Résumé de thèse de Doctorat de Mme Elodie BULTOT

Titre de la thèse : Study of the out-of-plane behaviour of unreinforced masonry walls

Résumé :
Being one of the oldest building materials, masonry construction is widespread in all regions of the globe and still constitutes the largest part of the built environment in the Mediterranean Basin and Western Europe; masonry is in particular widely used in Belgium.

Despite this wide usage of the masonry construction, some aspects of the masonry behaviour, especially the response of unreinforced masonry walls to out-of-plane horizontal loading, remain to be investigated. In case of earthquake, out-of-plane bending of unreinforced masonry walls is a very common failure mode that can lead to the complete collapse of the structures and is considered as the most serious life-safety hazard for masonry constructions. To overcome this, the out-of-plane masonry walls behaviour must be better understood and failure mechanisms identified.

To develop a new approach to these issues, an extensive experimental campaign was initiated a few years ago to highlight the fundamentals of masonry walls behaviour loaded perpendicularly to their plane. The experimental work consisted of two sets of tests dealing with dry masonry and mortar bound masonry respectively. Small unreinforced masonry walls were tested in 4-point bending. Three bending configurations (vertical, horizontal and diagonal bending orientations) were investigated, for several types of bricks and vertical pre-compression rates.

In parallel, a numerical simulation method has been developed. Validated on the basis of the experimental campaign, it allows to study masonry walls of any geometry made of any kind of bricks or blocks bounded with any type of mortar, enabling the consideration of various scenarios of earthquakes and the identification of the conditions leading to system instability.