

2012/13 Undergraduate Research Grant Scheme – Executive Summary

Project title:

Sustainable moment resisting connections

University:

Queen's University Belfast

Supervisor:

Dr Daniel McPolin

Contact details:

David Keir Building, Stranmillis Road, Queen's University Belfast

Telephone: 02890974233

Email: d.mcpolin@qub.ac.uk

Student:

Ruth Mulholland

Project summary:

Timber is an efficient structural material due to its high strength to weight ratio and environmental impact compared to traditional construction materials such as concrete and steel. This experimental project considers timber as a sustainable method of creating moment resisting connections. The connection under research consisted of two Basalt Fibre Reinforced Polymer (BFRP) rods, embedded in timber with a 2mm adhesive thickness. The connection replicates the beam and post connection of a portal frame.

The main aims of the project were the development of theory for predicting capacity of the frames, determination of failure modes, performance of embedded dowel connections and the impact of pitch. Variables considered in this project were the configuration of the rods in relation to the edge distance of the timber and the angle of inclination of the frame. The frames were tested by loading the frames to failure at 0.1kN increments. Loading, deflection and strain were recorded at each increment.

The findings concluded that using BFRP was a successful form of reinforcement and confirmed its advantageous properties. In relation to the variables, the angle of inclination at ten degrees and the rods positioned at a minimum edge distance had the highest ultimate capacity compared to the others. The failure of the frames were due to a combination of failure modes, no failure mode acted independently. The main failure mode was the rod - adhesive failure and also tensile timber cracking. A factored moment equation was produced based on geometry of the joint giving closer to experimental numerical results than the original moment equation.