

## Shear Behaviour of RC Deep Beams with Openings Strengthened with Carbon Fiber Reinforced Polymer

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**Abstract :** Construction industry is making progress at a high pace. The trend of the world is getting more biased towards the high rise buildings. Deep beams are one of the most common elements in modern construction having small span to depth ratio. Deep beams are mostly used as transfer girders. This experimental study consists of 16 reinforced concrete (RC) deep beams. These beams were divided into two groups; A and B. Groups A and B consist of eight beams each, having 381 mm (15 in) and 457 mm (18 in) depth respectively. Each group was further subdivided into four sub groups each consisting of two identical beams. Each subgroup was comprised of solid/control beam (without opening), opening above neutral axis (NA), at NA and below NA. Except for control beams, all beams with openings were strengthened with carbon fibre reinforced polymer (CFRP) vertical strips. These eight groups differ from each other based on depth and location of openings. For testing sake, all beams have been loaded with two symmetrical point loads. All beams have been designed based on strut and tie model concept. The outcome of experimental investigation elaborates the difference in the shear behaviour of deep beams based on depth and location of circular openings variation. 457 mm (18 in) deep beam with openings above NA show the highest strength and 381 mm (15 in) deep beam with openings below NA show the least strength. CFRP sheets played a vital role in increasing the shear capacity of beams.

**Keywords :** CFRP, deep beams, openings in deep beams, strut and tie modal, shear behaviour

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