Geophysical Research Abstracts
Vol. 14, EGU2012-1691, 2012
EGU General Assembly 2012
© Author(s) 2012

Evolution trends in vulnerability of R/C buildings exposed to earthquake induced landslide hazard

S. Fotopoulou and K. Pitilakis
Aristotle University of Thessaloniki, Civil Engineering, Thessaloniki, Greece (sfotopou@civil.auth.gr)

The assessment of landslide risk depends on the evaluation of landslide hazard and the vulnerability of exposed structures which both change with time. The real, dynamic vulnerability modeling of structures due to landslides may be significantly affected by aging considerations, anthropogenic actions, cumulative damage from past landslide events and retrofitting measures. The present work aims at the development of an efficient analytical methodology to assess the evolution of building vulnerability with time exposed to earthquake –induced landslide hazard. In particular, the aging of typical RC buildings is considered by including probabilistic models of corrosion deterioration of the RC elements within the vulnerability modeling framework. Two potential adverse corrosion scenarios are examined: chloride and carbonation induced corrosion of the steel reinforcement.
An application of the proposed methodology to reference low-rise RC buildings exposed to the combined effect of seismically induced landslide differential displacements and reinforcement corrosion is provided. Both buildings with stiff and flexible foundation system standing near the crest of a potentially precarious soil slope are examined. Non linear static time history analyses of the buildings are performed using a fibre-based finite element code. In this analysis type, the applied loads (displacements) at the foundation level vary in the pseudo-time domain, according to a load pattern prescribed as the differential permanent landslide displacement (versus time) curves triggered by the earthquake. The distribution for the corrosion initiation time is assessed through Monte Carlo simulation using appropriate probabilistic models for the carbonation and the chloride induced corrosion. Then, the loss of area of steel over time due to corrosion of the RC elements is modeled as a reduction in longitudinal reinforcing bar cross-sectional area in the fibre section model. Time dependent structural limit states are defined in terms of steel material strain. Fragility curves/surfaces are derived for different points in time (0, 20, 40, 60, 90 years) as a function of Peak Horizontal Ground Acceleration PHGA at the seismic bedrock or permanent co-seismic ground displacement PGD at the slope area for both chloride and carbonation induced deterioration scenarios. It is observed that the fragility of the structures generally increases over time due to corrosion. This increase is more pronounced for the chloride induced corroded RC buildings founded on isolated footings.