SEISMIC EVALUATION OF STEEL DUAL SYSTEMS AGAINST ARTIFICIAL EARTHQUAKES

S.MojtabaALIAN AMIRI
Ms.c. Student, Semnan University, Semnan, Iran
mojtabaalian@yahoo.com

ElmiraSHOUSHTARI REZAVNI
Ms.c Student, Amirkabir University of Technology, Tehran, Iran
elmira.shoushtari@aut.ac.ir

RezaVAHDANI
Assisstant Professor, Semnan University, Semnan, Iran
reza.vahdani2001@gmail.com

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ABSTRACT

Dual systems in form of steel moment frames accompanied with chevron bracings are among commonly used systems in high seismicity regions in the world. Therefore, the recognition of their seismic behaviour is of high importance. Except a few parts of the world that have sufficient earthquake records, artificial accelerograms can be used in other regions. One method for generating artificial accelerograms is using wavelet transform. In this paper, 5-, 10-, 15- and 20-story structures are designed according to ASCE7 requirements. Spectra matching process is performed for 44 earthquake records. Pushover and nonlinear time history analysis is done in order to investigate seismic behaviour of this system against real and artificial earthquake records. It can be concluded that responses against artificial records has far less dispersion, while the average responses in these two sets of records are approximately the same.Incremental dynamic analysis is done, and adjusted collapse margin ratios are calculated, in order to check whether frames can meet the FEMA-P695 criterion. Fragility curves are obtained to know the probability of collapse for these earthquakes.

INTRODUCTION

Special concentrically braced frame systems (SCBF) allow yield and buckling of braced frames, and yield of joints for energy dissipation. SCBF's are considered as one of the most widely used bracing systems in seismic regions. Structural engineers have shown greater tendency to utilize these systems in the last decades as special moment resisting frames systems (SMRF) proved inefficient in Northridge earthquake of 1994. Prior to this earthquake, SMRF systems were considered as one the best structural systems for seismic regions. But the above mentioned earthquake as well as other recent earthquakes created brittle fractures in the joints of these systems, ultimately breaking experts' trust in these system. SCBF systems are intrinsically hard systems that can absorb seismic waves by structural and non-structural formations that are significantly small. As a result, considerable volume of research has been conducted on SCBF system with the main objective of system improvement and joint efficiency.

Requirements for dynamic analysis in special cases such as design irregularities or uneven distribution of mass and stiffness in the height of buildings are mentioned in most of seismic regulations. Due to its simplicity and the special attention paid by guidelines to designing spectrums, the response spectral analysis method is widely used in most of the linear analyses conducted for structural designing. However, the