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Performance Evaluation of Composite Beam under Uniform Corrosion

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Abstract : Composite member (concrete and steel) has been widely advanced for structural utilization due to its best performance in resisting load, reducing the total weight of the structure, increasing stiffness, and other available advantages. On the other hand, the environment load such as corrosion (e.g. chloride ingress) creates significant time-dependent degradation for steel. Analysis performed in this paper is mainly considered uniform corrosion for evaluating the composite beam without examining the pit corrosion as the initial corrosion formed. Corrosion level in terms of weight loss is modified in yield stress and modulus elasticity of steel. Those two mechanical properties are utilized in this paper for observing the stresses due to corrosion attacked. As corrosion level increases, the effective width of the composite beam in the concrete section will be wider. The position of a neutral axis of composite section will indicate the composite action due to corrosion of composite beam so that numerous shear connectors provided must be reconsidered. Flexure capacity quantification provides stresses, and shear capacity calculation derives connectors needed in overcoming the shear problem for composite beam under corrosion. A model of simply supported composite beam examined in this paper under uniform corrosion where the stresses as the focus of the evaluation. Principal stress at the first stage of composite construction decline as the corrosion level incline, parallel for the second stage stress analysis where the tension region held by the steel undergoes lower capacity due to corrosion. Total stresses of the composite section for steel to be born significantly decreases particularly in the outermost fiber of tension side. Whereas, the available compression side is smaller as the corrosion level increases so that the stress occurs on the compression side shows reduction as well. As a conclusion, the increment of corrosion level will degrade both compression and tension side of stresses.

Keywords : composite beam, modulus of elasticity, stress analysis, yield strength, uniform corrosion
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