ABSTRACT

Sneed, Lesley Haynes. PhD, Purdue University, December, 2007. Influence of Member Depth on the Shear Strength of Concrete Beams. Major Professor: Julio A. Ramirez.

The objective of this dissertation was to determine experimentally and analytically whether and how member depth plays a role in the shear strength of normalweight non-prestressed concrete beams without shear and skin reinforcement. The experimental component of this work consisted of tests on eight simply-supported beams that were designed, constructed, and tested to failure. Test results, supplemented with data from selected tests in the literature, formed the basis of the analytical component to address the broader issue of understanding the influence of the effective depth on the shear strength of these members.

Findings indicate that varying the effective depth parameter while holding constant other “influential parameters” can lead to differences in predominant mechanisms of shear transfer and influence the relative behavior and shear strength. In particular, the arch action, dowel action, and interface shear transfer mechanisms were shown to be influenced by geometric scale, which can lead to decreasing shear strength with increasing effective depth. Results also suggest that it is inappropriate to compare collections of test data that were not geometrically scaled to analyze the shear strength of concrete beams. In practical design of non-prestressed concrete beams, however, it is difficult to decouple the influence of effective depth from the effect of geometric scale

because of limitations with respect to geometry and materials (i.e. reinforcing bar sizes, maximum aggregate sizes, and concrete cover).

In this study, the observed reduction in shear strength with increasing depth resulted in shear strengths as low as one-half the nominal value given in ACI 318 (2005 and 2008). An evaluation of the requirements for minimum shear reinforcement for beams in ACI 318 (2005 and 2008) identified specific deficiencies with respect to the beams tested.