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Coatings that affect bond to reinforcement: Position Statement #3 - Industry Issues

ACI 318-02, "Building Code Requirements for Structural Concrete," Section 7.4.1 states: "At the time concrete is placed, reinforcement shall be free from mud, oil, or other nonmetallic coatings that decrease bond." The commentary does not indicate which nonmetallic coatings decrease bond. It does, however, indicate that research has shown that a normal amount of rust increases bond, and further states that: "Specific limits on rust are based on tests, plus a review of earlier tests and recommendations."

ACI 301-99, "Specifications for Structural Concrete," Section 3.3.1.1, states: "When concrete is placed, reinforcement shall be free of materials deleterious to bond." No guidance is provided on which materials affect bond, but section 2.3.1.13 on Formwork states: "Do not allow formwork release agent to contact reinforcing steel...." This provision was introduced in ACI 301-1996.

Engineers or inspectors typically direct concrete contractors to clean bars that are coated with materials believed to decrease bond. Form-release agents, bond breakers, and cement splatter sometimes come in contact with reinforcing steel before concrete is placed. In the absence of data concerning the types of materials that decrease bond, cautious engineers and inspectors usually require all such materials to be cleaned from the reinforcing. However, two recent studies have provided test data showing that some of these materials don't decrease bond.

Two articles--"How Clean Must Rebar Be?" (CONCRETE CONSTRUCTION, June 1998) and "Effect of Reinforcing Bar Contamination on Steel-Concrete Bond During Concrete Construction" (ACI SP-209, Proceedings, ACI Fifth International Conference, December 2002)--contain results of bond tests on reinforcing bars that had the entire surface covered with nonmetallic coatings. In the first study, bond was measured on bars embedded in cylinders (similar to tests used to establish the effect of rust on bond). In the second study, bars were embedded in beams to simulate flexural conditions in members. Both studies used three specimens for each coating to compare against three control specimens.

The test results of both studies indicate that form-release agents (three different types including water- and petroleum-based products), bond breakers (three different types including water- and solvent-based products), and cement splatter (same mix proportions as the concrete) did not affect the bond for concrete strengths of 4000 and 5000 psi. Based on these test results, and the statements in ACI 318 and ACI 301, removing these materials from reinforcing bars isn't required because the materials don't decrease bond.

ACKNOWLEDGEMENT: ASCC concrete contractors believe that the removal of form-release agents, bond breakers, and cement splatter provides no structural performance benefit. This Position Statement #3 has been produced in its entirety by ASCC and Copyright 2003 by Hanley-Wood, Inc. and The Gale Group. Copies of the references cited are available from Safewall or directly from the American Society of Concrete Contractors.