

2012/13 Undergraduate Research Grant Scheme – Executive Summary

Project title:

Corrosion-damaged RC beams repaired in shear with embedded FRP bars

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Project summary:

Repairing corrosion damage to reinforced concrete (RC) infrastructure can be very costly, it is estimated that the United Kingdom (UK) spends approximately £620 million on repairing and strengthening RC bridges. This produces a need for an effective and durable shear strengthening method. There are many different options; Jacking and scaffolding, external steel plates and FRP bars and sheets. This paper covers the results of an experimental research project on corrosion damaged RC T-beams repaired/strengthened in shear with embedded carbon fibre reinforced polymer (CFRP) bars. The project focused on T-beams to mimic a slab and beam setup common place in RC bridges. It contains a literature review covering the basics of shear stresses, initial crack formations and patterns and the effective depth to shear span ratio. It shows the effect of corrosion damage on the internal shear links/steel stirrups and the shear resistance mechanisms, the paper also identifies the effect of embedded CFRP bars on the shear behaviour of the two tested corrosion damaged RC beams. The internal shear links of the two beams used were artificially corroded to approximately 11% and then tested to failure. The corroded T-beam strengthened with CFRP bars exhibited a shear strength increase of 10% over the un-strengthened corroded T-beam; the total shear capacity of the two beams was similar but had different concrete shear strengths so the shear force capacity index was calculated to compare the shear strengths. The addition of CFRP bars had little effect on the stiffness of the beam compared to the un-strengthened T-beam as shown by the deflection vs. shear capacity measurements. The embedded CFRP bars affected the shear behaviour of the strengthened beam, causing narrower and more evenly distributed cracks compared to the corroded un-strengthened T-beam, this is shown by the collection of photos taken during the testing.

Keywords: beam; reinforced concrete; corrosion; fibre-reinforced polymer; CFRP; shear; strengthening.