

COST FP1004

Short-term scientific missions

15-17 April 2015 – Lisbon, Portugal

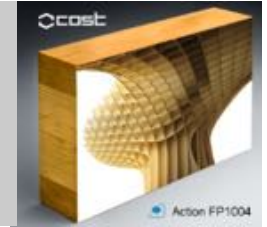


GFRP connectors for thin topping timber-concrete composites

Jonathan Skinner

Structural Engineer, Ramboll UK

Acknowledgments



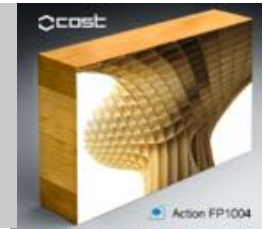
Elin Salisbury

MEng Student, University of Bath

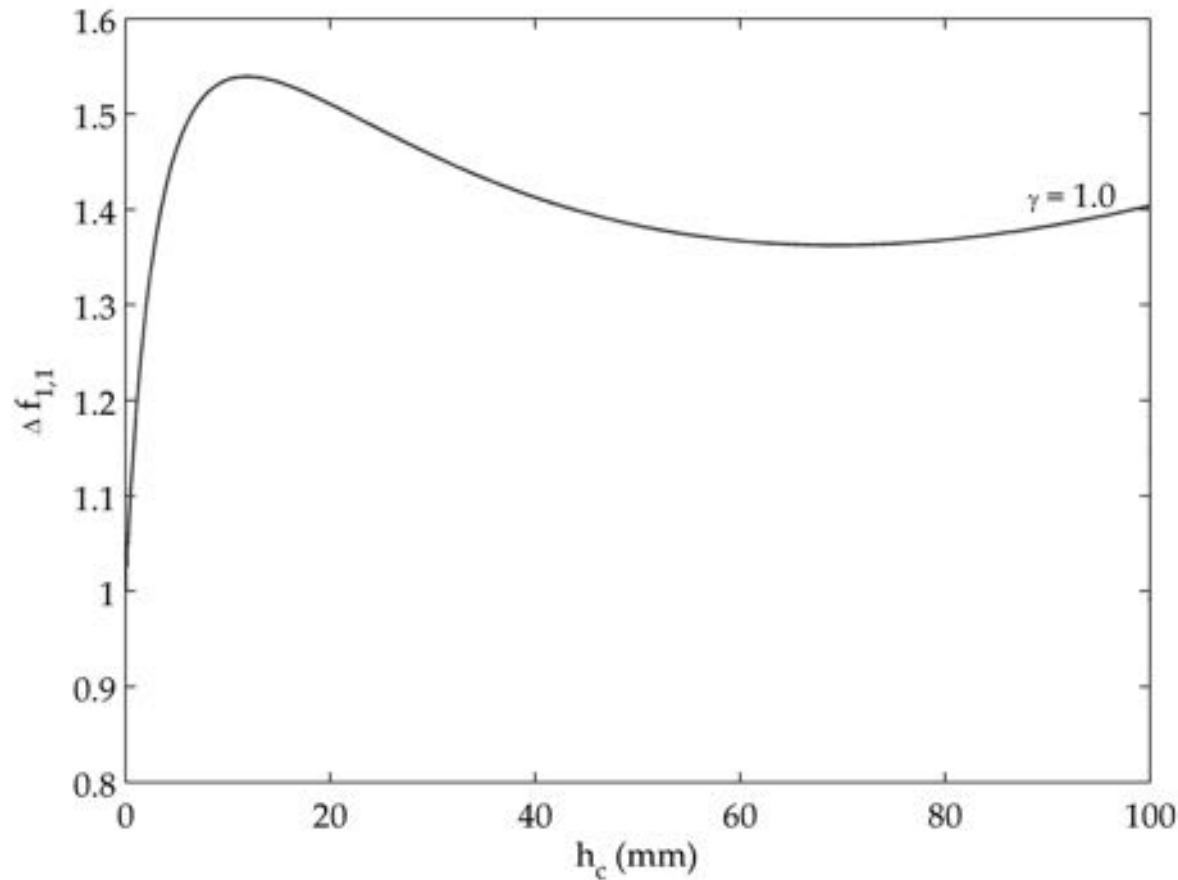
