Experimental investigation on the seismic disaster mitigation of unreinforced brick masonry buildings in Northern Pakistan

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The Himalayan region is considered to have the potential to produce earthquakes of magnitude 8.0 or greater once every 100 years. Since the occurrence of an earthquake cannot be prevented; therefore, seismic disaster mitigation remains the only option for the civil society. Unreinforced masonry (URM) buildings, constructed with stone or brick, are very common in Northern Pakistan part of Himalayan belt. The seismic performance of stone masonry was found very poor in October 2005 Kashmir earthquake and was the main source of fatalities as most of the collapsed buildings in the area were constructed with stone masonry. Unreinforced brick masonry (URBM) buildings, however, performed much better than stone masonry buildings, and survived collapse in most of the highly affected areas except Balakot town and in some parts of Muzzafarabad. The performance of URBM would have been much better if buildings were designed and constructed using engineering principles of earthquake disaster mitigation instead of experienced based thumb rules developed by the masons. Taking the lessons from the earthquake disasters of October 2005, the authors carried out an experimental investigation to evaluate and quantify the seismic performance of unreinforced brick masonry (URBM) shear walls constructed using stone dust mortar being widely used in Northern Pakistan, and thus to further promote the research and development for earthquake disaster prevention. In-plane shear-compression tests were carried out on twelve walls, using quasi-static cyclic loading. The effect of geometry and extent of gravity load on various parameters used to quantify seismic performance such as equivalent viscous damping for evaluating energy dissipation capacity, ultimate ductility and drift ratio of the walls is examined and discussed. Finally, drift ratios for performance levels corresponding to various damage levels, for unreinforced brick masonry walls are proposed on the basis of experimental results.
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