Advisory Committee on Earthquake Hazard Reduction Program

EERI White Paper Summary

Earthquake Risk Reduction: Addressing the Unmet Challenges

The Need for an Interdisciplinary Research Approach

December 17, 2008
University of California, Berkeley, Berkeley, CA

January 2008 White Paper prepared by EERI Working Group:

William J. Petak, *Chair*
Thalia Anagnos
William Anderson
Stephanie Chang
Ronald T. Eguchi
Ronald Mayes
Dennis Mileti
Stuart Nishenko
Thomas D. O'Rourke
Susan Tubbesing, *Principal Investigator*
Marjorie Greene, *Project Staff*

Practitioners Perspective

Major Challenges

- Understanding and forecasting social and economic consequences
- Better understanding of the decision making process
- Motivation for action
- Incorporation of advanced sensors

Major Challenges

- **Understanding and forecasting social and economic consequences**
  - **Initial models of economic loss, casualties and shelter demand exist but we have a long way to go to produce the kinds of consequence estimates that will get the attention of decision makers and support better emergency response planning.**

Major Challenges

- **Better understanding of the decision making process**
  - **We still do not know the key leverage points that affect decisions by public officials and building owners as well as the larger public. We really need to improve our ability to characterize and communicate risk and uncertainty.**

Major Challenges

- Motivation for action
  - The infrequent nature of catastrophic earthquakes presents challenges for preparedness at the individual and organizational levels. Understanding how to motivate desired behavior is a major hurdle in the earthquake risk reduction community.
  - Building Rating System

Major Challenges

- Incorporation of advanced sensors
  - Low cost sensors can now provide significant amounts of information on the state and performance of buildings and infrastructure. As the built environment becomes “smart” we need to understand how to use this information to provide real time adjustments and emergency response.

Examples of Effective Interdisciplinary Approach

- Development of HAZUS – originally developed for analyzing potential losses from earthquakes it has now been adopted to floods and hurricanes.

- ATC 58 – performance based seismic design that provides a realistic understanding of the risk to life, occupancy and economic loss as a result of future earthquakes on a specific building. Provides building owners, tenants, lenders, insurers and other stakeholders the opportunity to specify their desired performance. It will be a huge step forward in the ability of the SE profession to communicate with owners.

Examples of Effective Interdisciplinary Approach

- EERC's produced an environment that supports multi-disciplinary research
  - They created long term projects that enabled the various disciplines to work with and learn what others have to offer.

Examples of Effective Interdisciplinary Approach

- Large scale test bed projects at the earthquake engineering research centers
  - LAMB (MCEER), Memphis Test Bed (MAE), NGA Models (PEER)
  - Use of remote sensing (MCEER), Opensees (PEER), MAE Viz (MAE) OpenSHA (SCEC and USGS)

Future Examples of Effective Interdisciplinary Approach

- NEES Grand Challenge projects
  - Ports and harbors
  - Non-ductile concrete buildings
  - Non-structural systems

Building Rating System

- ***Why are we doing this? What are we trying to achieve?***
  - **The objective of a system that rates the earthquake performance of buildings is to communicate seismic risk to non-engineers.**
  - **The ultimate goal is for the rating system to spur action that will reduce seismic risk from the overall building inventory.**

Who uses the rating?

- The system should be usable by all occupants, buyers, sellers, and tenants of a building.
- Thus, the audience for the system includes a broad and general population, many of whom know little about seismic risk.
- The most frequent users may be facility experts (structural engineers, brokers, insurance industry, investors), and the system should be usable by all who assess, quantify, reduce, mitigate, insure or accept risk.
- However, the system requires integrity and clarity without regard to the users or their desires.

What information does the rating provide?

- **Recommendation:** The rating should provide comparative information on the seismic risk inherent in any given building. It should include two components: a quantitative assessment over multiple parameters (dimensions), and a qualitative, overall "value judgment."

- The rating should be presented in a standardized format, contain enough information to provide a basis of decision making, and be clear enough to be understandable by those likely to use it.

Recommendation for Quantitative Component

- The multiple quantitative parameters reported should include safety (“deaths”), durability (“damage”), and continuity (“downtime”). The rating should phrase the dimensions with “positive” words, although the committee is not attached specifically to the words above.

Recommendation for Qualitative Component:

- The “value judgment” should include something like an overall letter grade or a number of “stars” (like for restaurants), which conveys an overall qualitative assessment.

- The committee did not reach unanimity on this issue, but a majority of committee members believe that a qualitative, relative “grade” would help communicate seismic risk to a broad audience.

Which building types / occupancy types are included?

- **All building types should be considered in the effort, including single family residences. The committee considered limiting the scope to exclude single family residences, mainly because the inventory is so diverse. However, because single-family residences constitute a large portion of existing buildings, excluding them might not achieve the goal of influencing the building inventory as a whole.**

- **The committee did not reach unanimity on this decision and eliminating single family residences is a potential way of reducing scope in the future, if the job of developing the ratings system becomes unmanageably large.**

How is the rating reported?

- The rating should be presented in a consistent and standardized format. In the context of a sales transaction, the rating would be reported as part of the disclosure package released to prospective buyers or other stakeholders in the property.

Who initiates and pays for the rating?

- **Since we are developing a strictly voluntary system, we would not specify how the rating is initiated and paid for.**

- **In the context of a sales transaction, we envision that buyers and sellers could initiate and pay for a rating independently. This could be an action that is recommended by real estate agents, in the same way real estate agents recommend that residential sellers obtain a pest report.**

The ultimate goal is for the rating system to spur action that will reduce seismic risk from the overall building inventory.