



News Release

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Researchers Use Shake-Table Results to Develop Rational Design Methodology for Precast Concrete Parking Structures

PCI's Technical Committees work to codify results of research to help designers produce better seismic protection in all zones

CHICAGO, ILL. — The Precast/Prestressed Concrete Institute (PCI) has completed tests of a large-scale, three-story precast concrete parking structure and has begun using the results to create standards that can be incorporated into building-code requirements.

The tests, completed in August at the NEES/Englekirk Resource Center in San Diego, CA are part of the final year's work on a five-year, \$2-million-plus research program to improve industry standards for the design and construction of diaphragms used with precast, prestressed concrete components. As part of that research, researchers simulated eight levels of seismic forces on a half-scale field model using the largest outdoor "shake table" in the world.

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The tests, which were witnessed by more than 100 engineers from around the country, emulated seismic stress in three localities: the East Coast (using conditions applicable to Charleston, S.C.), the Midwest (Knoxville, Tenn.), and the West Coast (Seattle, Wash., and Berkeley, Calif.). The half-scale structure was subjected to seismic conditions approximating various forces up to 8.0 on the Richter scale.

“The building performed very well,” says Tom D’Arcy, principal and founding president of The Consulting Engineers Group in San Antonio, Tex., and a past PCI chairman of the board member, who is overseeing an advisory committee reviewing the results. “Now we begin the hard work of analyzing the data and creating specific standards that will be accepted by code officials, so that designers will feel assured when they use these new rational design criteria.”

The ultimate recommendations will be created by PCI’s Research & Development Committee, chaired by Professor Douglas Sutton of the School of Civil Engineering at Purdue University in West Lafayette, Ind. Those will be made following peer review in various technical publications and input from knowledgeable professionals in development of code provisions. These activities are expected to be initiated in 2009.

The research program is carried out by a consortium of three universities. It is led by Dr. Robert B. Fleischman, associate professor in the Department of Civil Engineering & Engineering Mechanics at the University of Arizona in Tucson. Researchers at the University of Arizona have been conducting comprehensive analytical research, while full-scale static tests of reinforcing details and precast concrete connections have been conducted at Lehigh University in Bethlehem, Pa., under the direction of Drs. Clay Naito

and Richard Sause. The San Diego shake-table testing took place at the Network for Earthquake Engineering Simulation (NEES)/Englekirk Structural Engineering Research Center, under the direction of Dr. Jose Restrepo from the University of California at San Diego.

The goal of the research is to better understand the behavior of precast concrete diaphragms. This understanding has been long sought and has grown in importance since the 1994 Northridge earthquake, explains Paul Johal, director of research and development for PCI. The massive temblor, measuring 6.8 on the Richter scale, caused significant damage to several precast concrete parking structures.

The half-scale structure, measuring 17 feet wide by 58 feet long and approximately 28 feet tall, was used to test three types of flooring components: untopped double-tees, topped double-tees, and hollow-core concrete slabs. The shake table, measuring 25 feet by 40 feet, with a load capacity of 2240 tons, was used to run 16 tests on the structure. The structure withstood the forces of a Maximum Considered Earthquake (MCE Berkeley), which is likely to occur only once in 2500 years in high seismic zones.

The research is funded with grants from the National Science Foundation, NEES, and The Charles Pankow Foundation, with substantial industry support from PCI. In addition, several individual PCI Producer Members, as well as material suppliers and Professional Members, made significant contributions.

For more information on the research program, contact Jason Krohn, P.E., PCI's director of technical activities, at (312) 583-6771, jkrohn@pci.org or 209 W. Jackson Blvd., Ste. 500, Chicago, IL 60606-6938.

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About PCI

The Precast/Prestressed Concrete Institute (PCI), founded in 1954, is the foremost developer of standards and methods for designing, fabricating, and constructing precast concrete structures. PCI also operates the world's leading certification program for firms and individuals in the precast concrete structures industry.

PCI publishes a broad array of periodicals, technical manuals, reports, and other informational documents, including an award-winning technical journal. It also conducts educational seminars, technical conferences, conventions, exhibitions, and awards programs.

Institute members include firms comprising the precast concrete structures industry as well as architects, consultants, contractors, developers, educators, engineers, materials suppliers, service providers, and students.

PCI has 11 regional affiliates across the United States, and maintains relationships with other organizations, both national and worldwide, having interest in precast concrete.