Richard Harris

Professor of Timber Engineering, University of Bath

STSM – Coimbra, Portugal



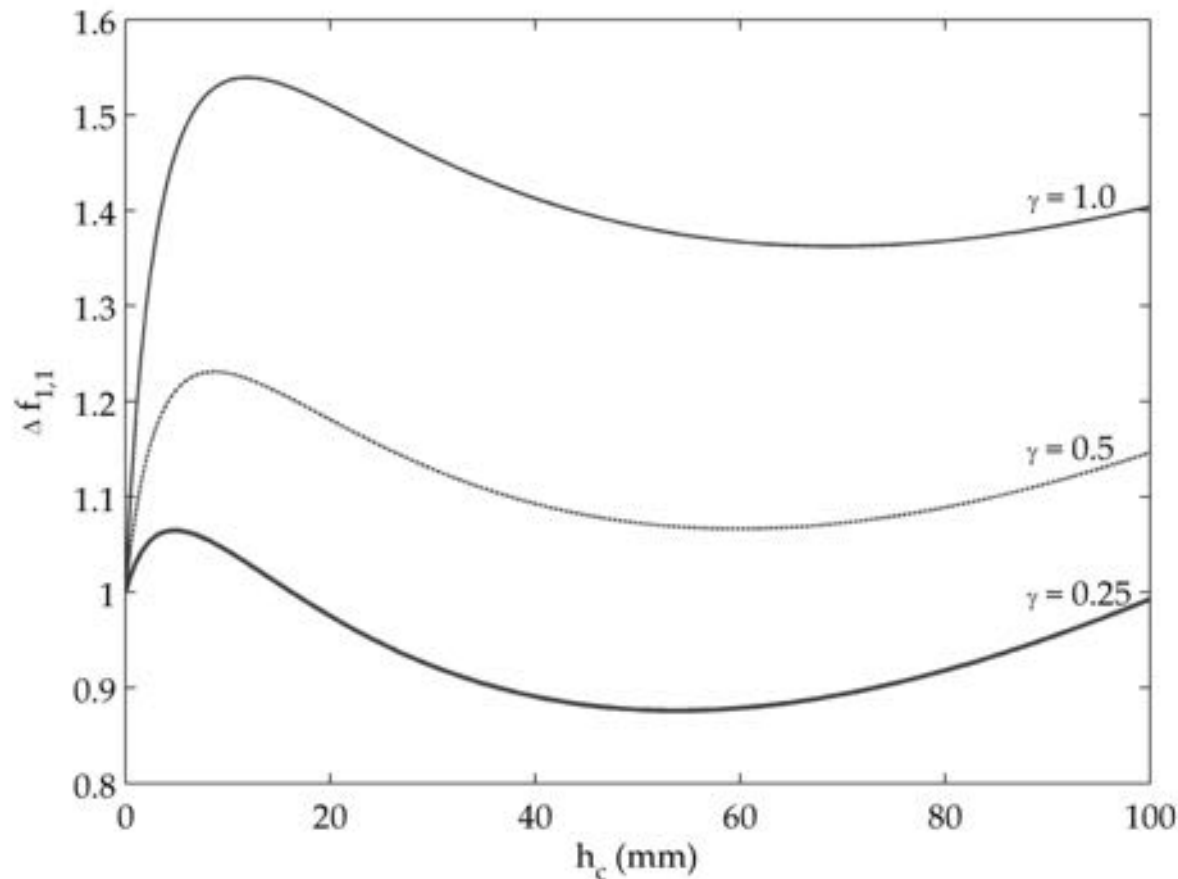
Theoretical frequency vs topping thickness



$$\Delta f_1 = \sqrt{\frac{(EI)_{TCC} \cdot m_T}{(EI)_T \cdot m_{TCC}}}$$

Skinner et al. (2014) Concrete upgrade to improve the vibration response of timber floors. Proc of the ICE-Struct and Build 167(9): 559-568

