ABSTRACT

The present research work presents an experimental campaign of ambient vibration tests performed on twenty infill masonry walls from two buildings under construction and from another existent building. The main objective is to evaluate the influence of the boundary conditions, geometric dimensions, presence of openings with different dimensions as well as the existence of grooves along the wall for the installation of electrical cables, in the out-of-plane main frequencies of the infill walls tested. In the paper, it is presented a detailed description of the studied buildings, testing setups, equipment used, and further information regarding the walls tested. The main test results are presented and discussed.

Keywords: Infill mansory walls, dynamic characterization, vibration tests.

INTRODUCTION

During the last years innumerable studies have been performed in order to understand the seismic behaviour of the infill masonry walls justified by the survey reports after the major earthquake events. In fact, the contribution of infills to the structural response of buildings when subjected to seismic loadings can be favourable or not, depending on a series of phenomena, detailing aspects and mechanical properties, such as the relative stiffness and strength between the frames and the masonry walls, the type of connection between masonry and structures, etc. It is consensual that the presence of the infill walls may increases significantly the in-plane structural stiffness and consequently the natural period of the structure, and it could lead to the attraction of seismic demands to some structural elements that were not designed to resist them (Furtado et al. 2015). On one hand the vertical stiffness irregularity due to the absence of infill panels could introduce a soft-storey mechanism. On the other hand the non-balanced in-plane distribution of infill walls can introduce global torsion in buildings, which can induce large demands in columns that were not considered in the original design.

Moreover, the out-of-plane behaviour of the infills has been confirmed as one of the most critical failure mechanism of this type of non-structural element. Among the factors that can cause the out-of-plane instability, and consequently poor performance, can be listed: i) deficient/insufficient support-width on the reinforced concrete beams and/or slabs, normally adopted to minimize the thermal bridges effect; ii) no connection between the interior and the exterior panel in the case of the buildings’ façade, which are composed by double-leaf masonry walls; and, iii) no connection to the surrounding RC structural elements.

Recently, some experimental studies have been carried out in order to characterize the in-plane and the out-of-plane behaviour of the infill panels (Calvi and Bolognini 2001; Furtado...
et al. 2016). It was observed that the out-of-plane capacity of the infill walls is reduced with the increasing in-plane demands. So, the out-of-plane response should be considered in the numerical modelling of such elements, and the interaction with the in-plane response should be implemented (Furtado et al. 2015; Furtado et al. 2015). To model this non-structural elements, an extensive mechanical characterization is required since many types of infills can be found in different countries, ranging from hollow clay bricks to concrete blocks, thus significant differences can be observed in the infills properties.

RESULTS AND DISCUSSION
The dynamic characterization of the infill masonry walls (Figure 1) can be used as a tool to calibrate numerical models of such type of elements, to evaluate their out-of-plane stiffness and average young modulus. It is also important to quantify the variation of natural frequencies of the walls, in function of the geometric dimensions, boundary conditions, presence of openings such for example doors or windows, and last but not the least the level of damage.

Fig. 1 - Ambient vibration tests on infill masonry walls in a building under construction: a) with different boundary conditions, geometric dimensions; and b) with presence of openings.

REFERENCES