Structural Efficiency of Concrete Beams Reinforced with Hybrid Reinforcement Bars Under Thermal Loads

By

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Abstract

Nine RC concrete beams were experimentally tested to assess the effect of temperatures on the flexural performance of concrete beams with hybrid bars and GFRP-Steel reinforcement. The study focused on the temperature levels (25 °C, 300 °C, and 600 °C), the reinforcement ratios, and the type of reinforcement bar. The test findings revealed a significant decline in the stiffness of beams with a GFRP-Steel reinforcement compared to hybrid reinforcement bar (HRB) beams. The stiffness decreased by 17% and 31% for 300 °C and 600 °C temperatures. Moreover, all beam specimens exhibited a flexural failure mode. Non-linear Finite Element Analysis (NLFEA) results accurately reflected the trends observed in the experimental results, and the average ratio of the experimental and NLFEA ultimate capacity was 1.02. Finally, experimental results were used to evaluate nominal flexural strength. The comparison showed that nominal flexural strength predicts flexural stress. The average experimental-nominal flexural strength ratio was 1.14.

Keywords: hybrid reinforcement bars; elevated temperature; RC beams; ANSYS; nominal flexural strength.