

ABSTRACT

Nowadays, almost all buildings around us, including a great part of historical patrimony, are based on multi-storey load-bearing masonry structure. The security of such constructions, especially when they are subjected to lateral loading, is a growing concern cause, particularly in seismic zones.

In order to contribute to better knowledge of this type of buildings, this work proposes an experimental model of a brick load-bearing structure loaded horizontally until failure and its testing procedure. The model, which will be built at a one-fourth-scale, represents a three-storey typical building with a load-bearing wall of 35-mm-thick in the middle of the plan section, limited by four peripheral load-bearing walls of 72,50-mm-thick. The distance between the walls is 714 mm and typical storey height is 512,5 mm. The load-bearing walls of the model are constructed with bricks and cement mortar manufactured according to real procedures. Thus, the mechanical properties of the materials used in the construction of the model are very similar to the prototype materials.

To better understand the final solution and testing procedure, experimental campaigns previously carried out with similar models have been widely studied. Test results and the main conclusions of these models are shown in the present document.

In addition, this research shows various analysis methods used in the study of resistance on this type of buildings subjected to lateral loading. The results obtained with the application of some of these methods, have been compared with the experimental ones obtained with the reduced-scale building models tested.

Besides, an analytical calculation method based on the overall equilibrium of the structure and the cracking envelopes for the two types of load-bearing walls of the model is used to determine the failure load of the model. The cracking envelopes have been obtained according to theoretical cracking models, developed on previous experimental information with biaxial compression-shear tests involving some panels on fourth-scale brick masonry.

An experimental campaign to characterize the mechanical behaviour of masonry has been carried out. Firstly, bricks and cement mortar were tested to determine their mechanical properties. Also, a series of uniaxial compression tests involving some fourth-scale brick masonry specimens were carried out to obtain the compression resistance and the cohesion of masonry brick. Finally, the two typology of load-bearing panels used on the fourth-scale building model were tested to biaxial compression-shear.

An approximated method to determine masonry angle of friction is proposed in this work. According to the experimental results, more accurate methods should be considered.