Reassessment of the Earthquake Design Philosophy in Australia

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Abstract: Australia is contained completely within the Indo-Australian plate, a region of low to moderate seismicity. However, the Australian continent is the most active intra-plate region for earthquakes in the world. Historical events have shown that these intra-plate earthquakes can cause moderate to high magnitude and shallow depth earthquakes, similar to what we have seen in Christchurch recently, that have the potential to cause a catastrophic event. The extensive damage that could be caused by these earthquakes in any one of the Australian capital cities is due to the vulnerable nature of their building stock that we have designed and created over the past century. The events of the Canterbury earthquake sequence in New Zealand, 2010 through to 2011, have shown us the destruction a rare earthquake near a densely populated area can cause. The Christchurch earthquake represents the largest natural hazard disaster in New Zealand's written history. The event has caused earthquake and structural engineers in Australia to review current seismic loading standards and detailing measures for structures due to the possibility of a rare earthquake occurring near one of our capital cities, which could cause the same devastation as what has recently occurred in Christchurch.

Research Objectives:

- Review of the Geoscience Australia (GA) 2012 Australian Earthquake Hazard Map
- Conduct a PSHA of each capital city in Australia using the AUS5 model for purposes of obtaining PGA values for a 500-year and 2500-year return period
- Review the Ground Motion Prediction Equations (GMPEs) and New Ground Attenuation (NGA) models to represent the ground motion of an earthquake in Australia
- Review of the Spectral Shape Factors given in the current AS 1170.4-2007 using recent high-quality earthquake recordings from the PEER Ground Motion database
- Develop improved generic capacity curves for various vulnerable categories of buildings using recent research results, including reinforced and precast concrete walls and cores
- Develop alternative code enhancements
- Estimate the increased construction costs for new construction using the various alternative code enhancements
- Estimate the reduction in expected losses due to improved building performance
- Identify those code enhancements that optimally improve building performance by comparing expected increases in construction costs with expected reductions in losses