

2013/14 Undergraduate Research Grant Scheme – Executive Summary

Project title:

Shear connection of cross laminated timber to steel beams with gangnail plates

University:

University of Sheffield

Supervisor:

John Buick Davison

Contact details:

Department of Civil and Structural Engineering, Sir Frederick Mappin Building, Mappin Street, Sheffield, S1 3JD

Telephone: 0114 222 5354

Email: j.davison@sheffield.ac.uk

Student: Christopher Jarvis

Project summary:

Timber is seen as a “green” material as it can be a sustainable material, therefore in recent years it has been in increased demand. Recently the technology and design philosophies behind the use of Cross-Laminated Timber (CLT) have made it an alternative building material. The hybridisation of structures using Cross-Laminated Timber and a steel or concrete frame has become an area of interest due to the “green” aspect and the total weight of the structure will likely be less than a comparable steel-concrete composite frame.

A poorly researched area is that of composite action between a steel beam and CLT flooring where at present only non-composite action is considered. Therefore this research will investigate the level of composite interaction achieved between a steel beam and Cross-Laminated Timber flooring using a Gangnailplate (GNP) shear connection as commonly used in trusses. The research undertaken is in the form of experimental results that will explore the basic principles of this idea and a theoretical design will be used to establish the amount of composite interaction possible from the experimental data.

The experimental results show that the failure mechanisms are semi-ductile and the shear capacity of the GNPs are considerable. Using relevant sections from the Eurocodes relating to steel, timber and composite design, a design method was established. Theoretical results show that partial composite interaction is possible for the case investigated, however further research is required to establish the relationship when increasing the amount of GNPs. Practical issues were highlighted that could limit the use in the construction industry, such as the substantial force required to press the CLT on to the GNPs.