عنوان مقاله:

Analysis of RC Continuous Beams Strengthened with FRP Plates: A Finite Element Model

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خلاصه مقاله:

Strengthening of reinforced concrete (RC) beams with externally bonded fibre reinforced polymer (FRP) plates/sheets technique has become widespread in the last two decades. Although a great deal of research has been conducted on simply supported RC beams, a few studies have been carried out on continuous beams strengthened with FRP composites. This paper presents a simple uniaxial nonlinear finite-element model (UNFEM) that is able to accurately estimate the load-carrying capacity and the behaviour of RC continuous beams flexurally strengthened with externally bonded FRP plates on both of the upper and lower fibres. A 21-degree of freedom element is proposed with layer-discretization of the cross-sections for finite element (FE) modelling. Realistic nonlinear constitutive relations are employed to describe the stress-strain behaviour of each component of the strengthened beam. The FE model is based on nonlinear fracture mechanics. The interfacial shear and normal stresses in the adhesive layer are presented using an analytical uncoupled cohesive zone model with a mixed-mode fracture criterion. The results of the proposed FE model are verified by comparison with various selected experimental measurements available in the literature. The numerical results of the plated beams (beams strengthened with FRP plates) agreed very well with the experimental results. The use of FRP increased the ultimate load capacity up to 100 % compared with the non-strengthened beams as occurred in series (S). The major objective of the current model is to help engineers' model FRP-strengthened RC continuous beams in a simple manner

کلمات کلیدی:

Finite Element; Continuous Beams; Plated Beam; Interfacial Stresses; Maximum Capacity; Debonding