

Effect of the plate bondstress-slip property on the flexural strength of FRP Plated RC beams using a displacement-based approach

ABSTRACT

This study presents the theoretical results of a displacement-based approach for CFRP plated RC beams while varying the bondstress-slip relationship of the plate to see the influence of this material property on the global behavior. The experimental programme included three ordinary and three plated RC beams that had similar dimensions and similar material properties. From the displacement-based analysis, it was shown that the theoretical and experimental results for the ordinary RC beams were almost identical. However, for the CFRP plated RC beams, it was shown that using a linear descending bondstress-slip model for the FRP plate in the analysis underestimated the flexural capacity of the plated beam as the theoretical results were about 75% of the experimental values. Moreover, through a parametric study, it was shown that adding an ascending branch to the FRP plate's bondstress-slip property (e.g., using a bilinear bondstress-slip model) results in better correlation with the experimental values at service loads in comparison to using only a linear descending branch without an ascending component. In addition, it was also shown that adding a frictional component to the bondstress-slip model of the FRP plate to allow the force in the plate to build up as debonding ensues gives closer results to the experimental values observed in the laboratory. The accurate simulation of the FRP plate's bondstress-slip material property was seen to greatly affect the plated member's capacity and ductility behavior.

Keyword: Adhesively plated beam; FRP; Intermediate crack debonding; Displacement-based analysis; Partial interaction; Bondstress-slip