UNIVERSITI TEKNOLOGI MARA

SEISMIC PERFORMANCE OF TWO-STOREY RC FRAME WITH AND WITHOUT SPECIAL BASE ISOLATION UNDER IN-PLANE QUASI-STATIC LATERAL CYCLIC LOADING

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ABSTRACT

The 2015 Ranau Earthquake caused severe damages to the RC building which was designed and constructed using British Standard (BS8110) known as a non-seismic code of practice. This study assesses the seismic performance of RC frame with and without special base isolation designed using BS 8110. Four special base isolations designed for the low-rise building were delivered to Heavy Structural Laboratory, UiTM Shah Alam, Selangor, Malaysia. The special base isolation was installed on the strong floor and bolted together using the highly treaded rod. The special base isolation acts as the energy absorber that can absorb the earthquake energy by isolating the building from the ground motion. The RC frame was designed, constructed, and tested under in-plane quasi-static lateral cyclic loading. After the construction of RC frame with special base isolation was tested in laboratory was completed, four number of base isolations were removed from the strong floor and replaced with I steel beam. The foundation beam of the RC frame without special base isolation was bolted to the strong floor using a highly treaded rod. The seismic response was compared between RC frame with and without special base isolation in order to establish the effectiveness of the special base isolation as energy dissipators in RC frame which designed using a non-seismic code of practice. Subsequently, the structural response of the two-story RC frame was assessed under six past earthquake records using the Ruaumoko 2D and Dynaplot Program. These earthquakes are the 2015 Ranau Earthquake, the 1971 Pacoima Dam Earthquake, the 1985 Mexico City Earthquake, the 1995 Kobe Earthquake, the 1940 El-Centro North-South and the 1940 EL-Centro East-West Earthquake. The seismic vulnerability and deformation capacity of RC frame under moderate and significant earthquake records and Designed Basic Earthquake and Maximum Considered Earthquake for Malaysia were assessed. The results showed that the RC frame with special base isolation can be classified as Ductility Class Medium (DCM) compare to RC frame without special base isolation only Ductility Class Low (DCL). It can be observed that the RC frame with special base isolation only behaves in the elastic region with a low lateral load absorb on structure as compare to RC frame without special base isolation behave in elastic and non-linear behaviour. The special base isolation absorbs the energy from the earthquake and protects the structures from severe damage. The effectiveness of the additional damping provided by the special base isolation is adequate in resisting earthquake load with 0.12g PGA and lower. An average equivalent viscous damping for RC frame with special base isolation after conducted experimental work is 17.44% instead of 5.46% damping for RC frame without special base isolation. However, it is still insufficient to decrease lateral displacement of the RC frame with special base isolation when subjected to 0.214g PGA and above. RC frame with special base isolation sustained under DBE and MCE for Type 1 and Type 2 earthquakes with no structural damage and moderate or slight damage as compared to RC frame without special base isolation which experience extensive damages and subsequently high damage and unsafe to be occupied after the earthquake. This findings showed that the RC frame with special base isolation can withstand with the highest recorded earthquake in Malaysia, known as the 2015 Ranau Earthquake with 6.0 magnitude and a peak ground acceleration of 0.12g with only slight damages.

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