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2011/12 Undergraduate Research Grant Scheme – Executive Summary

Project title:
Development of novel prestressed timber composites

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Project summary:
Glue laminated timber (glulam) has allowed timber sections with larger dimensions, less variation and greater strength than that of solid timber to be produced. However, this can be an expensive process, especially for substantial loading conditions where large cross-sections are required. The technique of prestressing timber could be used to further enhance the properties of glulam, creating the opportunity to use a sustainable material in situations which it had not previously been suitable.

The aim of this research is to investigate the flexural performance of prestressed timber using steel threaded bar. Prestressing timber beams has the potential to increased load carrying capacity and spans, along with the potential for reductions in structural depth and service deflections.

This research programme involved the flexural testing of six unreinforced timber control beams, and six prestressed timber beams using 8mm steel threaded bar which were post tensioned in nature.

The 10kN prestressed beams displayed an increase in ultimate load carrying capacity of 48.7% over that of the unreinforced beams, and at the same load within the elastic limit net deflections were reduced by 27.3%. Three of the six prestressed beams showed signs of initial compression yielding on the top edge of the beam before ultimate tension failure of the beams occurred.

The level of prestressing force applied to the beams in this investigation was limited by the tensile strength of the steel bar, as some of the beams used in this testing programme were left over from initial prestressing research, and therefore the size of the hole in the beams was fixed. Further research should include the use of larger diameter steel bars or other materials with a high tensile capacity such as FRP, allowing a greater initial prestress force to be applied to the beams, increasing the positive effect of the prestressing process.