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This research aimed to study the displacement ductility ratio and the reliability of reinforced concrete buildings, designed in accordance with seismic regulations of Thailand. Three-story commercial buildings, five-story and eight-story residential buildings were selected in this study. The fundamental natural frequencies of these buildings are in the range of 0.3 – 0.8 second. For a comparison, these buildings were designed according to the Strength Methods specified by the **E**ngineering **I**nstitute of **T**hailand (E.I.T.) and the **B**uilding **C**ode (B.C.) of Thailand. The difference between the E.I.T. standard and the B.C. standard is the load factors. The E.I.T. standard specifies the load combination as follows: 1.4(DL) + 1.7(LL) + 1.1(E), where E = 1.7(EL), while the B.C. standard specifies 1.7(DL) + 2.0(LL). The B.C. standard does not specify the load factor for seismic loading. In this study, the seismic factor for the B.C. standard is chosen to be consistent with the seismic load factor specified by the E.I.T. standard. Thus, the seismic load for the B.C. standard equals 1.1(E), where E = 2.0(EL).

Computer program SXMOTION was developed for the simulation of ground motions for stiff firm ground. Uncertainties of earthquake ground motions were randomly sampled and matched by the **L**atin **H**ypercube **S**ampling (LHS) technique. Twenty samples of each ground motion parameter, e.g. predominant natural frequency, coefficient of damping, peak factor, phase angle, and strong motion duration were randomly sampled to represent the uncertainties of the ground motions. The structural damage indices were analyzed by computer software IDARC2D. P-$\Delta$ effects are included in both monotonic analysis and dynamic analyses. An improved Park and Ang damage model (1985) was adopted in this study. For the assessment of the structural

reliability, the seismic loading parameters were assumed to be random variables whereas material properties, live load, dead load, and wind load were considered deterministic. The failure of structure occurs when damage indices are higher than a damage threshold. Monte Carlo simulations eventually were employed to obtain accurate reliability results.

The results of monotonic analysis showed that when the base shears equaled the designed base shears, structural damage indices were not greater than 0.007. Thus, the buildings were slightly damaged. It should be noted that the base shear coefficients calculated according to the E.I.T. standard were less than the base shear coefficients of the B.C. standard. At the first yield state, the damage indices were not greater than 0.017 and the buildings were slightly damaged. At yielding state of structure, the damage indices were not greater than 0.153, the buildings were considered to suffer minor damages. It is worth nothing that the structural over strength factors are about 1.65 to 2.22, and increase when the buildings are higher. The displacement ductility ratios of the buildings designed according to the E.I.T. standard and the B.C. standard are almost the same, having values from 5 to 10, and decrease when the buildings are taller. The statistical analysis of the damage indices obtained from the dynamic analysis indicates that the damage indices are log-normally distributed. The mean damage indices of the buildings designed according to the E.I.T. standard are greater than the mean damage indices of the buildings designed according to the B.C. standard. The result from reliability analysis showed that, if a probability not greater than $1x10^{-3}$ is considered to be an acceptable probability of damage (or failure), then the probability of slight damage is unacceptable when the **P**eak **G**round **A**cceleration (PGA) of earthquakes is greater than 0.2g (g is the acceleration of gravity : 9.81 $m/s^2$) for buildings designed according to both standards. When the PGA is greater than 0.35g (0.30g) the probability of the moderate damage is unacceptable for buildings designed according to the B.C. standard (the E.I.T. standard). The collapse mechanism analysis showed that the three-story building collapsed by column-sidesway mechanism while the five-story building and the eight-story building collapsed by mixed sidesway mechanism.