Experimental assessment of cyclic shear response of brick masonry walls retrofitted with TRM

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ABSTRACT

As one of the main historical construction materials, masonry is abundant in the built cultural heritage of many earthquake-prone areas of the Mediterranean countries. Earthquake mitigation approaches are now focusing on strengthening solutions with more compatible and ecological materials to improve the in-plane lateral strength and displacement capacity, which are the two most significant parameters when it comes to seismic assessment of masonry buildings [1].

This paper focuses on an experimental program which involves the construction of walls composed of handmade solid clay brick and hydraulic lime mortar, a recurrent typology for historical buildings. The walls were tested under cyclic in-plane actions in three different configurations: unreinforced, repaired and reinforced [2,3]. The retrofitted configurations were obtained by externally bonding textile reinforced mortar (TRM). The investigated TRM system was a continuous bidirectional grid of basalt embedded in hydraulic lime mortar.

The repaired configuration was obtained by first testing the specimens in the unreinforced configuration, and then repairing the damaged wall by filling the open cracks and replacing the damaged bricks ("scuci-cuci" technique). After these works, the specimens were retrofitted and tested again. The aim was to evaluate the response of the strengthening technique as a post-earthquake repair and improve the understanding of the governing parameters of the restored lateral response of the specimen in terms of shear capacity, lateral stiffness degradation, energy dissipation and damping.

The experimental results illustrate the suitability of the proposed basalt TRM for seismic retrofit and post-earthquake repair of existing masonry buildings. The research outcomes highlight the effectiveness of the investigated systems in increasing the resistance and ductility of unreinforced brick masonry. In addition, the results allow a better understanding of the behaviour of masonry walls subjected to cyclic horizontal displacement in terms of displacement capacity. It must be remarked that, for the many current codes, the displacement capacity is an essential parameter when it comes to assessing the ultimate limit state [4].

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