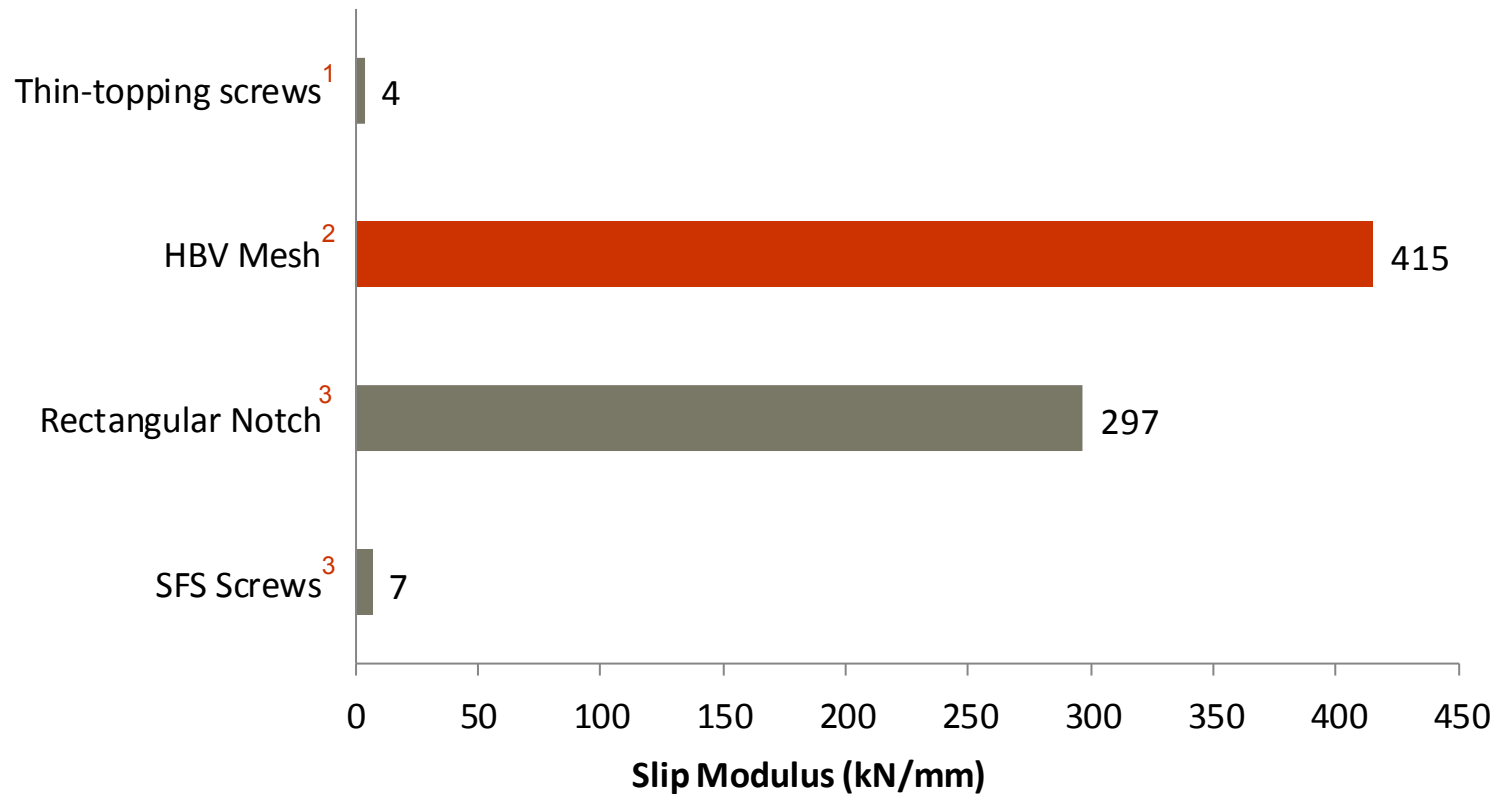
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Slip Modulus of various TCC connectors



