UCSD Engineers receive $3.4 million grants to develop standards for earthquake-resistant bridges

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UCSD ENGINEERS RECEIVE $3.4 MILLION GRANTS

TO DEVELOP STANDARDS FOR EARTHQUAKE-RESISTANT BRIDGES

A team of structural engineers from the University of California, San Diego has been awarded two grants totalling $3.4 million to create new design methods for building earthquake- resistant bridges.

The three-year grants, from the California Department of Transportation, will be used to investigate alternative techniques that could be used to improve bridge strength and flexibility.

"We'll take a look at what has been done in seismic design in the past," said M. J. Nigel Priestley, professor of structural engineering at UCSD. "We'll try to determine whether or not there are better ways of conceptualizing how structures should perform in earthquakes to reduce damage in moderate earthquakes and avoid extreme cases of damage with major earthquakes."

To accomplish these tasks, Priestley and UCSD Structural Engineering Professor Frieder Seible will direct a team from UCSD's Charles Lee Powell Structures Laboratory that will include two postdoctoral engineers, a research engineer and about 10 graduate students. The Powell laboratory is one of the largest structures research laboratories in the Western Hemisphere.

Under the grants, the UCSD researchers will investigate about 10 areas where design could be either simplified or performance could be improved. Virtually every major aspect of bridge design will be studied including strength and ductility tests for columns, piles and pile caps, hinges, cap beams, joints and the superstructures themselves. Analyses of how ground beneath the bridges react to seismic events also will be studied.

In one project, research will be conducted on the use of lightweight concrete, since seismic forces increase with the mass of the structure.

"Lightweight concrete tends to be brittle," said Priestley. "What we are trying to do is turn this brittle material into something that is ductile enough to be able to support large deformations that must exist in seismic response."

Another project will focus on how to design bridges that essentially are suspended from hangars. In this manner, during earthquakes the structure would be allowed to swing free in all directions and significantly minimize structural damage.

"By doing this we can essentially turn the bridge into a pendulum and this should limit seismic response," said Priestley.

These latest Caltrans grants follow a successful research project in which UCSD structural engineers developed techniques for the state transportation agency to retrofit older bridges. More than 500 bridges statewide have been strengthened since the October 1989 Loma Prieta earthquake, most employing designs and methods developed at UCSD.

Researchers under the new Caltrans grant will work closely with engineers involved with the proposed landmark 450-foot highway bridge over Interstate 5 built from lightweight composite materials. The bridge project recently was awarded $10.5 million in federal funds through a program aimed at helping the nation's defense industry convert its technologies to peacetime uses. Seible and Gilbert Hegemier, director of the Powell lab, are heading up a consortium of university and private firms to design and build the 1-5 bridge. That group includes the University of Delaware; E.I. DuPont de Nemours and Hercules, Inc., of Alpharetta, Ga.; Shell Chemical Co. of Houston, Tex.; Lockheed Missiles and Space Co., of Palo Alto, Calif.; B.P. Chemicals, Inc., of Santa Ana, Calif.; and J. Muller International, Trans- Science Corp. and XXsys Technologies, all of San Diego.

"The seismic design project will help with the 1-5 bridge project and the 1-5 project may have some solutions that could help with the seismic design project," said Priestley.

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