Determination of Defect Criticality and the Resulting Performance Effects of CFRP Strengthened RC Beams

Jason Delaney
jcdelaney@ucsd.edu

Vistasp Karbhari
Professor of Structural Engineering, UC San Diego
9500 Gilman Drive, Mail Code 0085
La Jolla, CA 92093
Phone (858) 534-6470, Fax (858)534-6373, vkarbhari@ucsd.edu

The effectiveness of externally bonded Carbon Fiber Reinforced Polymer (CFRP) composites in structural rehabilitation is strongly dependent on the bond performance between the CFRP and the reinforced concrete surface to which it is bonded. Many recent studies have been conducted as an attempt to quantify aspects of bond performance and bond behavior in this situation. Due to the complexity of the problem, most research has been conducted only on idealized specimens. This study investigates how bond performance may be affected in less than ideal conditions involving specific defects that may be encountered in the field. Any defects in the FRP, concrete, or at the bond line may result in stress concentrations causing local bond failure and therefore may produce an unfavorable influence on the global strengthening performance. Large-scale flexural tests are utilized to investigate the bond behavior of precracked specimens involving various defects such as crack spacing, unbonded length, unbonded shape, unbonded location, and waviness in CFRP fiber orientation. From these tests it is hoped that the critical aspects of defects that have an adverse influence on the global strengthening performance of a rehabilitated section may be determined. The resulting data allows for crucial observations to be made pertaining to how to relate idealized or more “perfect” laboratory behavior to specific “imperfect” field applications.

KEY WORDS:

FRP, Concrete, Rehabilitation, Defect