SHEAR STRENGTH AND DEFORMATION CAPACITY OF REINFORCED CONCRETE SHEAR WALLS

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Reinforced concrete structural (shear) walls are commonly used to provide lateral stiffness and strength to resist earthquake and wind loads. Prior to the introduction of modern seismic codes (e.g. EuroCode 8, ASCE 7, ACI 318, Turkish Seismic Code 2007, Japanese Standard for Seismic Evaluation of Existing Reinforced Concrete Buildings), shear wall buildings were mostly designed without adequate reinforcement and detailing. Earthquake reconnaissance has clearly demonstrated that such buildings are more vulnerable to severe damage/collapse. Seismic rehabilitation of existing buildings, which involves adding new components or retrofitting the existing components, is well acknowledged to reduce the risk of damage in the future earthquakes. To achieve effective rehabilitation, behavior and response of the buildings should be well understood and analytical modeling of the systems should be able to capture expected responses reasonably close to accurate.

Various research have been conducted to develop technical guidelines for seismic assessment and rehabilitation of existing concrete frame buildings (e.g. Turkish Seismic Code, EuroCode 8, ACI 369); however, studies for shear wall buildings are relatively limited. For better evaluation of existing structural wall buildings, an accurate assessment of median (expected) and dispersion of wall shear strength and deformation capacity are needed.

This study aims to assess current seismic code provisions, and to improve reliability and accuracy of estimated shear strength using a detailed wall test database consisting of a large number of shear wall tests conducted around the world. The wall test database was also used to investigate the influence of various parameters (e.g. reinforcement details, axial load ratio, wall geometry) on wall shear strength and deformation capacity, and to recommend alternative relations for strength and deformation capacity depending on expected wall behavior. The new relations will allow better modeling capability and improved failure assessment of shear wall buildings.