Discussion

Shear Strength of Stud Connectors in Lightweight and Normal-Weight Concrete

Paper presented by OLLGARD, SLUTTER and FISHER
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Discussion by **James Chinn**

THE AUTHORS have done a very commendable job of testing and analyzing test results of lightweight composite specimens. As a member of the Advisory Committee for the study, the writer heartily approved of the report and the recommendations, based on the equation in Fig. 9(a), submitted for inclusion in the AISC Specification.

In reviewing the data, the writer isolated the lightweight concrete test results for study, and the conclusions drawn should be of interest to some of the Journal's readers. A computer analysis was made of the results from the lightweight and sanded lightweight specimens containing ¾-in. studs, ignoring the normal weight specimens and those containing ⅝-in. studs.

By the least squares criterion, the best straight line fit to the plot of Q_u/A_s vs. $\sqrt{f_c'E_c}$ was given by

$$Q_u/A_s = 20.87 + 0.2952\sqrt{f_c'E_c} \qquad (6)$$

in which Q_u/A_s, f_c', and E_c are all in ksi units.

This line is plotted on the authors' Fig. 9(b) (See Fig. 1) for comparison. It intersects the authors' Eq. (3) line at a value of $\sqrt{f_c'E_c}$ equal to 101.90 ksi. If the commonly accepted formula for relating modulus of elasticity to unit weight is used, one finds that this corresponds to the following unit weights for the concrete strengths indicated.

f_c' (psi)	w (pcf)
3,000	154
4,000	116
5,000	92

James Chinn is Professor of Civil Engineering, University of Colorado, Boulder Colorado.

The shear connector values given by Eq. (3) are slightly conservative for unit weights less than these and slightly unconservative for unit weights which are greater. As an example, Eq. (3) gives a value 17.7 percent less than given by Eq. (6) for $f_c' = 3{,}000$ psi and $w = 90$ pcf.

For the plot of Q_u/A_s vs. $(f_c')^{0.3}(E_c)^{0.44}$, the best straight line for the ¾-in. studs in lightweight and

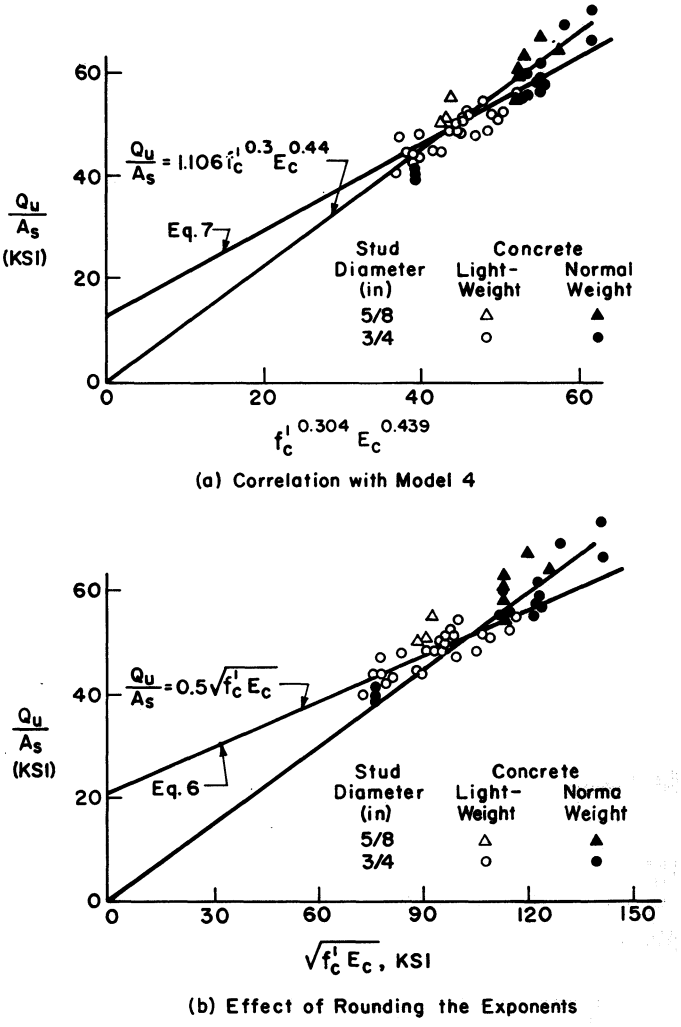

Fig. 1. Comparison of connector strength with concrete strength and Modulus of Elasticity

sanded lightweight specimens was given by

$$Q_u/A_s = 13.05 + 0.819(f_c')^{0.3}(E_c)^{0.44} \quad (7)$$

This line is plotted on the authors' Fig. 9(a) (see Fig. 1) for comparison. It intersects the authors' line at a value of $(f_c')^{0.3}$ $(E_c)^{0.44}$ equal to 45.47. This corresponds to the following unit weights for the various concrete strengths.

f_c' (psi)	w (pcf)
3,000	134
4,000	106
5,000	89

The shear connector values given by the authors' equation will be slightly conservative for unit weights less than these and slightly unconservative for greater unit weights. For $f_c' = 3{,}000$ psi and $w = 90$ pcf, the authors' equation gives a value 7.2 percent less than Eq. (7).

The results obtained in the Lehigh University study are in line with results of tests on pushout specimens performed at the University of Colorado. These contained rotary-kiln-produced lightweight aggregates from a number of producers. A report is being prepared on the Colorado tests, and it will be finished shortly.