Objectives:
Investigate the efficiency of different strengthening schemes on improving the in-plane structural performance of FRP strengthened unreinforced masonry (URM) walls with central openings.

Background:
URM walls is a source of great concern because their failure during seismic events has many times been identified as one of the major causes of property and human losses.

Test Setup

Conclusions:
• FRP composites are efficient in improving the performance of URM walls and NSM GFRP bars were observed to work properly with masonry;
• Vertical reinforcement in the piers significantly increased the stiffness, maximum lateral load-carrying capacity and energy dissipation capacity of URM walls;
• Strengthening with a combination of horizontal and vertical reinforcement significantly improved the overall structural behavior of URM walls including lateral load-carrying capacity, stiffness, and maximum displacement capacity.