NUMERICAL STUDIES ON RESIDUAL SEISMIC CAPACITY OF RC FRAMES WITH UNREINFORCED BLOCK WALL BASED ON THEIR CRACK PATTERNS

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Abstract

In this study, two Concrete Block (CB) infilled reinforced concrete frames which had been experimentally investigated before are numerically simulated to develop pre- and post-earthquake seismic evaluation method. In these simulations, full scale, one bay, single story specimens having different axial loads in columns are analyzed under cyclic and push-over loading. Then, the contribution of Unreinforced Masonry (URM) walls to overall behavior is examined. Parameters including stiffness, ductility, strength, crack patterns and widths in walls and frames which may be of great significance in terms of post-event assessment are also studied. In this paper, the relationship between observed damage and seismic performance mainly focusing on crack width in URM walls is discussed by means of smeared crack, homogenized, isotropic modeling.

Keywords: masonry infill, RC frame, residual capacity, crack width

1. INTRODUCTION

Regarding the fact that annual death toll of earthquakes in Iran reaches to 4000 people and a large number of people who lost their lives in earthquakes, inhabited in unreinforced masonry houses, seismic assessment of these structures in order to perform an optimized method and quantity of rehabilitation, seems to be a challenge. A considerable number of demolished structures are located in earthquake-prone areas and hence had probably experienced some earthquakes in the past. So they have undergone some damages in their load-bearing and non load-bearing elements. In that case, determination of residual capacity of these buildings is an invaluable key to decide whether a typical building is worth rehabilitation or not. Since simplicity and feasibility of each assessment process should be an indispensable factor, the required parameters for assessing a building should be kept as less as possible and easily acquirable. In response to this need, a method proposed by Choi et al. [1] can assess the residual seismic capacity of reinforced concrete frames with unreinforced block wall based on their crack widths. Since by now, few investigations have been made on quantity-oriented seismic assessments of concrete frame with masonry infill panels.

2. SELECTION OF THE MODELS

To satisfy the objective of this study, and in order to have an experimental work to verify the results with them, the models are exactly the same as Nakano's et al. [2].

Figure 1 shows the simulated models. To determine the effect of infill wall on different aspects of the combined system's behavior, the bare frame was modeled first. By exerting different amounts of vertical loads, the models represent bare and infilled frames in different stories. The axial loads applied in each column are 720 KN ($4N/mm^2$) and 180 KN ($1N/mm^2$) for simulating the 1st and the 4th story, respectively. Models B1, B4, I1 and I4 represent Bare and Infill frames of the 1st and the 4th story, respectively.