Case Study On a Nonlinear Static and Dynamic Behavior of a 2D-Story Steel Frame with Different Configuration

Landry Wilfried Tim Sob, Changgen Deng, Moneef Mohamed Elobaid Musa

Department of Structural Engineering, Tongji University, Siping Road, Shanghai, CHINA

Md Nasir Uddin, Faharidine Mahamoudou

Department of Disaster Mitigation for Structure, Tongji University, Siping Road, Shanghai, CHINA

Contact:landrytim@tongji.edu.cn

Abstract

This paper investigated the seismic performance of steel frames under earthquake motion. Two-story steel frames were designed based on a code-design method for a medium and high-risk seismic zone. The frame's nonlinear static and dynamic analyses have been performed using OpenSees software and sap2000. We consider diverse configurations, concentrated plasticity, and fiber-model were employed. The results obtained in the analytical study concluded that the user design method was reasonable and the mean maximum drift of the frames under the ground motion sets was in an acceptable range.

Keywords: nonlinear static analysis; dynamic analysis; earthquake motion; steel frame; concentrated plasticity model; fiber model.

1 Introduction

A.Elnashai et al. (1) Presented how stiffness is the most pertinent parameter in responding to serviceability requirements under the frequent small earthquake. Strength is utilized to control the level of inelasticity under the infrequent medium-sized earthquake; finally, collapse prevention under the large rare earthquake is most affected by ductility. A.Chopra(2) explain the theory and application to earthquake engineering. Two-story steel frames were designed for a seismically active area using the Chinese Seismic Design Code (3) to address this issue. OpenSees software (4) was employed for nonlinear static and dynamic analyses.

2 Elastic Analysis

The 2-story steel frame structure is to be designed. The seismic design of the frame is carried out. The structure is assumed to be located on medium-stiff soil (500≥ V_s >250) (class II), in Sichuan Province, a region with a Seismic Fortification Intensity of 8 (basic acceleration of ground motion of 0,20g). The seismic loads and seismic design criteria used for the structure were established according to "GB 50011-2010 Code for Seismic Design of Buildings".

2.1 Loads Assumption

Considering two uniformly distributed loads (Live load, superimposed dead load) and a span between planar frames of S = 4,00 *m*, the linearly distributed loads acting on beams were summarised in Table 1.

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