

A case study of a building in L'Aquila, Italy for evaluating the effects of masonry infills on the seismic behavior of r.c. frame structures

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Summary

It is known that the seismic response of a structural system is highly influenced, in addition to the earthquake input, by the dynamic characteristics of the system itself. It has been observed during the L'Aquila earthquake that some buildings have shown unexpected good performances. The aim of this paper is to understand why these structures, designed for accelerations lower than those recorded during the L'Aquila's earthquake, have shown performances higher than the design ones. The attention is focused on a real case study of a reinforced concrete frame building structure located in L'Aquila. The paper investigates the role of the masonry infills which, before reaching their ultimate capacity, allows to avoid significant structural damage and excursion in the inelastic range. The seismic behaviour of the examined building is studied within Performance Based Seismic Design approach. In particular, by imposing the performance objectives, an "objectives curve", in the Force-Displacement diagram related to the mechanical characteristics of the structure, is obtained. Both the contribution of the columns and the masonry infills are considered in the evaluation of the Force-Displacement diagram. Then, time-history analyses are performed by applying to the building under study recorded ground motions of the L'Aquila earthquake. A non linear model of the structure, and in particular of the masonry infill, is implemented for the analyses. The examined response quantities are bending moments and chord rotations of columns and beams as well as forces and deformations of masonry infills. For comparison purposes two cases are studied: the first is the bare frame, the second is the infilled frame. These analyses allow to identify the effects of the masonry infills on the response of the case study.

Keywords: masonry infills, L'Aquila earthquake; seismic performances.

1. Introduction

The object of this study is the influence of the masonry infills on the seismic behavior of RC frame structures, with particular reference to the case study of a building located in L'Aquila which was subjected to the seismic event of the 6 April 2009.

On the basis of the data observed by the authors in different inspections in L'Aquila, it was noted that most part of reinforced concrete buildings remained substantially intact and just some masonry infills was more or less damaged. Only in few cases it was observed severe damage to structural elements. Rare were the cases in which failure was reached.

The aim of this paper is to comprehend the reasons why structures, designed for accelerations lower than those recorded during the L'Aquila's earthquake, have shown better performances (with low structural damage) than design ones. It was hypnotized that the masonry infills, generally non