Seismic Retrofitting by using Friction damper in Horizontally Irregular Infilled Structures

M. R. Tabeshpour, A. Azad, A. A. Golafshani
1-M.R.Tabeshpour Faculty of Engineering sabzevar Tarbiyat moalem University
2-A.Azad Civil Engineering Department Sharif University Kish Campus
3-A.A.Golafshani Civil Engineering Department Sharif University

tabesh_mreza@yahoo.com
amir0azad@gmail.com
golafshani@sharif.edu

Abstract

Steel frames with masonry infill walls are common systems in the ordinary residential structures. High stiffness value of the infill walls has significant effect on the behavior of structure, torsional problem is the one them. A friction damper device can be used to minimize torsional effects in the structure. Nonlinear analysis and modeling of the infill walls and the damper is done by "Opensees" [1]. Results show that the presence of infill walls can lead to severe torsion increase through the frame which can be solved by using friction damper device. This technique can benefit the complete capacity of structure with minimum intervention in the structure and architecture.

Keywords: masonry infill walls, torsion, nonlinear analysis, friction damper device.

1. Introduction

An ideal form of structure is considered normally in order to analyze the structure, which undoubtedly has differences with its actual model. The actual model has also some differences with the computational model such as defects in the existence of infill walls, which will be neglected from their effects on the structure analysis and design. Distribution of these elements and their effects on stiffness and lateral strength of the constructions have generally overlooked during the design process. Seismic retrofitting of the structures needs detailed evaluation of these elements in reaction of structures to the applied loading. Although existence of the infill walls basically provides higher stiffness and strength for the frames, but their detrimental effects on the structure performance is ignored due to lack of adequate information about the behavior of frames and infill walls. Meanwhile, recent studies has shown that different arrangements of stiffness, mass and strength towards each other can have significant effect on structure behavior and their response parameters[2].Upon changing the arrangement of infill walls, the centers of stiffness and strength through the structure will be changed which can cause torsion to be appeared. Finally, low strength and ductility, high weight and severe decrease in strength under seismic loads can be among the main reasons of failure in structures with brick walls. Reconnaissance of recent earthquakes indicates that to implement a system-based capacity assessment method, these critical (weak) points are appropriate to choose proper technique to adequate strengthening of them.

The principal function of a structure is to transfer the effective loads, significant part of which has dynamic nature (seismic, harmonic and impactive), to the foundation as well as the soil beneath it. Safe and effective transmission of these loads as well as providing the necessary silence for serviceability requires that vibrations and their relevant forces be decreased and limited through the structural and nonstructural components. Therefore, in recent years some significant efforts have been implemented on researching the structure control devices particularly during earthquakes, which has led to prevalent advancements in using these instruments during two recent decades. Generally, structure control systems are used to decrease the responses of structure (movement, speed and acceleration) and utilizing these systems seems to be an appropriate strategy for seismic energy dissipation and protection of structure against earthquake loads.