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The Timber Floor Seismic Design by Means Finite Element Method

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Abstract

To improve accuracy results of numerical analysis, the finite element method software needs to use appropriately with considering accurate input data. Among several factors in realistic and economical seismic structural design, the damping ratio needs to be investigated as a calculated and input data in numerical analysis. In the present study, the effect of accurate damping ratio on timber floor seismic design has numerically been examined. The 6 first modes from a series of eigenvalues were selected to calculate natural frequency and damping ratio. The seismic results with and without applied calculated damping ratio were compared. The strain, displacement, and seismic load response are interpreted. The numerical analysis results were showed that the higher nonlinear displacement occurs in timber floor when the damping ratio was modified in numerical modeling. It was found that the floor seismic design is more critical compared to a column in select accurate damping ratio. The damping ratio has highly effect on timber floor seismic design.

Keywords: Timber Floor; Seismic Design; Damping Ratio; Strain; Displacement.

1. Introduction

The floor of a structure is the critical part in seismic design. The floor plays an important role in load transferring and controlling seismic strain energy during developing displacement and nonlinear deformation. The several structural collapse start from the floor and collapse extended with unbalancing transferring load mechanism in structure through development strong inertial interaction and accelerates increasing structural elements eccentricity, finally results in fast structural collapse. The floor reacts with deformation and displacement when it is under loads, and unallowable displacement and deformation depend on floor geometry, mechanical properties of materials and nature of applied. However, the select accurate or near accurate damping ratio is very essential in a timber seismic design with simulate strain energy interaction mechanism. The floor of timber building have been investigated and the enhancement of seismic resistance of timber structure was studied [1-3]. There is a report on the improvement of the seismic resistance of historical industrial timber buildings [4]. Several research were reported on timber beam and column to study displacement, strain energy and seismic load sharing [5-7].

In the present study, based on elasticity method is applied in numerical analysis, it aims to enhance the timber structure seismic design with realize strain energy concept. However, in the literature, the effects of seismic loading on timber frame has been reported, and the timber seismic response is analyzed [8], and on the other hand to minimize error in solving elasticity problem several investigations were described [9-10], and it has been observed that the concept of strain energy and damage under different strain rate have been reported in the literature [11-14].

The tall mass-timber buildings subjected to wind loads [15], the post-tensioned rocking timber wall systems [16], the timber-framed house subjected to the wind loading [17], seismic resisting of timber structures [18] have been

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