

EVALUATION OF THE POUNDING ON THE COLUMNS OF A MID-RISE BUILDING IN TERMS OF SHEAR FORCE DEMANDS

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Abstract: *In some of the earthquake-prone areas such as Türkiye, many buildings are constructed as adjacent with insufficient gaps, which causes colliding during an earthquake. Although this collision may cause severe damage to the structural elements, many seismic codes do not consider this pounding effect in the estimation of the seismic performance of the adjacent buildings. The collision may occur either between slab-slab or slab-column depending on the level of the stories. It is well-known from the literature that slab-column collision may result in more extensive damage to the building and the most dominant damage type induced to the columns due to slab-column collision is shear damage. In this study, the shear force demand of the columns of an adjacent building was investigated with and without considering the slab-column pounding effect. Since the adjacent buildings constructed with insufficient gaps are generally mid-rise, especially in Türkiye, the considered building in this paper is a 6-story RC frame building. Nonlinear analytical models of the existing building were prepared in SAP2000 as stand-alone and adjacent to one side and nonlinear time history analyses (NTHA) were performed for 11 ground motion records. Different approaches exist for defining pounding elements analytically, with the penalty (force-based) method being the most common and the force-based method was considered for defining pounding elements in this study. In this method, springs representing the impact stiffness of the colliding structures are utilized and they can be considered linear or nonlinear (Hertz). A sensitivity analysis was performed to select the most convenient spring type. To accomplish this, a nonlinear time history analysis was performed on a building adjacent to another one, considering both linear springs and Hertz models as pounding elements. The goal was to determine the spring type that would yield the most reasonable induced shear forces on the columns due to the pounding effect. After selecting the appropriate pounding element and conducting 11 nonlinear time history analyses for both standalone and adjacent buildings, the shear force demands on the columns were estimated, and the shear force increase rates resulting from the pounding effect were calculated. Furthermore, a comparison was made between the shear force demands on the columns when they were alone versus when they were adjacent, taking into account the shear force capacity.*