ABSTRACT

Retrofitting existing reinforced concrete (RC) structures has increased over the decades due to corrosion of steel reinforcement inside the concrete, and increased loading causing failure. Using carbon fibre-reinforced polymer (CFRP) materials to strengthen RC members in shear, and flexure is an effective method to retrofit RC structures. The purpose of this research was to study the effect of strengthening flexure capacity in plain concrete beams with externally bonded (EB) CFRP with different wrapping configurations. Two flexural-strengthening wrapping methods of CFRP were used in the investigation: under-wrapped, and U-wrapped. The research's objectives included comparing the maximum deflection of under wrap and U-wrap of plain concrete beams in flexure, the effects of the configuration of CFRP layers on the flexural resistance and maximum deflection of beams, and the failure angles of under wrap and U-wrap of plain beams in flexure. Plain concrete beams with dimensions of 100mm x 100mm x 500mm were used. A concrete mix design that was approximately rounded up to the standard prescribed ratio of 1:2:4 was used. The target strength for the concrete was 20 MPa. The method used for testing was three control beam flexural tests.

Three separate beams using single, double, and triple CFRP were under-wrapped, respectively. Three distinct beams were single, twice, and three times U-wrapped using CFRP, respectively. All beams were flexural tested using centre-point loading. For the one-layer under wrap, the flexural strength resistance increased by 10.73%, for the two-layers by 13.60%, and for the three- layers by21.31%. While with the U-wrap, the flexural strength improved by 0.73% for the one-layer U- wrap, 0.52% for the two-layer U-wrap, and 21.30% for the three-layer U-wrap. The downside of the U-wrap and under-wrap strengthening techniques is the premature failure caused by the CFRP's debonding. The use of anchoring CFRP would increase flexural strength. Reinforcing concrete beams externally with CFRP improved the flexural strength of the beam.