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Effects of Ground Motion Input on the Derived Fragility Functions: Case study of 2010 Haiti Earthquake

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Empirical fragility functions are derived by statistical processing of the data on: i) Damaged and undamaged buildings, and ii) Ground motion intensity values at the buildings' locations. This study investigates effects of different ground motion inputs on the derived fragility functions. The previously constructed fragility curves (Hancilar et al. 2013), which rely on specific shaking intensity maps published by the USGS after the 2010 Haiti Earthquake, are compared with the fragility functions computed in the present study. Building data come from field surveys of 6,347 buildings that are grouped with respect to structural material type and number of stories. For damage assessment, the European Macroseismic Scale (EMS-98) damage grades are adopted.

The simplest way to account for the variability in ground motion input could have been achieved by employing different ground motion prediction equations (GMPEs) and their standard variations. However, in this work, we prefer to rely on stochastically simulated ground motions of the Haiti earthquake. We employ five different source models available in the literature and calculate the resulting strong ground motion in time domain. In our simulations we also consider the local site effects by published studies on NEHRP site classes and micro-zoning maps of the city of Port-au-Prince. We estimate the regional distributions from the waveforms simulated at the same coordinates that we have damage information from. The estimated spatial distributions of peak ground accelerations and velocities, PGA and PGV respectively, are then used as input to fragility computations. The results show that changing the ground motion input causes significant variability in the resulting fragility functions.