Design forces of reinforced concrete walls for seismic design of buildings considering effects of soil-structure interaction in Bangkok, Thailand

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ABSTRACT

Most buildings in Thailand use reinforced concrete structural walls as the lateral-force resisting systems and the design procedure usually follows response spectrum analysis (RSA) in the ASCE 7 standard. The latest seismic design code in Thailand DPT.1301/1302 introduces a new method, so called Modified Response Spectrum Analysis (MRSA), to calculate shear forces demands for design of shear walls. This method had been studied using buildings modelled with fixed supports at the base and it was found that the MRSA method can estimate story shear force and shear force in walls with good accuracy when compared to the nonlinear response history analysis (NLRHA) results. However, Bangkok is located on soft soil where pile foundations are usually required, and the foundations are laterally supported by soft soil which should be modelled as soil springs at the base rather than fixed support to consider the soil-structure interaction (SSI). This research aims to investigate the effect of soil-structure interaction on seismic response of a medium-rise building and accuracy of MRSA when SSI is included. A 15-story building was modelled with fixed supports and flexible supports using springs representing flexibility of soft soil to consider SSI. The building was analyzed by MRSA and NLRHA where NLRHA results were used as reference values as NLRHA is the most realistic analysis method. The seismic response of the flexible base model was compared to the fixed base model, and it was found that (1) the natural period of the building modelled with soil springs is longer than the building with fixed base support; (2) the story shear force in the case of flexible support is lower than case of fixed support around 5-10%; (3) the story overturning moment in case of flexible support is lower than the case of fixed support around 10-15

Keywords: Seismic design, modified response spectrum analysis (MRSA), soil-structure interaction (SSI), soft soil, lateral-force resisting systems

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