The effect of morphology on the structural behaviour of masonry walls

Leslie Alejo*, Nuno Mendes[‡] and Paulo Lourenço[†]

[*]PhD Candidate
ISISE, University of Minho
Campus do Azurém, 4800-058 Guimarães, Portugal
e-mail: leslie.alejoguerra@gmail.com

[‡] Post-Doc Researcher
ISISE, University of Minho
Campus do Azurém, 4800-058 Guimarães, Portugal
e-mail: nunomendes@civil.uminho.pt

[†] Full professor
ISISE, Department of Civil Engineering, University of Minho
Campus do Azurém, 4800-058 Guimarães, Portugal
e-mail : pbl@civil.uminho.pt

ABSTRACT

The earthquakes have been showed that existing masonry buildings can present different types of damage associated to the in-plane and out-of-plane behaviour. The out-of-plane behaviour is complex and depends on several parameters, such as material and geometric properties, stiffness of floors, connection between structural elements and characteristics of the input motions. Several types of analysis and modelling approaches have been used for evaluating the out-of-plane behaviour of masonry buildings, such as the limit analysis based on the kinematic approach with rigid macroblocks.

The out-of-plane failures can occur either due to rigid overturning or local damage associated to the separation of the external leaf. The local damages of masonry are mainly associated to the type of morphology of the wall section, i.e. the type of bond between units and mortar in the transversal direction of the wall. A mortar that is not able to provide an appropriated bond, such as the rubble stone masonry, can cause local damages and decrease load capacity of masonry walls.

This paper presents a study on the influence of the morphology of the cross-section on the seismic performance of masonry walls. A case study was adopted and several numerical analyses were carried out. A 2D numerical model based on FEM and the simplified micro-modelling approach, taking into account the morphology of the cross-section, was prepared. The response of the wall was obtained through the non-linear dynamic and pushover analyses. The response was also compared with the responses obtained from the macro-modelling approach and the limit analysis.