Mitigation of Seismic Risk pertaining to Non-Ductile Concrete Buildings using Seismic Risk Maps
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ABSTRACT
This paper presents the creation, improvement, and application of a web-based seismic risk map tool developed at the USGS in Golden, CO (http://earthquake.usgs.gov/research/hazmaps/). It is hoped that this tool will be used to identify building types that are at risk and evaluate the potential benefits of retrofitting them. The tool can be used to identify non-ductile concrete buildings, which are the most susceptible to seismic damage, and provide a quantitative measure of the risk associated with these buildings. The tool can also be used to evaluate the effectiveness of retrofitting strategies, such as brace installations or shear reinforcement, and to identify areas where additional risk mitigation efforts are needed.

METHOD & MATERIALS

HAZUS
HAZUS is a multi-hazard risk assessment software (http://www.fema.gov/past/hauszus). It incorporates a building damage spectrum and vulnerability function to determine the potential damage that a particular building may sustain during an earthquake. The tool is used to assess the risk of each building type and to identify areas where additional risk mitigation efforts are needed.

COMPONENTS OF RISK

HAZARD
- Mean annual frequency of ground motion (spectral acceleration at a particular period of oscillation) at a particular location: ascertained by risk maps.

FACTORS affecting HAZARD:
- Highly dependent on the ground conditions, or site class, at a particular site.

MARSHALL & MATERIALS

NEHRP Site Class Definition

Partial Description of HAZUS Building Categories

Label Description HAZUS
C1L Low Ductility
C1M Low Ductility
C1H Low Ductility
C2L Medium Ductility
C2M Medium Ductility
C2H Medium Ductility
C3L High Ductility
C3M High Ductility
C3H High Ductility

HAZUS Damage States

- HAZUS divides building damage into four states: slight, moderate, severe, and catastrophic.

FRAGILITY/VULNERABILITY
- HAZUS uses fragility functions to quantify the probability of damage levels for a particular building type.

RISK

- Risk summation using fragility functions: the expected annual loss ratio can be multiplied by the value of a building to quantify risk in terms of expected annualized losses.

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LITERATURE CITED


Zahr, M. J. & Allen, G. W. (2001). Estimating a site class distribution in the US. (see Figure in next column)