

Effect of reinforcement corrosion on bond strength

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Construction and Building Materials 10 (2), pp. 123-129, 1996

Abstract: The effect of reinforcement corrosion on the bond strength between steel and concrete was investigated. The bond behaviour of reinforced concrete elements, including the ultimate bond strength, free-end slip, and the modes of failure in precracking, cracking and postcracking stages was studied. Also, the effect of different crack widths and the rib profile degradation for various degrees of corrosion on the bond strength were evaluated. In order to establish different levels of corrosion, a calibration curve establishing a relationship between the duration of the impressed current and the corresponding degree of corrosion was prepared. The magnitude of corrosion was measured as gravimetric loss in weight of the reinforcing bars. The results indicate that in the precracking stage (0-4% corrosion) the ultimate bond strength increases, whereas the slip at the ultimate bond strength decreases with an increase in the degree of corrosion. The degradation of bond results from the crushing of concrete keys near the bar lugs. When reinforcement corrosion is in the range of 4 to 6%, the bond failure occurs suddenly at a very low free-end slip. At this level of reinforcement corrosion, a large slip was noted as the ultimate failure of the bond occurred due to the splitting of the specimens. Beyond 6% rebar corrosion, the bond failure resulted from a continuous slippage of the rebars. The ultimate bond strength initially increased with an increase in the degree of corrosion, until it attained a maximum value of 4% rebar corrosion after which there was a sharp reduction in the ultimate bond strength up to 6% rebar corrosion. Beyond the 6% rebar corrosion level the ultimate bond strength did not vary much even up to 80% corrosion. In terms of the effect of rib profile, a sharp reduction in the bond strength was initiated when its degradation exceeded 25%. This decrease in bond strength continued up to 45%. Thereafter, there was no significant effect of the rib profile degradation on the bond strength.