¹ Skinner et al. (2014) Screw connectors for thin topping, timber-concrete composites, *Mater and Struct*, 47(11), 1891-1899;

² Clouston et al. (2005) Shear and bending performance of a novel wood-concrete composite system. *J. Struct Eng*, 131(9), 1404-1412;

³ Deam et al. (2008) Connections for composite concrete slab and LVL flooring systems. *Mater and Struct*, 41(3), 495-507;

Ideal TCC connector attributes



Cost effective

- Inexpensive to manufacture and quick to install

Practical installation on site

- Sighting a notch through floor boards is difficult

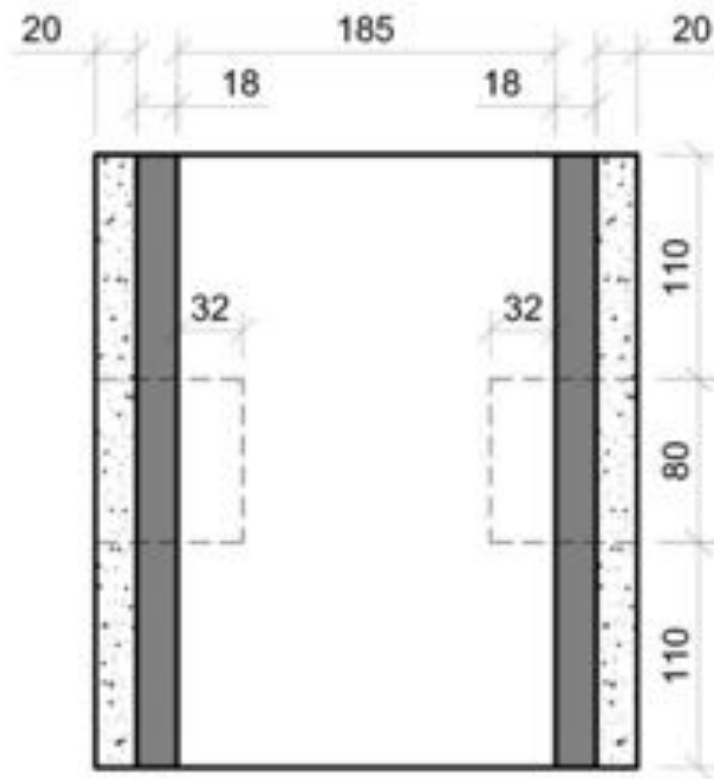
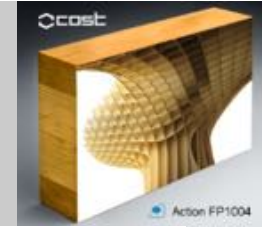
Safety on site

- HBV Mesh very sharp and a hazard if left exposed on site

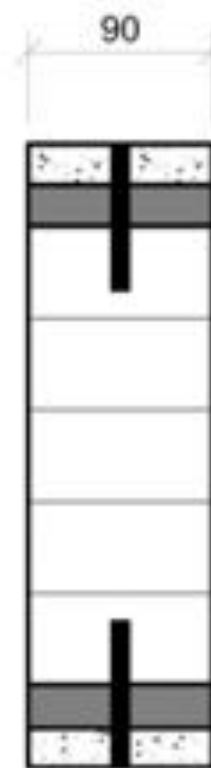
Reversibility

- Ideally the refurbishment should be reversible so that the structure can be returned to its original state.

