

# Effect of ECC Layer Thickness and Reinforcement Ratio on The Load Carrying Capacity of Steel-Reinforced Composite Beams

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## **Abstract:**

In recent years, Engineered Cementitious Composites (ECC) has emerged as a promising alternative construction material to traditional concrete due to their exceptional tensile strain-hardening behaviour and ductility.

Though research studies have been carried out to investigate the flexural behaviour of steel-reinforced concrete (RC) beams with ECC replacement in tension zone, no comprehensive investigation is attempted to quantify the effect of ECC layer thickness in conjunction with the amount of longitudinal reinforcement which significantly affects the strength and performance.

This study presents a comprehensive investigation on the effect of ECC layer thickness and steel reinforcement ratio on the flexural capacity of ECC-concrete composite beams. For this purpose, steel reinforced ECC-concrete composite beams from literature are selected and numerically analyzed through nonlinear FE software ABAQUS to predict the flexural response. Damage plasticity model available in ABAQUS platform is employed to define the material characterization. The results from the FE analyses are compared against the experimental results and are found to show a close agreement.

Using the validated FE analyses procedure, detailed parametric studies are conducted to evaluate the effectiveness of different design parameters such as (a) ECC height replacement for a particular reinforcement ratio, (b) reinforcement ratio for an ECC height replacement, and (c) adequate reinforcement ratio for effective strengthening for a particular cross-section.

The study reported that 40% ECC layer thickness and 1.70% steel reinforcement ratio are found to exhibit enhanced load carrying capacity in composite beams. The effective tensile reinforcement ratio for the ECC-concrete composite beams from minimum to maximum varies in the range of 0.92%–1.85%, respectively.

**Bio-sketch: Dr. Madappa VR Sivasubramanian**

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