

Flexural Properties of RC Beams Strengthened with A Composite Reinforcement Layer: FRP Grid and ECC

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Abstract : In this paper, a new strengthening technique for reinforced concrete (RC) beams is proposed by combining Basalt Fibre Reinforced Polymer (BFRP) grid and Engineered Cementitious Composites (ECC) as a composite reinforcement layer (CRL). Five RC beams externally bonded with the CRL at the soffit and one control RC beam was tested to investigate their flexural behaviour. The thickness of BFRP grids (i.e., 1mm, 3mm and 5mm) and the sizes of CRL in test program were selected as the test parameters, while the thickness of CRL was fixed approximately at 30mm. The test results showed that there is no debonding of CRL to occur obviously in the strengthened beams. The final failure modes were the concrete crushing or the rupture of BFRP grids, indicating that the proposed technique is effective in suppressing the debonding of externally bonded materials and fully utilizing the material strengths. Compared with the non-strengthened beam, the increments of crack loading for strengthened beams were 58%~97%, 15%~35% for yield loading and 4%~33% for the ultimate loading, respectively. An analytical model is also presented to predict the full-range load-deflection responses of the strengthened beams and validated through comparisons with the test results.

Keywords : basalt fiber-reinforced polymer (BFRP) grid, ECC, RC beams, strengthening

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