

ABSTRACT

McCain, Kaylor A. M.S.C.E., Purdue University, December 2012. The Effect of Scale on the Resistance of Reinforced Concrete Beams to Shear Force. Major Professor: Santiago Pujol.

Tests of reinforced concrete beams have shown that as the depth increases, the unit shear strength of the beam decreases. Researchers have warned of the potential danger that this phenomenon, commonly referred to as the size effect, could have on the shear strength of structural members with depths larger than 24 in. and no web reinforcement. In this study, the influence of beam depth on the unit shear capacity of reinforced concrete beams without web reinforcement is examined for test specimens that have all dimensions (width, bar diameter, bar spacing, cover, and maximum aggregate size) scaled in proportion to depth.

This experimental program consisted of four 30-in. deep beams and six 12-in. deep beams, all simply supported and loaded at midspan to failure. All dimensions of the 30-in beams were 2.5 times the dimensions of the 12-in. beams. Four beams had a shear span to effective depth ratio of 2.9. The other six beams had a shear span to effective depth ratio of 2.3.

The test results indicated that when all of the dimensions were geometrically scaled in proportion to the depth, increasing the size of the beam (within the range tested) had a minimal effect on the unit shear strength. The reduction in mean unit shear strength was approximately 10% between the 12-in. and 30-in. deep beams.