

NORTHEASTERN UNIVERSITY

Distinguished Seminar Series

Civil & Environmental Engineering

FORENSIC ANALYSIS OF ECCENTRICALLY BRACED FRAME FRACTURE IN THE 2011 CHRISTCHURCH EARTHQUAKE: MULTI-SCALE SIMULATIONS, TESTS, AND FINDINGS.

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ABSTRACT

The Christchurch Earthquake of 22nd February 2011 revealed the first field fractures observed worldwide in Eccentrically Braced Frames (EBFs). These fractures are surprising because they occurred in the “fuse” region of a system that is otherwise considered highly ductile. The fractures have global implications for seismic design, since design standards in New Zealand are as stringent as those in the United States, Japan and elsewhere. The seminar will present a comprehensive study that examines these fractures forensically, with the objective of providing a understanding of the various factors that contributed to fracture. The study is based on samples of the fractured links that were salvaged from the fractured frames. The study spanned several scales, scientific methods and aspects of behavior including (1) material testing (2) frame simulations of the entire structure (3) continuum finite element simulations of the failed regions, and (4) micromechanics-based models for simulating fracture. When integrated, findings from these various research components provide a compelling, yet nuanced understanding of the EBF fractures. Perhaps more importantly, the study features an “end-to-end” simulation of a structural system across various scales, with the benefit of measured material data and observed structural response. Thus, it provides a unique opportunity to examine the advances and the challenges in high-fidelity simulation of fracture in structures. The seminar will address these methodological challenges in addition to the practical aspects of the EBF fracture.



Amit Kanvinde's research focuses on the seismic response of steel structures, with an emphasis on their extreme limit states such as fracture and fatigue. Professor Kanvinde received his doctorate in Structural Engineering from Stanford University in 2004, where he held the John A Blume Fellowship. Since then, he is a faculty member at the University of California at Davis, where he is currently Vice Chair of the Department of Civil and Environmental Engineering. A primary focus of his research at Davis has included large scale testing on column base connections, buckling braces and column splices. Another area of his research focuses on the development of micromechanics-based models for fracture and ultra low cycle fatigue in structural steels. He was awarded the best graduate student paper award by the Earthquake Engineering Research Institute in 2003, and more recently, the Norman Medal by the American Society of Civil Engineers, in 2008.

**Monday, February 4, 2013
12:00 p.m. – 1:00 p.m.
135 Shillman Hall**