Seismic Demand of RC Moment Frames with Infill Masonry Walls

Hosein Ghaffarzadeh[1], Leila Keyvani[2], Mona Rahmani[3]

1- Assist. Prof., Faculty of Civil Eng, University of Tabriz, Tabriz, Iran
2- M.Sc. Student of Structural Eng., Faculty of Civil Eng, University of Tabriz, Tabriz, Iran
3- M.Sc. Student of Earthquake Eng., Faculty of Civil Eng, University of Tabriz, Tabriz, Iran

lkeyvani@dr.com

Abstract

Infill masonry walls are commonly constructed in the exterior frames of RC moment frame buildings. Their effects on the behavior of the RC moment frame buildings typically are ignored during design process. This study investigates the effect of infills on seismic characteristics of RC moment frames. A typical 4-story intermediate RC moment frame was designed for a specified seismic hazard level and satisfies the minimum requirements of relevant codes. To evaluate the effects of infills, masonry walls are added in exterior frames. A nonlinear 3D analysis was performed to determine maximum plastic rotations, plastic hinge formation pattern, drift demand, lateral stiffness and strength. The results were compared with the behavior of the initial RC moment frame without infills. The results show significant differences in seismic demands of the entire structure, such as decrease in drift and ductility.

Keywords: infill masonry wall, seismic demand, RC moment frame, nonlinear analysis.

1. INTRODUCTION

Masonry walls are one of the most common type of infills used in some parts of the world in buildings especially RC frames. Iran, Turkey, Colombia, Middle East, Mexico and Algeria are some countries use masonry walls as infills within the frames. Engineers during the analysis and design process typically ignore the effect of infills and the only contribution of walls such as other non-structural elements are their masses. Where as masonry walls develop a strong interaction with the boundary frames when subjected to the lateral loading. The performance of theses structures in a sever earthquake remains a major discussion today.

In recent years, standards recommend guidelines to design more ductile structures to dissipate the energy of earthquake, thus RC frames built in earthquake-prone regions should possess ductility, or the ability to sustain significant deformation under extreme loading condition, but Infills affect the dynamic characteristics of structures and most of time enhance the strength and stiffness of buildings, but the increase in stiffness lead not necessarily to an increased seismic resistance of the entire structure. The increased stiffness of the building due to the presence of infills reduces the ability of the frame to flex and deform.

During the last decades significant experimental and analytical researches has been conducted, in order to find a rational explanation for the effects of infills on the structures [1, 2, 8]. Different types of analytical macro-models, based on the physical understanding of the overall behavior of an infill panel, were developed over the years to imitate the behavior of infilled frames [3] single strut model is the most widely used, of the available models [3, 5, 6]. This method was introduced by polyakov for the first time [7]. Most of the researches are evaluated as a 2D test or analysis that cannot realistically show the effect of masonry in a 3D building especially with unsymmetrical distribution of walls [2, 8].

The aim of this study is to evaluate the effect of masonry infills on the response of RC building. A 4 story RC moment frame was selected. Infills were added asymmetrically to the perimeter frames in accordance with the plan. Nonlinear 3D Pushover analysis was performed to capture the differences between the behavior of the building with and without contribution of infill walls.