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Bond Performance of Glass Fiber Reinforced Polymer Rebars Based on Pullout And Beam Tests

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Summary

Due to many advantages such as high strength to weight ratio, electromagnetic neutrality, ease of handling, and corrosion resistance, fiber reinforced polymer (FRP) reinforcing bar (rebar) gain increasingly more attention as an alternative reinforcement to replace steel rebar in concrete structures. However, it should not be treated in the identical way as steel rebar because the physical and mechanical behavior of FRP rebar are quite different to those of steel rebar. In this study, to provide data for the design code of FRP rebars used in concrete structures, the bond performance of glass fiber reinforced polymer (GFRP) rebars in concrete was investigated. For this objective, two types of test were considered. First, pullout specimens were tested to examine the distribution of bond stresses along the bond length of GFRP rebars. These were compared to steel reinforcing bars. Although the pullout test is popular because it provides a simple means of comparing the relative bond performance developed by different bars and materials, the results of pullout test do not represent the bond stress distribution of real reinforced concrete structures. That is, in the pullout test, reinforcement is under tensile stress and concrete is under compression but in the real concrete member, rebar and surrounding concrete is under the identical stress condition. Therefore, to get more realistic and better results, beam test was also carried out on 45 specimens reinforced with GFRP and steel rebars. Two different surfaces of GFRP rebar were considered to investigate the effects of rebar surface on the bond performance of GFRP rebars. The bond characteristics of rebars embedded in concrete specimens were affected by the surface type of rebars as well as the embedment length. This paper describes the test program in detail and discusses the results.

keywords: GFRP rebar; Test methods; Pullout; Beam test; Bond stress; Development length

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