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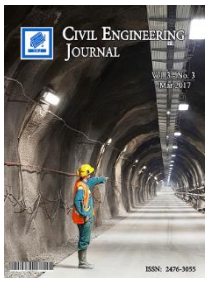

The Effects of Using Different Seismic Bearing on the Behavior and Seismic Response of High-Rise Building

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Abstract

The effects of using different seismic bearings were investigated to reduce the seismic response of buildings by assuming the vulnerability of 20-story regular RC building in this paper. The method of this study was that the studied building was studied in three different models in terms of its connection to the foundation. In the first model, the structures were placed on the rigid bearing and in the second and third models; lead-rubber bearings and friction pendulum bearings were placed at the counter between the structure and foundation, respectively. Then, the dynamic analysis was used to assess the behaviour and seismic response of the mentioned models. The results of the study showed that the structures in the first model functioned like cantilever column that would become uniaxial and biaxial bending under the effects of earthquake around the vertical axis of structure. Due to the tensile (tension) weakness in concrete, seismic loads caused major cracks in the tension part of the structures according to the place of the neutral axis that could lead to the collapse of structure. In addition, the use of mentioned seismic bearings under the earthquake caused the structure like a semi-rigid box slid on this equipment that reduced the structure's stiffness and increased the period of the structure in comparison with the first model. Using the studied seismic bearings caused the displacement of the roof of the first and twentieth stories of the structure become approximately equal and prevented the creation of the bending moment in the first model. The results of non-linear time history analysis showed that using the studied seismic bearings caused the response of the structure reduced significantly when the structure was placed on rigid bearings. It could be very valuable regarding the limitation of the capacity of the structure's members.

Keywords: Seismic Retrofit; High-Rise Building; Lead-Rubber Bearings; Friction Pendulum Bearings.

1. Introduction

One of the important issues in the existing buildings is their design in accordance with codes that are developed many years ago and these codes have been revised several times so far. By investigating the behavior of existing buildings against recent earthquakes and assessing the vulnerability of structures (especially in areas that earthquake accrued less during these years), it has been observed that these buildings are vulnerable to the earthquakes.

With the advancement of computers and consequently structural analysis-design softwares, great change happened in the civil engineering sciences that lead to the correction and permanent promotion of the codes. Besides, with the progress and development of seismographs, it was revealed that a significant number of earthquakes (especially earthquakes occurred near fault) had significant acceleration components which were much larger than the normal values stated in the codes (0.35 g - 0.4 g) respectively. The design of structures with high importance against accelerations much greater than the code's values is costly in terms of economic and very space-occupying and improper design. Because of the mentioned causes, using energy dissipation devices in structures due to the significant dissipation of energy caused by earthquake is one of the solutions against acceleration of bedrock in seismic design of structures.

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