Importance of Separation Distance on Building Pounding under Near-Fault Ground Motion, using the Iranian Earthquake Code

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Abstract

This paper investigates the effects of building pounding in RC building under near fault ground motion. Building pounding is the collision of adjacent building when ground vibrates, and buildings experience contacts in two typical ways: floor-to-floor and floor-to-column. Using the Iranian code to investigate pounding in RC buildings, three records of near fault earthquakes are used, where the near fault earthquakes have occurred: Kobe, Tabas and Taiwan. For this challenge, two buildings have been modeled with five and nine stories. Their models have been analyzed with the three records mentioned. Distance between buildings is 27 cm, as recommended by Iranian earthquake code. By comparing the computationally calculated time history of lateral displacements with the pre-designed gap, the results of this investigation suggest that there may be a common under-estimation of this gap in considering the Iranian regulatory separation distance between regular buildings.

Keywords: Building Pounding, Collision, Near-Fault Ground Motion, R/C buildings.

1. INTRODUCTION

Commonly earthquakes cause displacements in buildings. Due to close proximity of some structures, these lateral displacements can cause the collision of adjacent buildings. This behavior of buildings that have been found to impact each other during earthquakes was reported in the engineering technical literature, and it can inflict significant damage to structures and even collapse in some cases. Since all the structures can exhibit dramatic movements when they vibrate under earthquakes, building pounding is a special event for engineers to investigate and to assess the numerical study of collision. These collisions can be different depending on the structures that collide, but often they have been simulated with two typical models: floor-to-floor and floor-to-column (Figure 1). In such cases the buildings should be designed to resist the pounding loads, or alternatively be equipped with vibration mitigation devices that would counter or absorb the developed forces.

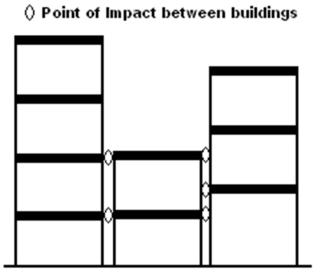

Figure 1. Pounding building cases under seismic excitation

The numerical formulation of building pounding is solved by a matrix equation of building motion. The matrices include buildings mass, their stiffness and their damping. The instantaneous loading can be of two different types: random and periodic. The governing structural equation of motion can be written as: