Earthquake Risk Reduction

Session 1 - Concepts and Terminology

This presentation reviews the basic concepts of earthquake risk reduction and introduces the key terms. Plate tectonics are discussed as the fundamental cause of earthquakes, with faulting being the proximate cause. Agents of damage, including faulting, shaking, liquefaction, land sliding, tsunami and fire following earthquake are explained. The presentation defines earthquake magnitude and intensity and provides several intensity scales. The session concludes with defining seismic vulnerability and reviewing the building blocks of an earthquake risk reduction program.

Session 2 - Hazard, Vulnerability and Risk Assessment

Earthquake risk reduction is a process that involves several steps. The first step is to detect the sources of earthquake that affect a community. It is also necessary to identify the potential hazards that an earthquake can generate. These hazards include shaking, land sliding, tsunami, liquefaction and fire following earthquake. The identification process should lead to maps of faults and other earthquake hazards. In some cases these maps are available from universities, national geological and seismological institutes, or emergency management agencies, but in some instances the hazard maps are non existent. In such cases, developing the maps of hazards is part of the first step. The next step is to understand the vulnerability of buildings and infrastructure to these earthquake hazards. Earthen (e.g., adobe) and masonry (stone or brick) buildings are typically the most vulnerable to shaking, but tsunami, land sliding and other hazards can damage even well-built buildings, if they are in the wrong location. The third step is assessing the overall risk, by combining the hazard and vulnerability information. The second session reviews in detail the steps laying down the ground work for earthquake risk reduction program.

Session 3 - Mitigation and ERR Program Development

The final presentation discusses the four basic approaches to earthquake risk reduction – structural, locational, operational and risk transfer. Each of these can be the most effective, depending on the particulars of a given situation, but an overall community earthquake risk reduction program typically combines these four techniques in a balanced program. Developing that program implies the analysis of the cost-effectiveness of various mitigation options and involves repetitions of the risk assessment methodology, using alternative risk reduction techniques. This is an iterative process and there is no ‘magic bullet’, but at the end the ERR can save lives when an earthquake occurs. The session concludes with guidance on implementing and maintaining the program.

Case Study 1 – **Risk Ranking in California East Bay Municipal Utility District**

The case study introduces the efforts of a large public utility company to mitigate earthquake risk in Northern California. It highlights the importance to clearly understand the scope and magnitude of risk before making a decision to accept or mitigate it. The paper reviews the way the company ranked the risk and the approach used to develop the assessment methodology and mitigation strategy.

Case Study 2 – California State Building Seismic Program

This case study presents a project of the Division of the State Architect (DSA) to assess and mitigate the earthquake vulnerabilities of nearly 16,000 state-owned buildings. The study demonstrates how an organization with a large building inventory can review and effectively screen out low-risk structures and make the loss reduction effort for the high-risk ones more cost-effective and manageable.

Case Study 3 – Seismic Safety of Schools in British Columbia

This case study outlines the road to a 1.5 billion, 15 year commitment by the government of British Columbia to school seismic safety. Over the course of a concerted one and a half year public education, media and lobbying campaign, school seismic safety has come to grip the collective social conscience and is becoming a focal point for promoting broader mitigation measures. The recognition of schools as an infrastructure priority has built a sense of community across the political spectrum in Canada. Key components to the approach were an alliance with the scientific community in educating government and the population about the risks and the solutions, and the incorporation of a public health approach to the problem.

Readings