ABSTRACT

Post-installed (PI) rebars are widely used in the construction industry for structural retrofitting, seismic upgrades, bridge widening, and the extension of structural elements. Epoxy-coated rebars, which are particularly common in the United States, are used in these applications due to their enhanced corrosion resistance. PI rebars can be designed as cast-in rebars following ACI 318, if qualified through AC308. When epoxy coated PI rebars are designed as cast-in epoxy coated rebars, a longer development length is required due to reduced bond strength. However, there is limited research and code guidance on the bond behavior of epoxy coated rebars when they are post-installed.. This brings up an important point about whether the same increased development length still needs to be considered when epoxy coated rebars are post-installed instead of black-bars.

This study investigates the bond performance of post-installed epoxy-coated rebars in comparison to both cast-in and post-installed black rebars, with a focus on varying concrete cover and embedment depth. The bond behavior was evaluated under tensile loading conditions, capturing both pullout and splitting failure modes to better understand the underlying mechanisms. A total of 54 experimental tests were conducted (24 pullout and 30 splitting tests), using three different types of adhesive mortars with varying base materials for the post-installed rebars. The experimental findings were validated using numerical simulations carried out in MASA (Macroscopic Space Analysis), which uses a microplane model with relaxed kinematic constraints to simulate nonlinear concrete behavior..

Results show that the bond strength of post-installed epoxy-coated rebars is comparable to that of post-installed black rebars. However, epoxy coated rebars exhibited lower initial stiffness compared to their black bar counterparts in the same mortar.