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Shear strength of brick masonry walls assembled with different types of mortar

Valerio Alecci, Mario Fagone, Tommaso Rotunno *, Mario De Stefano

Department of Construction and Restoration, University of Florence, 50121 Florence, Italy

HIGHLIGHTS

- Brick masonry walls assembled with different kinds of mortar are tested.
- Shear tests on triplets and diagonal compression tests on panels are performed.
- The shear strength under zero normal stress is the parameter obtained.
- A comparison between the values of the shear strength is presented.

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ABSTRACT

The prediction of masonry shear strength, by direct way, requires appropriate experimental tests on triplets, in line with standard EN 1052-3, or diagonal compression tests on panels according to ASTM 509-2010 and RILEM LUMB6. In the present paper the results of an experimental investigation, carried out by these two types of tests on brick masonry walls assembled with different kinds of mortar are reported.

A comparison between the values of the masonry shear strength, calculated applying the three formulas available in literature for the diagonal compression test data, and those obtained by laboratory tests on shear triplets, is presented.

1. Introduction

Masonry constructions still constitute today a large part of the building stock throughout the world. The historical and artistic heritage as well as the "common" residential buildings in the old urban and rural city centres are usually made of masonry.

Masonry material can scarcely bear tensile stress and it is, therefore, known as no-tension material. Furthermore, as it is a heterogeneous material, its mechanical behaviour depends on the geometric texture and the properties of the constituent materials.

In the last decades, seismic events which hit and badly damaged large areas of high density masonry buildings (such as the Umbria and Abruzzo regions in Italy) have increased the interest of the scientific community towards more appropriate modelling strategies to assess the seismic vulnerability of such buildings.

Although structural engineers are developing even more sophisticated numerical procedures, the "accuracy" of the modeling results always depends on the correct identification of a few mechanical parameters required to characterize masonry material. The shear strength under zero normal stress is one of these parameters; its exact definition plays a crucial role in the prediction of masonry behaviour under seismic actions.

Italian Seismic Code [1] in line with Eurocode 6 [2], allows to determine the shear characteristic strength f_{vk0} either through an estimate using a pre-calculated table of values or by a direct way which requires appropriate experimental tests on triplets, in line with standard EN 1052-3 [3].

For existing masonry walls, Eurocode 8 [4] suggests the direct determination of this parameter by diagonal compression tests according to ASTM 509-2010 [5] and RILEM LUMB6 [6] specifications.

Diagonal compression tests are performed on new masonry walls also, as available in literature [7–11] and suggested by Italian Guidelines [12].

Although the diagonal compression test is largely used, the interpretation of the test outcomes and the formula to calculate the masonry shear strength according to ASTM 509-2010 and RILEM LUMB6 specifications have been questioned by several researchers; currently, various interpretations of the test results and different formulas are available in literature [13,14].

In the context of the seismic design of new masonry constructions, the shear strength can be determined by two different kinds of tests, shear triplets and diagonal compression. The former is

* Corresponding author.
E-mail address: rotunno@unifi.it (T. Rotunno).

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