

Full-range bondstress-slip model for externally bonded FRP plates including a frictional component

ABSTRACT

Bondstress-slip models of externally bonded FRP plates have long been quantified using push/pull shear tests in which the bonded joint is slightly greater than the effective length of the plate. This inhibits the formation of a frictional component that may arise in long bonded joints. Moreover, previous researchers have used several factors to represent the bondstress-slip model parameters which gave a rise to a number of models. With that in mind, the first aim of this study was to assess the factors that affect the bondstress-slip parameters (τ_{max} , δ_1 and δ_{max}), and to propose a simplified bilinear bondstress-slip model that correlates well with experimental data. The second objective was to predict the frictional component in the bondstress-slip model that develops in FRP plated flexural members using a partial-interaction displacement-based approach, assess the factors that affect the frictional component and investigate the debonding mechanism of FRP plated members with a frictional component. As such, a database consisting of 98 pull/push shear tests available in the open literature was assembled and used to assess the factors that influence the bilinear bondstress-slip model parameters. Subsequently, a simplified bilinear bondstress-slip model was proposed and validated against 288 pull/push shear test results. Next, 8 FRP plated beams were investigated using a displacement-based analysis where it was seen that the frictional component depended largely on the length of the plated members. Also, it was seen that poor correlation with experimental results was observed when a bilinear model without a frictional component was used in the analysis, where the predicted ultimate strength was 66 – 78% of the experimental value. The findings of this study illustrate the importance of considering the frictional component in the bondstress-slip model, and how this may affect the strength, deformation and ductility of the plated member.

Keyword: Bondstress-slip; Bilinear model; Frictional component; FRP plated beams; Partial-interaction; Displacement-based analysis