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2012/13Undergraduate Research Grant Scheme

Project title: Evaluation of Shear Constant of Timber Glulam Composite Using Torsional Test Method

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Aims of research:
Shear constant of timber glulam materials plays an important role in structural modelling, such as lateral torsional buckling of the glulam beam, floor vibration and stabilities of long span glulam girders. In normal design approach, a fraction of the modulus of elasticity (MOE) from the bending test is adopted. However, recent researches have indicated there is little evidence of the strong correlation between the Shear Constant and MOE for solid natural timber beams. More and more researchers also suggested to use torsion test to measure the shear constant instead of using traditional bending and shear block test. There are a few investigations have been carried out in this area for solid natural timber beams. However, little work has been done for glulam timber beams. The aim of this project is to evaluate the shear constant of timber glulam beams using torsional test method. A traditional inclinometers and cutting edge photogrammetric approach will be employed.

Description of method:
In normal design approach, a fraction of the modulus of elasticity (MOE) from the bending test is adopted as the shear modulus of glulam beams. However, recent researches (Zhang 2011; Khokhar 2010; Khokhar 2009) have indicated there is little evidence of the strong correlation between the Shear Constant and MOE for solid natural timber beams. Thus, it is important to verify this relationship for glulam beams. In this project, a torsional test method is proposed and inclinometers are employed to measure the rotation of the specimens. Although, inclinometer is convenient on measuring the surface rotations, but the size of the sensor has also limited the measure only to the level of average rotation of the area covered by the sensor rather than the accurate rotation at a given location thus it is not possible to measure the shear strain distribution along the height of the cross-sections which is essential to understand the torsional behaviour of the glulam beams. The development of new techniques to measure the rotation of a smaller area is very important when determining the shear constant with torsion test method. In this project, in addition to using inclinometers, a photogrammetric technique for measuring the rotation of a small area will also be developed for the torsion test method to evaluate the shear constant of glulam beams.

References:
ZHANG, H., MOHAMED, A. AND XIAO Z., 2011. Evaluation of the shear constant of a timber beam using photogrammetric approach. The 13th International Conference on Civil, Structural and Environmental Engineering Computing, 2011, Crete, Greece.
KHOKHAR A. M., ZHANG H., RIDLEY-ELLIS D. AND MOORE J. 2010. The shear strength, and failure modes, of timber joists obtained from the torsion test method, The 11th World Conference on Timber Engineering, 2010, Riva Del Garda, Italy.
KHOKHAR A. M, ZHANG H. AND RIDLEY-ELLIS D. 2009. Shear strength of timber joists obtained from torsion tests. WG meetings COST Action E53-Quality Control for Wood and Wood Products, 2009, Lisbon, Portugal.

Benefits to structural engineering:
This project aims to propose a proper yet simple and effective method to evaluate the shear constant of the glulam beams. Shear constant plays an important role in analysis and design of glulam structures. It greatly influences the modelling of floor vibration, lateral torsional buckling, etc, of glulam beams. This study will enhance our understanding of the shear constant for glulam materials and it is relationship with MOE.

Proposed finish date: May 13