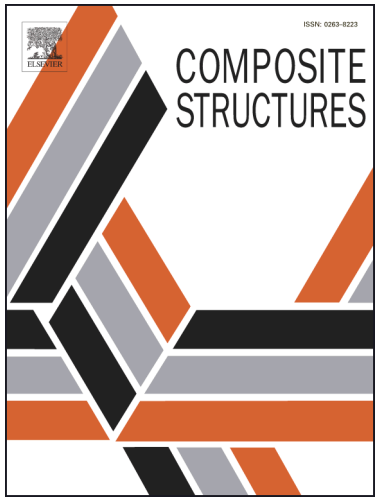

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Time-dependent assessment and deflection prediction of prestressed concrete beams with unbonded CFRP tendons

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Abstract: This paper presents the assessment of the time-dependent behavior and the prediction of the long-term deflection of concrete beams prestressed with internal unbonded carbon fiber reinforced polymer (CFRP) tendons. A numerical model for the time-dependent analysis of concrete beams prestressed with unbonded tendons is calibrated against experimental results. Parametric numerical simulations are then conducted on simply supported unbonded prestressed concrete beams subjected to long-term sustained loads to investigate the effect of using CFRP tendons instead of low-relaxation steel ones, the magnitude of the initial prestress, the loading conditions, and the quantity of the compressive reinforcing steel. The results show that the long-term prestress loss of beams with CFRP tendons is considerably higher than that of beams with steel tendons. Moreover, it is shown that increasing the quantity of compressive reinforcing steel leads to a substantial decrease in long-term downward deflection. A modification of the ACI 318-14 equation is proposed to predict the time-dependent deflection of prestressed concrete beams with unbonded FRP or steel tendons.

Keywords: Carbon fiber; Time-dependent behavior; Unbonded tendons; Beams

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