Title The Effect of Ground Motion Selection Procedure and Hazard Spectra on Design Seismic Demand of Near+-Fault Tall Buildings

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Abstract

Ground motion records and hazard spectra used for non-linear response history analysis are major factors influencing design seismic response of near-fault tall buildings which are subjected to special type of pulse-like motion during an earthquake. These high energy pulses impose large seismic demand on tall buildings within few seconds. This study compares design seismic demand on near-fault tall buildings using two separate ground motion selection and scaling approach. One is code-based approach using ASCE 7 (2005) where SRSS spectral acceleration of ground motion records have been linearly scaled to match target uniform hazard spectrum at MCE level and another is state of the art approach recommended by TBI (2010) where geometric mean spectral acceleration of ground motion records have been linearly scaled to match multiple target conditional mean spectra. The latter approach also recommends to use pulse-like motion explicitly for near-fault buildings. Non-linear response history analysis of a 40 story tall case study building with ground motions selected using these two different approaches showed that the inelastic base shear demand of core walls along major and minor principle directions are less by 35% and 23.5% respectively by using TBI(2010) recommendation than by following ASCE 7(2005) code. The value of inelastic story moment of core walls at mid-height were found to be nearly equal. Further, elastic demand computed using response spectrum analysis also showed reduction of base shear using TBI(2010) recommendation implying that TBI(2010) approach is superior to ASCE 7(2005) approach at predicting seismic demand of near-fault tall buildings.

Keywords Pulse-like motion, Near-fault tall buildings, Conditional mean spectrum, Uniform hazard spectrum, Inelastic base shear, Inelastic story moment, Story deflection