

UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING
Department of Civil & Environmental Engineering

Distinguished Lecture Series

Professor Ian Buckle
University of Nevada, Reno

Experimental Studies of the Seismic Performance of a Curved Highway Bridge using Multiple Shake Tables

Friday, November 30, 2012
12:00 – 1:00 p.m. Seminar
Room L2D2, Engineering Lecture Hall, UH

Abstract

Curved bridges have been seriously damaged, and some collapsed, in recent earthquakes due to their irregular geometry. Yet U.S. design codes make no special provisions for their seismic design. To gain insight into their behavior and develop design guidelines, a 2/5th-scale model of a highly curved bridge (overall length/radius = 1.8) has been studied experimentally using the NEES shake table array at the University of Nevada Reno.

Six different configurations of the bridge model have been tested so that the following comparisons of performance could be studied: with and without sacrificial shear keys at the abutments, with and without live load, with and without earthquake protective systems (full and hybrid isolation, ductile cross frames, and rocking piers); and with and without pounding at the abutments.

This presentation will overview the design and construction of the model in the Large-Scale Structures Laboratory at University of Nevada, some of the challenges working with a model of this size (145 ft long and weighing 130 tons) supported on four shake tables. An overview of principal findings will also be made including the importance of identifying the correct load path, the loss of torsional stiffness in the single column piers, the beneficial effect of live load, the improved performance of hybrid over full isolation, and the trade-off in damage when abutment pounding occurs.

Lessons learned from these experiments are valuable input to the design guidelines now under preparation.

About the speaker:



Professor Ian Buckle is the director of the Center for Civil Engineering Earthquake Research and professor of civil engineering at the University of Nevada, Reno. He has previously served as Deputy Vice-Chancellor (Research), University of Auckland, New Zealand, and as Deputy Director of the National Center for Earthquake Engineering Research, University at Buffalo, New York (now the Multidisciplinary Center for Extreme Events Research).

Dr. Buckle is also the director of the Large-Scale Structures Laboratory at Reno, which houses a multiple shake table facility, one of the fourteen Equipment Sites established in 2004 by the National Science Foundation in the George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES).

Dr. Buckle's research interests include seismic performance of bridges, lifelines and buildings; design and retrofit criteria for bridges; earthquake protective systems for bridges; and bridge performance for extreme loads such as earthquake, differential temperature, and overload. He has conducted full-scale field testing and large-scale laboratory testing of structures using static and dynamic loads; has been a member of earthquake reconnaissance teams in California, Japan, Taiwan, and Chile; and has conducted short courses in bridge engineering, seismic retrofitting, and the seismic isolation of highway bridges.