UNIVERSITI TEKNOLOGI MARA

SEISMIC PERFORMANCE OF BEAM-COLUMN JOINTS WITH FUSE BARS UNDER IN-PLANE LATERAL CYCLIC LOADING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree of qualification.

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ABSTRACT

The 2015 Ranau earthquake caused severe damage to the RC beam-column joint of school buildings in the Kundasang region, resulting in a soft-story mechanism. These buildings were designed and constructed using British Standard (BS8110), a non-seismic code of practice. As a solution for this problem, this study assesses the seismic performance of beam-column joints with fuse bars designed using Eurocode 8 and without fuse bars designed using BS8110 for a two-story RC school building prototype. The fuse bars were designed using the Pushover Analysis and incorporated in the seismic beam-column joints as passive energy dissipators to enhance the energy dissipation capacity of the beam-column joints. Three super-assemblages, corner beam-column joint, interior beam-column joint, and exterior beam-column joint with fuse bars, were designed, constructed, and tested under in-plane lateral cyclic loading. The seismic response comparisons between beam-column joints with and without fuse bars were made to establish the effectiveness of fuse bars as energy dissipators in beam-column joints. Subsequently, the global structural response of the two-story RC school building was assessed under eight past earthquake records using the Ruaumoko 2D and Dynaplot Program. The seismic vulnerability and deformation capacity of each joint under moderate and significant earthquake records and DBE and MCE for Malaysia were assessed. The results show that beam-column joints with fuse bars have Ductility Class Medium (DCM). The beam-column joints with fuse bars also have higher stiffness and lateral strength capacity. The effectiveness of the additional damping provided by the fuse bars is adequate in resisting earthquake load with 0.12g PGA and lower. But it is still not sufficient to decrease lateral displacement of the beam-column joints when subjected to 0.214g PGA and above. All three beam-column joints can also sustain under DBE and MCE for Type 1 and Type 2 earthquakes. The findings show that the beam-column joints with fuse bars can withstand the highest recorded earthquake in Malaysia, the 2015 Ranau earthquake with 6.0 magnitude and a peak ground acceleration of 0.12g.

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