CAPACITY INTERACTION CURVES FORMASONRY WALLS UNDER BIDIRECTIONALSEISMIC LOADING

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ABSTRACT

During an earthquake a wall is subjected to a three dimensional acceleration field and undergoes simultaneous in-plane and out-of-plane loading. The presence of one type of loading on a structural element affects the strength of that element against another type of loading. A considerable number of numerical and experimental studies, carried out to-date to investigate the behaviour of masonry walls under seismic loading, have considered the in-plane or the out-of-plane response of the wall separately without due consideration for any possible interaction between the two responses. In this paper, the results of a series numerical parametric studies are carried out on full scale unreinforced masonry walls are presented. The considered parameters are material properties of masonry and aspect ratio of the walls. Current study is in continuing of the previous experimental and numerical studies carried out by authors before. The parametric studies indicate that the material properties and aspect ratio of the walls has considerable effects of interaction curves of masonry walls. Also the elastic material properties and inelastic material properties in tension are more effective on the in-plane and out of plane loads interaction in masonry walls.

INTRODUCTION

A brick wall undergoing an earthquake global acceleration field is subjected to both in-plane and out-of-plane loads. The former results from the storey shear force under horizontal loading and the latter is either due to the out-of-plane inertia force caused by the considerable mass of the brick wall or the out-of-plane action of a flexible floor on the wall. In previous experimental and numerical studies carried out by authors (Najafgholipour et al, 2013), the results show interaction between in-plane and out of plane loads in unreinforced masonry panels. To complete the results and to investigate the effects of different parameters such as material properties of the masonry and aspect ratio of the wall on the in-plane and out of plane interaction curve of unreinforced masonry walls, a numerical parametric study is carried out and the results are presented in this paper.

Considerable experimental, numerical and analytical studies have been carried out on the behaviour of masonry buildings, particularly under earthquake loading and mostly on the behaviour of brick walls. Most of the researches are carried out on in-plane or out of plane behavior of unreinforced masonry walls without existence of the other loading type.Very few studies were carried out on the numerical response under simultaneous in-plane and out-of-plane loading. Shapiro et al (1994) studied the interaction of the in-plane and out-of-plane responses of brick infills in concrete frames. They carried out a series of tests to investigate the effects of in-plane cracks on the out-of-plane strength. Their test results showed that the in-plane cracks may reduce the out-of-plane strength of infills up to 100%. A similar experimental study was carried out by Falangan et al (1999) on brick infills in steel frames. Recently, Hashemi and Mosalam (2007) conducted an