

Immediate Deflection of Pretensioned Inverted T-Beam with Circular Web Openings Strengthened with GFRP Using Response Surface Methodology

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ABSTRACT

The urgent need for a web opening in the pretensioned inverted T-beams after the construction for essential services causes local cracking around the opening which leads to decrease in stiffness and load carrying capacity. Therefore, strengthening the vicinity of the opening is essential to restore the loss in load carrying capacity of the beam using GFRP. To study the deflection of pretensioned inverted T-beam with web opening, three-dimensional finite element beam models are developed before and after GFRP strengthening using the finite element analysis (FEA). Modeling methodology and nonlinear analysis approach in ANSYS are presented. The results obtained from the FEA beam model are compared with the test data in terms of load-deflection curve. It has been concluded that FEA models are good representations for GFRP strengthened beams with web openings in terms of the number of elements, structural details, and, especially, reasonably accurate results in general.

KEYWORDS: Finite Element; Glass Fiber Reinforced Polymer (GFRP); Prestressed Inverted T-Beam, Response Surface; Web Opening

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