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### Making California Earthquake Proof



Eric Niiler

KPBS, SAN DIEGO (2003-07-03) California's officials are wrapping up a seven billion-dollar project to make the state's bridges and freeway ramps earthquake proof. Among the improvements are new rubber bearings installed on the Coronado Bridge, and the replacement of an entire section of the Oakland Bay Bridge. With much of the work complete, some researchers are now considering the next phase of earthquake preparedness, an early warning system. KPBS reporter Eric Niiler has more.

Most Californians don't think of earthquakes until they get shaken by one. But structural engineers like Gianmario Benzoni think about earthquakes all the time. Here at the earthquake testing lab at UC San Diego, Benzoni and his colleagues are firing up the world's most powerful shake table, a device that can squeeze, twist and pound bridgework with the force of an earthquake. Today, they're testing a device that is going to be attached to the Richmond bridge near San Francisco.

Its really like a shock absorber, but more sophisticated. The native of Italy says the 21-foot long shock absorber will be attached underneath the bridge span.

One edge is on the pile, the other is on the deck. The shock absorber is placed onto the shake table and squeezed with 500 thousand pounds of pressure three times. What was that? It was very high speed, three cycles. This is way more than the earthquake will do, if they pass this test and match with the prototype, we feel it will be safe on to put on the bridge.

The testing here in San Diego is part of a 7-billion dollar retrofit program being undertaken by the California Department of Transportation. Since work began after the 1994 Northridge earthquake, CalTrans engineers have retrofitted nearly 25,000 freeway and toll bridges. Now, all that's left are four long-span bridges in the San Francisco Bay Area. CalTrans director Jeff Morales says the agency has been employing new technology to absorb the energy released by earthquakes. We're doing things that no one has every done before..we learn with every single project and with every earthquake. What we're doing today is radically different that what we did ten years ago.

One example is here just below the Coronado Bridge. In addition to surrounding the bridge piers with concrete reinforcing, engineers also came up with the idea of installing rubber bearings to absorb earthquake energy. UCSD dean of engineering Frieder Seible describes the earthquake fault line that runs below the bridge. Called the silver strand fault .this is where you can see the bridge being isolated by the rubber bearings.

The fault is inactive, but that could change in the future. To make the bridge safer, Seible says workers lifted up sections of the bridge span and slipped in the energy-absorbing bearings. They're about three foot in diameter and one and a half feet tall.

The Coronado retrofit cost 100 million dollars and was finished earlier this year. Other California bridges have special sensors that transmit earthquake information to a central computer. The data will help scientists quickly know which bridges could be damaged. Some researchers want to take these sensors a step further. Richard Allen, a seismologist at the University of Wisconsin, has proposed a setting up an early

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warning system in southern California. The idea is to measure the earthquake's sound waves that occur several seconds before the ground starts moving, and then shut down systems that carry people. Slowing stopping trains things like that..turning all the traffic lights on the freeway to red, perhaps issuing warnings at airports preventing planes from landing during the course of an earthquake.

Japan's early warning system slows down fast-moving bullet trains during seismic events. Mexico City gets a warning when earthquakes occur about a hundred miles away. But some critics say that won't work here in California. David Wald is a seismologist at the US Geological Survey in Colorado. The problem with California, or Los Angeles or San Francisco, is that the most damaging earthquakes will occur right beneath the city. So the time between when the earthquake starts and the strong shaking will cause damage is very short.

Like many state-funded projects in California, Allen's early warning system has been put on hold because of the budget crisis. But in the meantime, engineers are doing their best to make structures withstand earthquakes whether or not they get any warning beforehand.

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