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A shake table investigation on interaction between buildings in a row

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Abstract. Pounding damage has been observed frequently in major earthquakes in the form of aesthetic, minor or major structural cracks and collapse of buildings. Studies have identified a building located at one end of a row of buildings as very vulnerable to pounding damage, while buildings in the interior of the same row are assumed to be safer. This study presents the results of a shake table investigation of pounding between two and three buildings in a row. Two steel portal frames, one stiffer and another more flexible, were subjected to pounding against a frame with eight other configurations. Three pounding arrangements were considered, i.e., the reference frame (1) on the right of the second frame, (2) in the middle of two identical frames, and (3) on the right of two identical frames. Zero seismic gap was adopted for all tests. Five different ground motions are applied from both directions (right to left and left to right). The amplification of the maximum deflection due to pounding was calculated for each configuration. The results showed that, for the stiffer building in a row, row building pounding is more hazardous than pounding between only two buildings. The location of the stiffer frame, whether at the end or the middle of the row, did not have much effect on the degree of amplification observed. Additionally, for all cases considered, pounding caused less amplification for stronger ground motions, i.e., the ground motions that produced higher maximum deflection without pounding than other ground motions.

Keywords: seismic pounding; structure-structure interaction; row of buildings

1. Introduction

Seismic pounding occurs when two adjacent structures or parts of a structure vibrate out of phase and the separation distance is too small to accommodate the relative closing displacement. Pounding causes the structures to exert repeated hammer like blows on each other which may cause minor non-structural or severe structural damage that may even lead to the complete collapse of buildings (Rosenblueth and Meli 1986). Surveys after almost all major earthquakes in urban areas have found the presence of damage due to pounding of buildings and bridges (Kasai and Maison 1997, Anagnostopoulos 1996, Palermo *et al*. 2011, Chouw and Hao 2012). Several urban seismic vulnerability surveys have identified pounding as one of the major hazards (Jeng and Tzeng 2000, Bothara *et al.* 2008). Bothara *et al.* (2008) considered pounding as a critical structural weakness in the seismic assessment of Wellington city in New Zealand and found the

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