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EFFECT OF MASONRY INFILL WALLS ON THE SEISMIC BEHAVIOUR OF BUILDINGS DURING THE MAY 2011 LORCA EARTHQUAKE

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ABSTRACT

Masonry infill walls are of great importance in the global behaviour of building structures under seismic actions, especially when subjected to in-plane loading. After the earthquake that struck Lorca (Spain) in May 2011 the significance of these elements could be clearly observed: in some cases they constituted the actual lateral load-bearing system, increasing the global stiffness and strength, and, in others, they induced serious damage to structural elements.

Modal and dynamic analyses have been performed on a structural model of a typical building to study the differences in global behaviour between considering only the structure and also considering the external infill walls. Macro models have been implemented to simulate the effect of the infill walls in the structural analysis.

Keywords: masonry infill walls, seismic loading, numerical simulation.

INTRODUCTION

The majority of personal and material damage caused by the 2011 Lorca earthquake was due to falling parapets and brick infill walls. The collapse of these elements was caused by two different mechanisms: parapets failed due to out-of-plane loading, whereas in-plane actions caused the infill walls at ground level to collapse (Álvarez Cabal et al, 2011).

Therefore brickwork can be considered, on one hand, as passive elements that do not resist loads perpendicular to their plane and, on the other hand, as active elements when loaded in their plane, especially when its stiffness and strength are comparable to those of the structure.

Many of the inspected buildings in Lorca had a structural scheme consisting of several bays of parallel reinforced concrete frames supporting one directional floor structures. As a consequence, the structural stability parallel to the floor span was exclusively entrusted to non-structural elements (among which the earlier mentioned masonry infills).

Although it is true that in many cases these elements constituted the actual load-bearing system, they were also responsible for many column failures, what makes them important elements worth consideration.

With the objective of studying the behaviour of masonry infill walls under in-plane actions, a typical building of the San Fernando neighbourhood in Lorca has been analysed, Fig. 1. A structural model has been developed and subsequently modal and dynamic analyses have been carried out to quantify the importance of these elements in the building's seismic performance.

RESULTS AND CONCLUSIONS

The perimeter infill walls are considered in the structural model by means of two diagonal, compression-only, struts in each frame as proposed by Crisafulli (1997), considering the simplifications in the behavioural model according to Verderame (2010). The introduction of these infill walls yields, when compared to the structure-only model, different mode shapes as well as a reduction of their periods of vibration.

Also, the dynamic analyses show that the infill walls imply lower lateral displacements as well as a pronounced increase in total base shear.

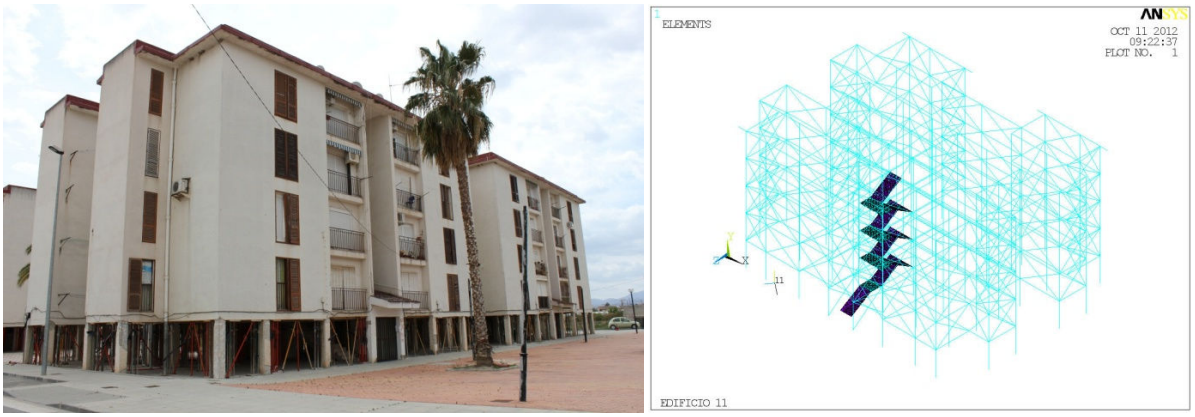

Fig. 1 - Typical build and model

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