sustains so little damage that it can be used immediately. Funded by the California Department of Transportation, scientists at a Nevada seismology lab plan to test a combination of new bridge designs on a giant "shake table" to see if they can better withstand big earthquakes like the one that hit Mexico on Tuesday. (AP Photo/Elaine Thompson)



In this photo taken Tuesday, Sept. 19, 2017, workers move equipment under a portion of a new offramp for Highway 99 where a tunnel for the roadway is still being constructed in Seattle. The offramp has a new type of column that flexes when the ground shakes in an earthquake, then snaps back to its original position so that the structure not only survives a quake without collapsing but also sustains so little damage that it can be used immediately. Funded by the California Department of Transportation, scientists at a Nevada seismology lab plan to test a combination of new bridge designs on a giant "shake table" to see if they can better withstand big earthquakes like the one that hit Mexico on Tuesday. (AP Photo/Elaine Thompson)



In this photo taken Tuesday, Sept. 19, 2017, a portion of a new offramp, center right, for Highway 99, stands completed and adjacent to the entrance for northbound traffic into the Highway 99 tunnel still being constructed in Seattle. The offramp has a new type of column that flexes when the ground shakes in an earthquake, then snaps back to its original position so that the structure not only survives a quake without collapsing but also sustains so little damage that it can be used immediately. Funded by the California Department of Transportation, scientists at a Nevada seismology lab plan to test a combination of new bridge designs on a giant "shake table" to see if they can better withstand big earthquakes like the one that hit Mexico on Tuesday. (AP Photo/Elaine Thompson)