

## 2013 MSc Research Grant Scheme

**Project title:** Fibre reinforced polymer grids as shear reinforcement in fabric formed concrete beams

**University:** University of Bath

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**Aims of research:** The aim of this project is to characterise the possibilities of using partially resin coated carbon fibre reinforced polymer (CFRP) grids as an alternative to conventional steel stirrups as shear reinforcement in sections of variable profile such as those fabricated using fabric formwork. Preliminary investigation completed by the authors have proved successful and warrant further investigation in order to bring this technology forward combining with existing knowledge of CFRP longitudinal reinforcement to provide a wholly composite reinforcing system with the capacity to cope with variable sections of an optimised beam with one sheet of carbon fibre grid.

**Description of method:** The project will highlight the advantages partially resin coated carbon fibre reinforced polymer (CFRP) grids, as an alternative to conventional steel stirrups as shear reinforcement in sections of variable profile. In order to address, and fulfil these objectives a synergistic approach incorporating experimental and analytical work packages is envisaged.

### Work package 1 (Theoretical)

**Shear in prismatic sections:** The main objective of this work package is to provide a thorough understanding of the state of shear in variable sections, and hence be able to provide prediction of the shear capacity of variable section reinforced with linear elastic materials in both flexure and shear.

### Work package 2 (Experimental)

**Characterisation of shear capacity of variable section reinforced with partially resin coated carbon fibre reinforced polymer (CFRP):** A total of 5 beam specimens manufactured with varying densities of partially resin coated carbon fibre reinforced polymer (CFRP) grids as the shear reinforcement, will be load tested to failure in order to determine their shear capacity and hence the effectiveness of the novel shear reinforcement. The results for the experimental study will be used to validate the theoretical analysis developed in work package 1.

**Benefits to structural engineering:** It is suggested that as much as 40% of the concrete used in new office buildings does little but increase structural deadweight. Using fabric formwork, it is possible to cast structurally optimised shapes based on simple design rules whilst achieving material saving in excess of 30%. Fabric formwork offers unique opportunities for the design of low embodied energy concrete structures. The knowledge gained from this study will facilitate the development of efficient and cost effective shear reinforcement of non-prismatic reinforced concrete sections, including those constructed of fabric formwork, allowing for significant reduction in the embodied energy of our concrete infrastructure.

**Proposed finish date:** 10/2013