# Design of shake table tests of multi-leaf masonry walls before and after retrofitting

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## ABSTRACT

A significant proportion of the built heritage in historic centres is constituted by rubble stone masonry structures. Leaf separation and disaggregation collapses observed after earthquakes highlight that the irregular arrangement, the poor quality of the mortars, and the weak connection between external leaves make perimeter walls dramatically vulnerable, especially under out-of-plane loads. On the one hand, the dynamic response of this type of masonry still needs to be fully investigated as their capacity is often overestimated by the widely used assessment approaches based on rigid-body mechanics [1]. On the other hand, effective retrofitting solutions are needed and, to this purpose, in addition to traditional methods (e.g., tie bars, grout injections, etc.), mortar-based composites, such as fabric reinforced cementitious matrix and composite reinforced mortar have been recently developed [2]. These systems, bonded upon the wall, often with transversal connectors, experimentally proved effective and have already been applied in the field, but cannot be used when the fair-face of the masonry has to be preserved, with a large part of architectural heritage left without suitable retrofitting solutions.

This work describes the design of shake table test on full-scale irregular stone masonry walls, whose materials and arrangement reproduce those surveyed in the historic villages of central Italy struck by the 2016-2017 earthquake sequence. The experimental setup was designed to induce out-of-plane vertical bending under earthquake base motion. A selection of seismic records was applied in horizontal and vertical directions. One wall was tested unreinforced and another one after retrofitting with a hybrid system comprising a composite reinforced mortar overlay on one side and joint repointing with high strength stainless steel wires on the other side. Transversal connectors were also installed. The strengthening solution was designed to preserve the external fair face of masonry, and also included a composite reinforced mortar matrix with thermal insulation properties on the internal face. The objective is twofold, to assess the seismic capacity of poorly designed multi-leaf walls and to evaluate the enhancement of the out-of-plane seismic capacity entailed by the proposed retrofitting solution against leaf separation and disaggregation.

## REFERENCES

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