

Enhancing Seismic Flexural Resistance of Historic Masonry Walls using Carbon Fiber Rope

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Abstract:

Earthquake damage to historic masonry buildings has shown the vulnerability of perimeter walls to out-of-plane failure. A common failure mechanism of unreinforced masonry (URM) buildings subject to earthquakes is out-of-plane collapse of the façade either as a result of insufficient flexural strength or due to cracking away from transverse walls and/or floors which provide lateral support. Although the role of transverse walls as bracing elements for the façade walls is very important and suitable connections should exist to spread the horizontal seismic forces among the resisting transverse walls, this paper focuses on the flexural strength of the wall itself. A new seismic rehabilitation technique for historic masonry façades, which utilizes epoxy impregnated carbon fiber rope (CFRP) mounted near the surface of the façade walls, is introduced to enhance the out-of-plane bending capacity. The technique was evaluated under both monotonic and quasi-static cyclic loading conditions. The test results demonstrated the high efficiency of the proposed technique. Significant increases in ultimate capacities, deformability, and energy dissipation were achieved for various reinforcing schemes compared to the behavior of similar unreinforced specimens.

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