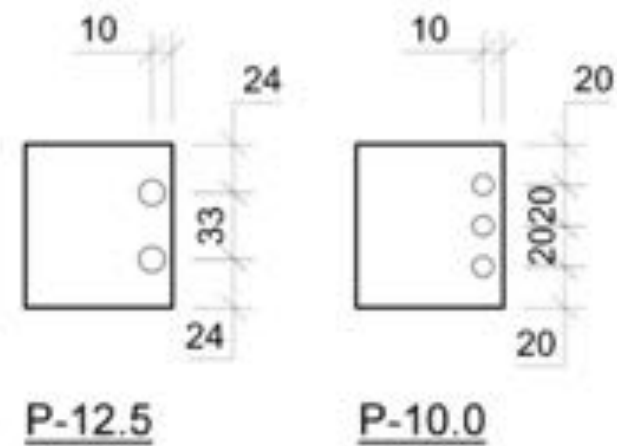
Test Specimens



Elevation



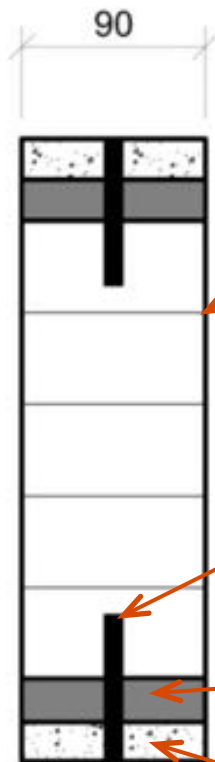
Plan



x3 replicates

Plate Layout

Test Specimens (cont.)



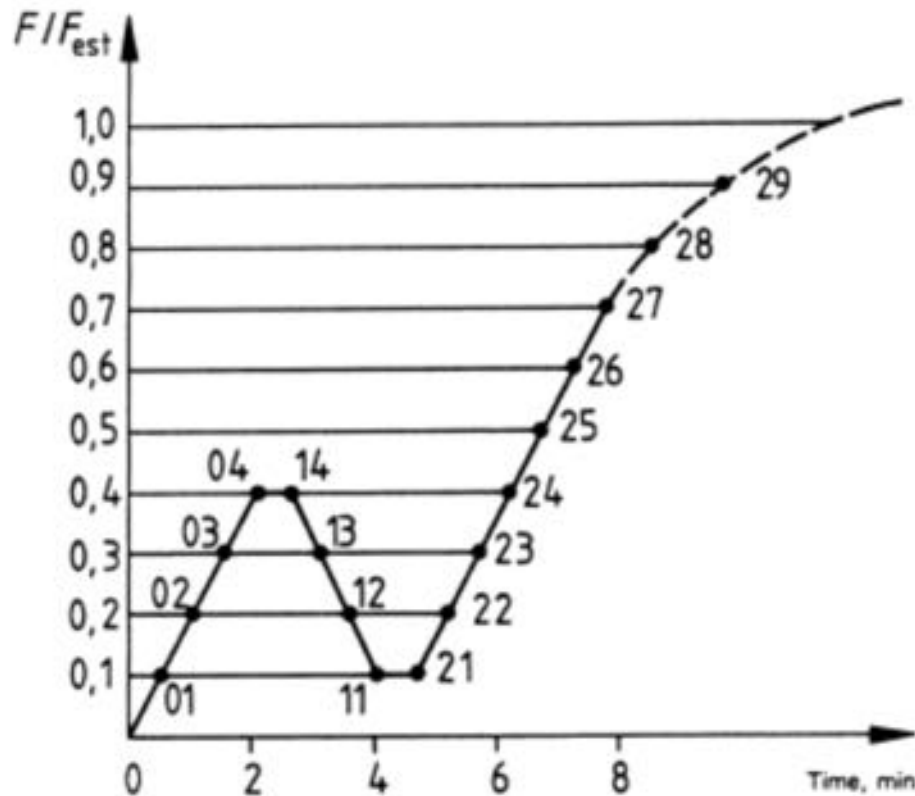
90mm wide, 300mm deep European whitewood, glulam block

9.6mm thick GFRP plates cut from Strongwell Extern 525 pultruded leg angles and fixed with polyurethane adhesive

