THE EFFECT OF SPIRAL STIRRUP SPACING ON STEEL AND GFRP REINFORCED CONCRETE BEAMS

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ABSTRACT

Reinforced concrete is one of the most widely used construction materials; however, steel reinforcement is highly susceptible to corrosion, which can reduce the strength, serviceability, and durability of structural members. Glass Fiber Reinforced Polymer (GFRP) has emerged as a promising alternative due to its high tensile strength, lightweight properties, and excellent corrosion resistance. This study investigates the effect of using Ø13 mm GFRP longitudinal reinforcement combined with different spacings of Ø8 mm steel spiral stirrups on the shear capacity, deflection, crack pattern, and failure mechanism of reinforced concrete beams. An experimental program was conducted using three beam specimens (1000 × 250 × 150 mm) with a concrete compressive strength of 25 MPa under single point loading until failure. One control beam was reinforced with Ø13 mm steel bars, while the remaining beams used Ø13 mm GFRP bars with steel spiral stirrup spacings of 200 mm and 60 mm. The results indicate that the beam with 60 mm stirrup spacing exhibited the best structural performance, achieving a maximum load of 197.3 kN, superior shear capacity, improved crack control, and greater stiffness compared with the 200 mm spacing. All specimens failed in shear, and the experimental results agreed well with theoretical predictions. Therefore, the combination of Ø13 mm GFRP longitudinal reinforcement and Ø8 mm steel spiral stirrups at 60 mm spacing is the most effective configuration for improving reinforced concrete beam performance.

Keywords : *reinforced concrete, GFRP, spiral stirrups, shear capacity, crack pattern.*