ASSESSMENT OF SEISMIC RESPONSE OF MID-RISE STEEL BUILDINGS WITH STRUCTURAL CONFIGURATION OF FRAMED TUBE SKELETONS

Masoud AZHDARIFAR
M.Sc. Student at Kharazmi University, Faculty of Engineering, Tehran, Iran
masoudazhdarifar@yahoo.com

Afshin MESHKAT-DINI
Assistant Professor at Kharazmi University, Tehran, Iran
meshkat@khu.ac.ir

Abdol-Reza SARVGHAD MOGHADAM
Associate Professor at International Institute of Earthquake Engineering and Seismology, Tehran, Iran
mogadam@iiees.ac.ir

Keywords: Non-Linear Dynamics, Steel Skeleton, Framed Tube, Strong Ground Motion, Velocity Pulse

ABSTRACT

In this research, the performance abilities of tube type lateral load resistant framed systems are studied in order to assess the dynamic response of mid-rise steel structures subjected to both far and near-field earthquake records. For this purpose, four 10 story structural models with separated framed tube based skeletons were selected and designed. The structural models have been designed according to the Iranian seismic code 2800 (third edition). The main criterion which was considered to select strong ground motions for performing nonlinear time history analysis is the existence of high amplitude and long period pulse or a multiple pulse feature in the velocity time history of each earthquake record. Assessment of the analytical results should emphasize on the importance of both lateral displacement and drift of all stories which must be considered exactly during the design process. Additionally, it was concluded that the maximum drift demand is about 0.035. The upper level of rotation of rigid connecting zones was calculated higher than seven percent of a radian. Generally, it was concluded that, the seismic response of mid-rise steel structures with framed tube skeleton is dramatically influenced by those strong earthquake records which are able to display energized long period pulses in their time histories.

INTRODUCTION

According to the engineering buildings observations associated with structural failures during the last earthquake tremors, there are some absolute uncertainties about the risks of near-fault ground motions on structures with conventional constructions. Structures response parameters under earthquakes are fundamentally different from those caused by wind or gravity loads. It is obvious that, much more detailed analysis and conceptual explanations would be faced while subjected to strong earthquake loads (Coull and Bose 1975, Bungale and Taranah 2005).

One of the systems used in the construction of mid and high-rise buildings are rigid tubular forms which can provide the structural efficiency for different performance levels. A framed tube skeleton can be defined as a three-dimensional system that provides very stiff structural bents which form a "tube" around the perimeter of the building. It is quite desirable to concentrate as much lateral load-resisting system components as possible on the perimeter of tall buildings to increase their structural depth and in turn, their resistance to lateral loads. This system consists of closely spaced exterior columns tied at each floor level by spandrel beams to produce a huge bent containing orthogonal rigidly frame panels which entirely forms a