

SEISMIC HAZARD MAPS

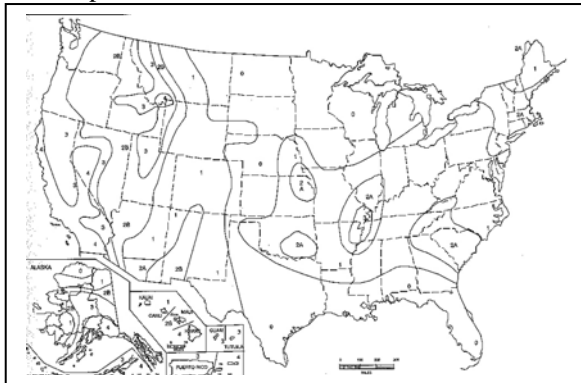
By Eugene Trahern, PE, SE, ARM

“Seismic Evaluations” are most commonly conducted to provide input to business decisions regarding acquisition, financing, or insurance for properties, specifically in order to identify earthquake risk to the property in terms of life-safety, property loss, business interruption and liability.

Background: Seismic risk is comprised of three components: Hazard, Vulnerability, and Exposure. Hazards relate to the “external forces” which cause damage, such as ground shaking, liquefaction, surface fault rupture, etc. Vulnerability relates to how well the structure is designed and detailed, along with weaknesses and deficiencies in the structural systems. Exposure is the value at risk, and can be expressed in terms of occupant loading (life-safety) or building value (property loss).

When one of the seismic risk components is low, the overall seismic risk is also generally low. As such, many investors choose to perform seismic risk studies in regions with moderate or high seismic hazards, and choose not to perform the studies in regions of low seismicity. Historically, these regions have been defined by the Seismic Zone Maps included in the Uniform Building Code (UBC). These maps were periodically modified based on information from the scientific community as to the potential hazards for each region.

The basis for the UBC seismic maps was the risk associated with a 10% probability of exceedance in a 50-year period, which equates to a 475-year return period.



1997 Uniform Building Code Seismic Zones

In recent years, the United States Geological Survey (USGS) has developed ground shaking maps for the United States which considers ground motions generated by all applicable sources (faults) as well as the return period for each fault. For each level of seismic risk, there are two maps which represent short (S_s) and long (S_1) period ground motions, which are used depending on specific building characteristics.

The International Building Code (IBC) which is intended to be a replacement to the previous three model building codes (UBC, BOCA, SBC) has

adopted these maps as they represent a more accurate understanding of the seismic risk associated with particular site. The maps selected for use, however, are now based on a 2% chance of exceedance in a 50-year period, or a 2500-year return period. This change was selected in order to incorporate seismic risk into the design for regions with large infrequent earthquakes, such as the New Madrid region in the central US and the east coast states. As such, there are now regions of the US which are currently in moderate or high seismic hazard zones which historically have not incorporated seismic design.

While new design is based on the current model building codes, the evaluation of existing buildings is based on other documents such as ASCE 31-03 “Seismic Evaluation of Existing Buildings”, published in 2003 and intended to replace previous documents such as FEMA-178 which was published in 1992. ASCE 31-03 also uses the new USGS maps as a basis for evaluation.

In addition to the ground shaking from the maps, the design and evaluation documents consider terms such as soil conditions to modify the seismic hazards equations.

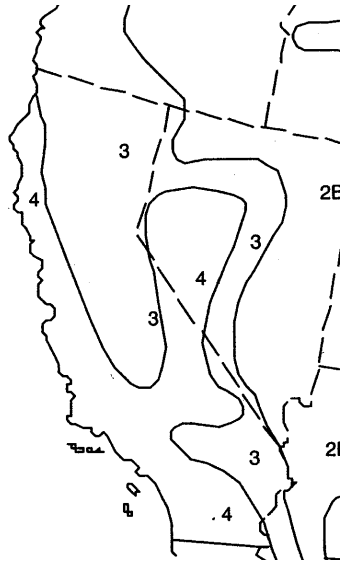


2003 International Building Code Seismic Map

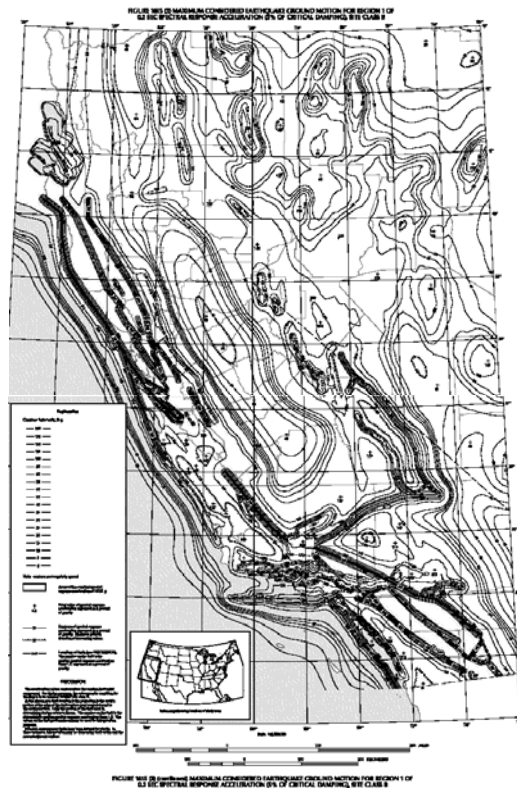
Summary: Seismic reviews and loss estimation are useful tools in helping define seismic risk for lenders and owner. However, as the seismic hazard maps have changed and are being adopted, it is no longer easy for the lay person to define if a particular region (or site) is in a moderate or high seismic hazard area. What once was defined as Seismic Zone 0 to 4, is now defined as S_s and S_1 , which are then modified with other variables such as soil conditions. For now, the investing community seems content with using the old UBC zones to define when seismic risk studies are conducted. Only time will tell what the future holds.

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1997 Uniform Building Code Seismic Zone Map for California and Nevada



2003 USGS Spectral Acceleration Map for California and Nevada