

## Numerical Study of Splay Anchors in CFRP-Strengthened Concrete Beams

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**Abstract :** This paper presents a detailed numerical investigation into the structural performance of splay anchor configurations for strengthening concrete beams with Carbon Fiber Reinforced Polymer (CFRP) sheets. CFRP is widely used in retrofitting concrete structures to improve flexural strength and extend service life. However, premature debonding limits the tensile capacity of CFRP sheets, reducing the effectiveness of these applications. This study addresses this limitation by exploring the potential of splay anchors as an emerging anchorage technique that mitigates debonding issues through improved load transfer mechanisms. Building on existing experimental studies, the research uses ABAQUS software to validate different splay anchor configurations and simulate real-world performance. The parametric study examines key anchor parameters, including diameter, spacing, and embedment depth, to evaluate their effects on bond strength, load distribution, and the flexural capacity of strengthened beams. Systematic analysis of these parameters allows for identifying configurations that enhance debonding resistance and increase the load-carrying capacity of CFRP-strengthened beams. Improved debonding resistance contributes to greater structural durability, reduced maintenance costs, and extended service life for retrofitted structures, particularly relevant for aging infrastructure like bridges and buildings. This approach not only advances sustainable retrofitting practices but also provides practical solutions tailored to infrastructure demands.

**Keywords :** CFRP strengthening, splay anchors, concrete beams, structural retrofitting, numerical analysis

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