Comparison between experimental techniques for the evaluation of the compressive properties of brick masonry

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ABSTRACT

Existing masonry buildings, which represent a large portion of the building stock in the Mediterranean area, are usually characterized by the presence of different constituent materials, whose quality often depended on the final use of the constructions. The modifications that existing buildings experienced over time, such as changes regarding the acting loads or the environmental conditions, could have modified the static configuration of the structures and could trigger local damages and crises. Therefore, it is of fundamental importance to assess the safety of these constructions and to determine if some retrofitting intervention is needed.

In this framework, one of the crucial aspects is the mechanical characterization of the masonry typologies. For what concerns the compressive behaviour of brick masonries, several testing methodologies exist for the determination of the compressive strength, the elastic modulus and the Poisson's ratio. In particular, slightly-destructive tests, such as double flat-jack tests and compressive tests on masonry cores, can be performed in place of destructive tests due to their limited invasiveness. However, they could be less representative of the overall behaviour of masonry structural elements. For these reasons, the objective of the research is to evaluate the reliability of slightly-destructive tests in evaluating the compressive properties of masonry.

An experimental campaign is here presented, in which masonry specimens were built with clay bricks and hydraulic lime-based mortar to reproduce a poor-quality masonry typology, similar to the ones usually encountered in practice. Two different specimen geometries were chosen for the execution of standard compression tests on wallets and double flat-jack tests, both monotonic and cyclic. Moreover, masonry cores were also extracted from the masonry specimens and tested in compression. During the tests, displacements were monitored using both displacement transducers and the Digital Image Correlation technique. Compressive strength, elastic modulus and Poisson's ratio were evaluated from each testing methodology. The results obtained from the double flat-jack tests and the tests on cores, in terms of strength and deformability properties, were compared with the results of the standard compression tests, taken as reference. Correlations between the results of the slightly-destructive tests and the standard compression tests were established, obtaining a good agreement and confirming that these experimental techniques can be reliably adopted for the evaluation of the compressive properties of brick masonry.