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EFFECT OF CONCRETE/CFRP INTERFACE MODELLING ON FAILURE MECHANISM OF RC BEAMS STRENGTHENED WITH CFRP: A COHESIVE ELEMENT MODEL

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ABSTRACT

The main objective of this study is to investigate the adhesive behavior between CFRP laminates and concrete surface using Finite Element technique (FE). From the previous studies, it was found that most of the FE studies neglected the interaction between Concrete/CFRP interface by either assuming perfectly bond or using simple solid element between the interfaces. This can affect the accuracy of the results obtained from FE model. Therefore, in order to capture the real behavior between two surfaces, care should be taken when modeling concrete/CFRP interface. In this study, cohesive elements are used to model traction and shear behavior of concrete/CFRP interface. Ten case studies with various parameters, i.e. thickness of FRP laminates, length of FRP laminates and type of reinforcement, are chosen from the literatures to perform analysis using ABAQUS. The results of the study are presented and discussed in terms of loading capacity, failure pattern, interfacial stresses distribution between concrete/CFRP interface and strain distribution in CFRP plates.

The results obtained from FE models show good agreement with the experimental results. It is evident that the progressive de-cohesion of the laminate from the concrete face initiating in the area near to the point of high interfacial stress and leading to almost complete delamination and then to failure. By strengthening RC beam with CFRP laminates, the loading capacity of the beam increases approximately up to 70% depending on thickness of CFRP laminates and type of reinforcement. Regarding to the effect of the length of CFRP plates, it is found that the same level of loading capacity of the beam can be obtained when attaching CFRP laminates at least half of the shear span.

Moreover FE model can also foretell the failure pattern in terms of strain contour and strain distribution of CFRP plates.

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