DEPARTMENT OF CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING

University at Buffalo
The State University of New York

CSEE GRADUATE STUDENT ASSOCIATION

Student Chapter
University at Buffalo

MCEER
EARTHQUAKE ENGINEERING TO EXTREME EVENTS

# EERI Distinguished Lecturer:


## *Stephanie E. Chang*

*Professor, University of British Columbia, Canada*


# *"Dynamics of Urban Earthquake Risk"*


## Abstract

This presentation explores the question of how urban seismic risk is changing over time. Are our cities becoming safer, due to advances in earthquake engineering? Or is risk growing as a result of societal factors such as population expansion and urban development? At one level, some insight may be gained from long-term trends in *losses* from natural disasters. Global trends indicate that economic losses from natural disasters are growing rapidly, while human losses – catastrophic events notwithstanding – may be declining. From another perspective, long-term trends in *exposure* and *vulnerability* to natural hazards can also be observed by considering socio-demographic shifts in populations relative to hazard-prone areas. Yet in order to understand the dynamics of seismic *risk*, it is necessary to examine the multiplicity of factors influencing the likelihood of earthquake losses and how these factors have been changing over time, individually and interactively.

This examination must be undertaken at the urban scale, with an understanding of the historic development context of a particular city. Here, a case study of metropolitan Vancouver, Canada, is first presented. A loss estimation model was developed to estimate casualties. While structured similarly to standard loss estimation models such as HAZUS-MH, the model was tailored to reflect local construction practices as well as local data opportunities and constraints. The model was applied in a retrospective analysis, comparing losses if an identical seismic event were to have occurred at either end of a 35-year period (1971~2006) during which the urban area grew rapidly, doubling in population size. Results indicate not only whether the metropolitan area has become safer (in terms of expected earthquake casualties), but also the explanatory factors behind this trend and disparities within the urban area. The results provide some preliminary insight into future trends in earthquake risk.

The study also raises the question of whether the Vancouver results are likely to be unique or can be generalized to other urban areas. While the lack of available modeling studies precludes a definitive answer, some insights can nonetheless be gained by considering other cities whose urban development patterns and histories differ notably from Vancouver's. The discussion considers changes in some major risk factors in selected urban areas in the U.S. and around the world.


**DATE:** **Friday, April 22, 2011**

**TIME:** **11:00 A.M.**

**LOCATION:** **140 KETTER HALL, NORTH CAMPUS, UNIVERSITY AT BUFFALO**

**SPONSORED BY:** ***EERI***

**ORGANIZED BY:** ***Student Chapter of EERI at UB, CSEE-GSA, MCEER and Dept. of CSEE***

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# *Stephanie E. Chang*

## *Professor, University of British Columbia, Canada*

Stephanie E. Chang is a professor at the University of British Columbia, Canada, with a joint appointment in the School of Community and Regional Planning (SCARP) and the Institute for Resources, Environment, and Sustainability (IRES). She holds a Canada Research Chair in Disaster Management and Urban Sustainability. Her specialty is in the socio-economic impact of natural disasters, particularly earthquakes. She has co-edited a book on *Modeling Spatial Economic Impacts of Disasters* (2004) and published extensively on loss estimation models for critical infrastructure systems, infrastructure interdependencies, economic evaluation of disaster mitigations, and urban disaster recovery. Dr. Chang has recently served on the editorial boards of the journals *Earthquake Spectra* and *Papers in Regional Science*, as well as on the U.S. National Research Council's Committee on Disaster Research in the Social Sciences (2004-06) and its Committee on Earthquake Resilience – Research, Implementation, and Outreach (2009-11). In 2001, she received EERI's Shah Family Innovation Prize. She was also a 2008 fellow of the Aldo Leopold Leadership program of the Woods Institute for the Environment at Stanford University. She received her B.S.E. in Civil Engineering from Princeton University and Ph.D. in Regional Science from Cornell University.