BOND BEHAVIOR OF POST-INSTALLED GFRP REBARS

by

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ABSTRACT

Glass Fiber Reinforced Polymer (GFRP) rebars have a huge potential to be used as post-installed rebars in concrete due to their high tensile strength and non-corrosive nature. Additionally, GFRP rebars are non-magnetic, electrically non-conductive and have a higher strength to weight ratio compared to steel rebars. Sufficient studies have been conducted to investigate the bond behavior of cast-in GFRP rebars which have led to the formulation of ACI 440. Compared to conventional cast in concrete, post installed concrete connections using GFRP rebars is a new and upcoming area to explore. Due to scarce literature and resources available on the bond-behavior of post-installed GFRP rebars, a lack of general concession on the influence of rebar surface textures on the bond- behavior and an initial high investment required for these rebars, GFRP rebars as post-installed rebars are still under high scrutiny.

Post-Installed connections comprise of inserting a deformed rebar in a pre-dilled hole in hardened concrete using an injectable epoxy. Post Installed system allows construction between existing concrete to new concrete as in case of structural extension and/or rehabilitation purposes. The adhesive mortars used for post-installation generally have a high bond strength but in the current codes of practice, post installed rebars are considered equivalent to cast in rebars.

This study aims to develop a bond-splitting model using epoxy-based adhesive (DeWalt Pure200+) for post-installed GFRP rebars. A set of parameters-concrete cover, concrete strength, diameter, embedment depth which influence the bond splitting of behavior of rebars in concrete are identified. Numerical simulations showed promising results for GFRP rebars with a bond strength comparable to steel. Experimental investigation is carried out in two phases to determine the local bond strength by conducting confined pullout tests away from the edges at shallow embedment depths and the bond-splitting strength by varying the crucial parameters. Pullout tests on steel and GFRP rebars with varying embedment depths, concrete cover, relative concrete cover, rebar type and GFRP rebar were conducted. Special grips were designed for testing GFRP rebars.