

Sumnieng Ongsupankul 2006: Effectiveness of Confining Reinforcement on Strength and Ductility of Reinforced Concrete Highway Bridge Piers. Doctor of Engineering (Civil Engineering), Major Field: Civil Engineering, Department of Civil Engineering. Thesis Advisor: Professor Torkul Kanchanalai, Ph.D. 137 pages. ISBN 974-16-2475-1

The objective of this research is to study the behaviour on the strength and ductility of reinforced concrete bridge piers subjected to moderate seismic loading experimentally and analytically. For the experimental studies, six 1/2 to 2/3 model size specimens were constructed and tested under constant axial load and cyclic lateral loads. All specimens have square 400×400 mm section with effective height of 1550 mm. The concrete strength is in the range from 29.61 to 32.36 MPa. The longitudinal reinforcement ratio was 1.27 percent. The area ratios of transverse reinforcement are increased from 0.09% to 0.37% based on the AASHTO specification considering non-seismic performance and seismic performance of zone 3 respectively. The axial load was in the range of $0.074f'_cA_g$ and $0.081f'_cA_g$. The cyclic loading history was controlled by applying the lateral load to produce a step-wise displacement increment from 0.5% drift ratio until failure occurred.

Analytical verification of the test specimens and analytical study of highway bridge pier column models were investigated using a fiber element inelastic program. Forty-two specimens with tie reinforcement ratios of 0.19%, 0.37% and 0.56% and the axial loads of $0.05f'_cA_g$, $0.12f'_cA_g$ and $0.2f'_cA_g$ were analyzed. The fiber element inelastic analyze was used considering confined concrete property in the hinge zone.

For the analytical studies, it was found that the effectiveness of increasing the amount of tie reinforcement is that it increases the maximum deflection and dissipation energy of the specimens. The analytical verification of the tested specimens generally agreed with the test performance. It was observed that the criterion of limiting lateral strain in the core concrete gave satisfactory estimate of the maximum column deflection at failure.

The results showed the comparisons of the drift ratio at yield and failure displacement and the maximum moment of the specimens. For low axial force levels ranging from $0.05f'_cA_g$ to $0.2f'_cA_g$, tie reinforcement ratios ranging from 0.4% to 0.6% which correspond to approximately 50% to 70% of the minimum amount required by the AASHTO seismic provisions exhibit moderate ductility being 4. For the test specimens, the cross tie bars tend to enhance the ductility and dissipation energy and increasing the amount of tie bars does not affect the maximum moment.

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