NEHRP ACEHR Panel Discussion on
Existing Buildings Subjected to Earthquakes
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Informal Observations by Robert D Hanson

- **Year of construction** -- Everyone agrees that building codes and standards for new construction will result in better seismic performance than buildings constructed to the provisions of older codes and standards. Seismic design standards for retrofitting existing buildings, such as ASCE 41, have clearly identified the year of code adoption as a significant point for identification of potential seismic deficiencies.
- **Quality of construction and maintenance/alterations** -- The perception that the year of initial construction is most important remains even when poorer construction practices and quality have demonstrated lesser performance. Here the primary example is welded steel moment frames constructed with "poured" welded connections which fractured during the Loma Prieta and Northridge earthquakes. Many building owners have altered the structural systems when providing for new uses. Some are done without adequate consideration of the potential reduction in seismic resistance.
- **Size and life risk with building size/use** – Past earthquake experience has shown that buildings between 8 and 12 floors are more vulnerable than shorter and taller buildings. The exceptions to this general observation receive needed post-event evaluation and proposed changes to the code and standards. The recent Chile earthquake provides examples of this. Failures of tall buildings have the potential for greater life loss and greater public scrutiny, as they should.
- **Major cause of life loss** – The major loss of life from building collapses are due to failure of the gravity supporting system. There are a few examples of buildings tipping over, but they are much less frequent than the vertical collapses. Thus, seismic retrofit designs must include appropriate consideration of the gravity stability of the structural system. URM and nonductile concrete buildings are potentially the greatest problems.
- **Should life loss be the only criteria for seismic upgrades**? – Codes and standards for new construction still focus on preventing collapse, but more projects are including the concepts of reduced repair cost and increased functionality in their seismic designs. FEMA P-58 appears to be having a significant impact on engineers looking for better performing buildings.
- **Perceived excessive cost for seismic retrofits** – Seismic retrofits are usually performance based, but still are tied to a fraction of the design levels for new construction. Is this linkage between existing and new design requirements necessary? The Ministry of Education, Province of British Columbia initiated a process which identifies hazardous school buildings, assesses their vulnerability and design retrofits for life safe K through 12 public school buildings. They have used nonlinear dynamic evaluation of existing structural element capacities and new element capacities to aid the designer in the selection of appropriate cost effective upgrade elements. In most cases the retrofits are much less costly than the alternative approach of using the current Canadian standards for seismic upgrades for school buildings.