

عنوان مقاله:

Effects of GFRP Stirrup Spacing on the Behavior of Doubly GFRP-Reinforced Concrete Beams

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خلاصه مقاله:

This study investigates the impact of varying glass fiber-reinforced polymer (GFRP) stirrup spacing on the performance of doubly GFRP-reinforced concrete beams. The research focuses on assessing the behavior of GFRP-reinforced concrete beams, including load-carrying capacity, cracking, and deformability. It explores the feasibility and effectiveness of GFRP bars as an alternative to traditional steel reinforcement in concrete structures. Six concrete beams with a cross-section of 300 mm (wide) × 250 mm (deep), simply supported on a 2100 mm span, were tested. The beams underwent four-point bending with two concentrated loads applied symmetrically at one-third of the span length, resulting in a shear span (a)-to-depth (h) ratio of 2.8. The experimental findings reveal that altering the GFRP stirrup spacing along the longitudinal axis of the beams, from 200 mm (equivalent to the effective depth (d)) to 50 mm (equal to (d/4)), altered the mode of failure from flexure-shear to flexure-compression. However, when the spacing was equal to or less than (d/3), there was no significant improvement in load-carrying capacity, as the contribution of GFRP bars in resisting shear loads was limited. Under service loads, the GFRP-reinforced beams exhibited wider cracks, but reducing the stirrup spacing helped restrain crack widening. Incorporating GFRP bars in the compression zone had a positive effect on reducing crack width in the tension zone. Additionally, using GFRP stirrups with spacing varying between (d) and (d/2) in the pure bending region increased the deflection ductility indexes. To enhance the ductility of GFRP-reinforced concrete beams, it is recommended to use GFRP stirrups in the pure bending region with spacing greater than the spacing between GFRP stirrups in the shear spans. The study highlights that the current ACI code overestimates the shear capacity provided by GFRP stirrups, particularly when the spacing is less than or equal to (d/3). Doi:

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کلمات کلیدی:

.GFRP Bars; Doubly Reinforced Concrete Section; Flexural Strength; Shear Strength; Dowel Action; Deflection; Cracking

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