COMPARING NONLINEAR BEHAVIOR OF TRF AND EBF LATERAL RESISTANT SYSTEMS UNDER CYCLIC LOADING

Mahdi GORZIN
MSc. Graduated in structural engineering, University of Zanajn, Zanajn, Iran
mahdigorzin@yahoo.com

Mostafa GHASSEMI
MSc. Graduated in structural engineering, University of Zanajn, Zanajn, Iran
m_ghassemi@znu.ac.ir

Hossein TAJMIR RIAHI
Assistant professor, University of Isfahan, Isfahan, Iran
tajmir@eng.ui.ac.ir

Keywords: T-shape Resistant Frame, Eccentrically Braced Frame, Cyclic Behavior, Nonlinear, Energy Dissipation

ABSTRACT

Selecting a proper lateral seismic resistant system is an essential part ofany structural design. There are many parameters for assessment of structures such as strength, stiffness, ductility and energy dissipation. Nonlinear behaviour of a seismic resistant system is a determinant parameter in strongearthquakes. Each lateral seismic resistant system has some advantages and disadvantages that help engineers to select the best one for the specific project situation. There are many systems which are used as resisting system against earthquake excitation. The most common systems are moment resisting frame (MRF), concentrically brace frame (CBF) and eccentrically brace frame (EBF). EBF has shown better behaviour in the past earthquakes in accordance with the other mentioned systems. T-shaped resisting frame (TRF) has been proposed recently as a ductile lateral resistant system. In this paper, nonlinear behaviour of TRF under cyclic loading is compared with EBF system. Effects of vertical member's web thickness of TRFs and its stiffeners distances are studied. Comparison parameters are Vonmises stress distribution, hysteresis curves, dissipated energy, viscous damping ratio and side column axial forces. Two dimensional single story steel frames are designed using EBF and TRF in the same condition. Then, a standard cyclic loading is applied to the models and the results are extracted and compared. Results show that vertical member's web of the TRFs play a role as link beams in EBFs. Maximum energy dissipation is damped by vertical member's web. Side columns forces of the EBF are more than the TRF ones because of components of the diagonal bracing in EBF systems. Investigations on hysteretic curves demonstrate that energy dissipation of TRFs are appropriate in accordance with EBF one and confirm stability of the TRF hysteretic curves.

INTRODUCTION

Improving computers and simulation abilities paved the way for novel ideas analysis in modifying seismic behaviour with high precision and less cost.Structures should have appropriate stiffness and strength to resist earthquake excitements and prevent major structural damages. Selecting a suitable lateral resistant system requires to know seismic behaviour of different systems. A well-designed system has enough strength, stiffness and ductility simultaneously and has a cost effective structure. Moment resisting system and bracing systems are most popular structural systems among all the structuresdue to their advantages. Moment resisting frames (MRFs) contain beams and columns which are connected to each other such that