EVALUATION OF THE SEISMIC RESPONSE OF A REINFORCED CONCRETE FOOTING TO INCREASING PEAK GROUND ACCELERATION USING PSEUDO-DYNAMIC EXPERIMENTATION

S. Hossell & C. Roth

University of Pretoria

Contact: chris.roth@up.ac.za

ABSTRACT

The pseudo-dynamic experimentation technique was utilised to evaluate the damage occurring in a reinforced concrete footing due to the overall response of a linear elastic two-storey, two-bay moment resisting steel frame structure that is subjected to an earthquake excitation. Five pseudo-dynamic experiments were performed by scaling the El Centro ground motion record, which occurred in California on May 18, 1940, to produce peak ground accelerations that ranged between 0.34 g to 2 g. All the laboratory experiments were undertaken under a constant axial load for the duration of the applied earthquake excitation and utilised Rayleigh damping to model the energy loss within the overall structure. The pseudo-dynamic method provides a reliable method to relate damage suffered by the footing due to the overall structure's response to the applied earthquake excitation. The method enables the structural capacity and failure mechanisms of the reinforced concrete footing to be observed in relation to the seismic demand. The hysteretic response of the footings and energy dissipation characteristics were determined and was shown that the yield strength of the longitudinal reinforcement within the footing has a significant impact on the maximum shear capacity and damage incurred by the footing. The damage is more pronounced with an increase in the number of cycles of vibration, particularly at displacements that exceed the yield strength of the reinforcement. An increase in the hysteretic energy dissipated by the reinforced concrete footing results in a concomitant increase in the observed damage to the footing in the form of concrete cracking, reinforcement yielding and spalling of the concrete.

Keywords: Pseudo-dynamic experimentation, reinforced concrete footing, seismic performance evaluation, hysteretic curves.