ABSTRACT

Author: Fleet, Eric, T. MSCE
Institution: Purdue University
Degree Received: May 2019
Title: Effective Confinement and Bond Strength of Grade 100 Reinforcement
Committee Chair: Robert J. Frosch

The primary reinforcement used for construction of structural concrete members has a yield strength of 60 ksi. This reinforcement grade was incorporated into construction over 50 years ago and remains the standard. Recent advances in material technology have led to the development of commercially available reinforcing steel with yield strengths of 100 ksi. While greater yield strengths can be utilized in design, it is essential that the bars can be properly anchored and spliced to fully develop their strength. Although design expressions are available for this purpose, they were established considering 60 ksi reinforcement. Therefore, the objective of this research program is to evaluate the development of high-strength reinforcing steel and establish a design expression for the development and splicing of this steel. Two phases of experimental tests were conducted. Phase I was performed by Glucksman (2018) and investigated the influence of splice length and transverse reinforcement on bond strength over four series of beam tests. This study (Phase II) consisted of reinforced concrete slab and beam testing conducted over three series that investigated reinforcement development. A focus was maintained on the effect of splice length, concrete compressive strength, stress-strain relationship of the steel (ASTM A615 vs. ASTM A1035), and transverse reinforcement. Based on the results, the influences of test variables were identified, and a new confinement model was developed that estimates the transverse reinforcement contribution to bond strength. Finally, a design expression is provided for calculating the development and splice lengths of high-strength reinforcement.