18mm thick particleboard interlayer

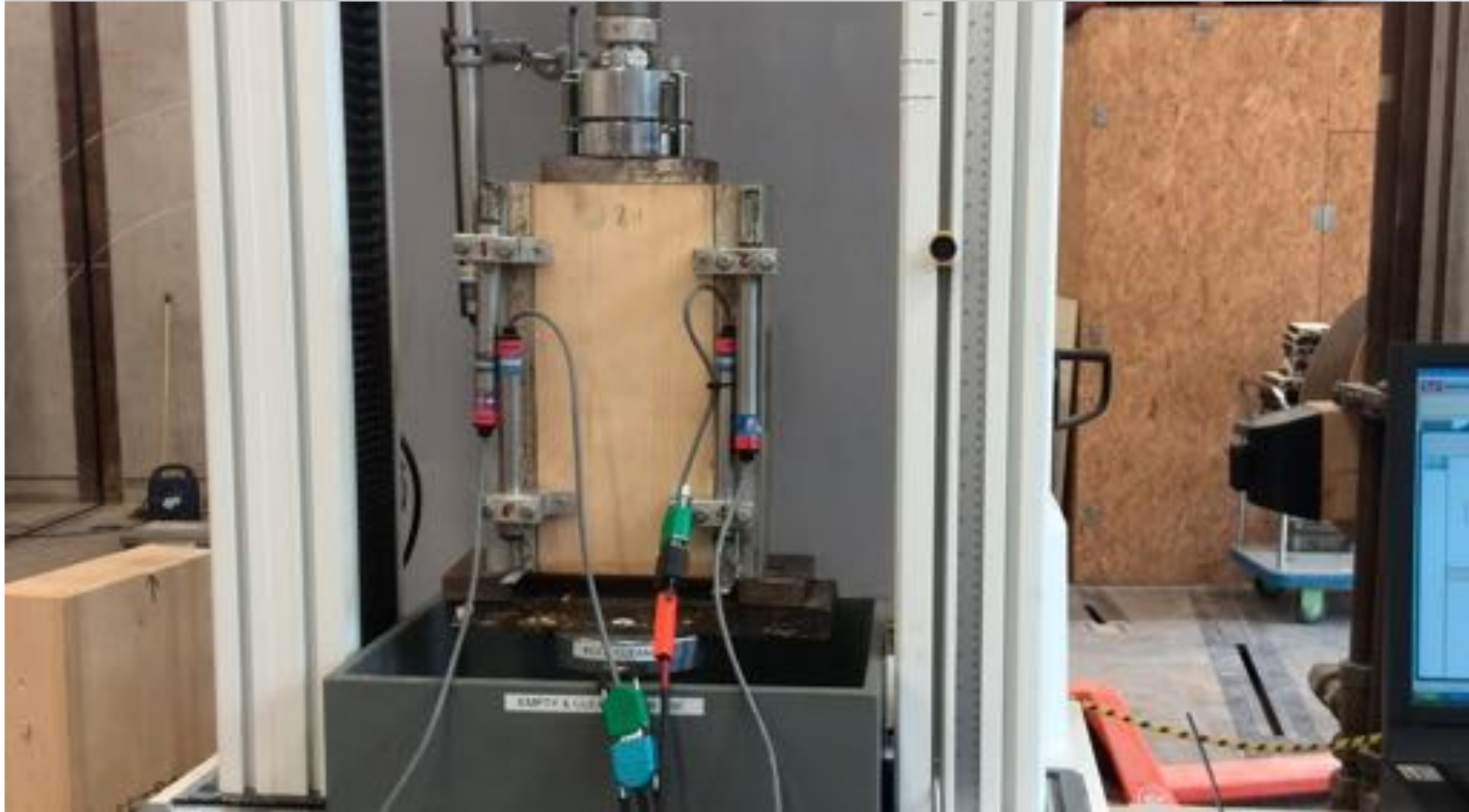
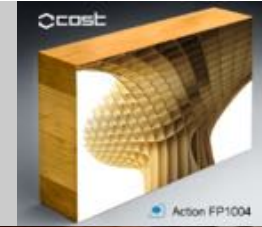
20mm thick IFS polymer modified screed topping

Test loading protocol

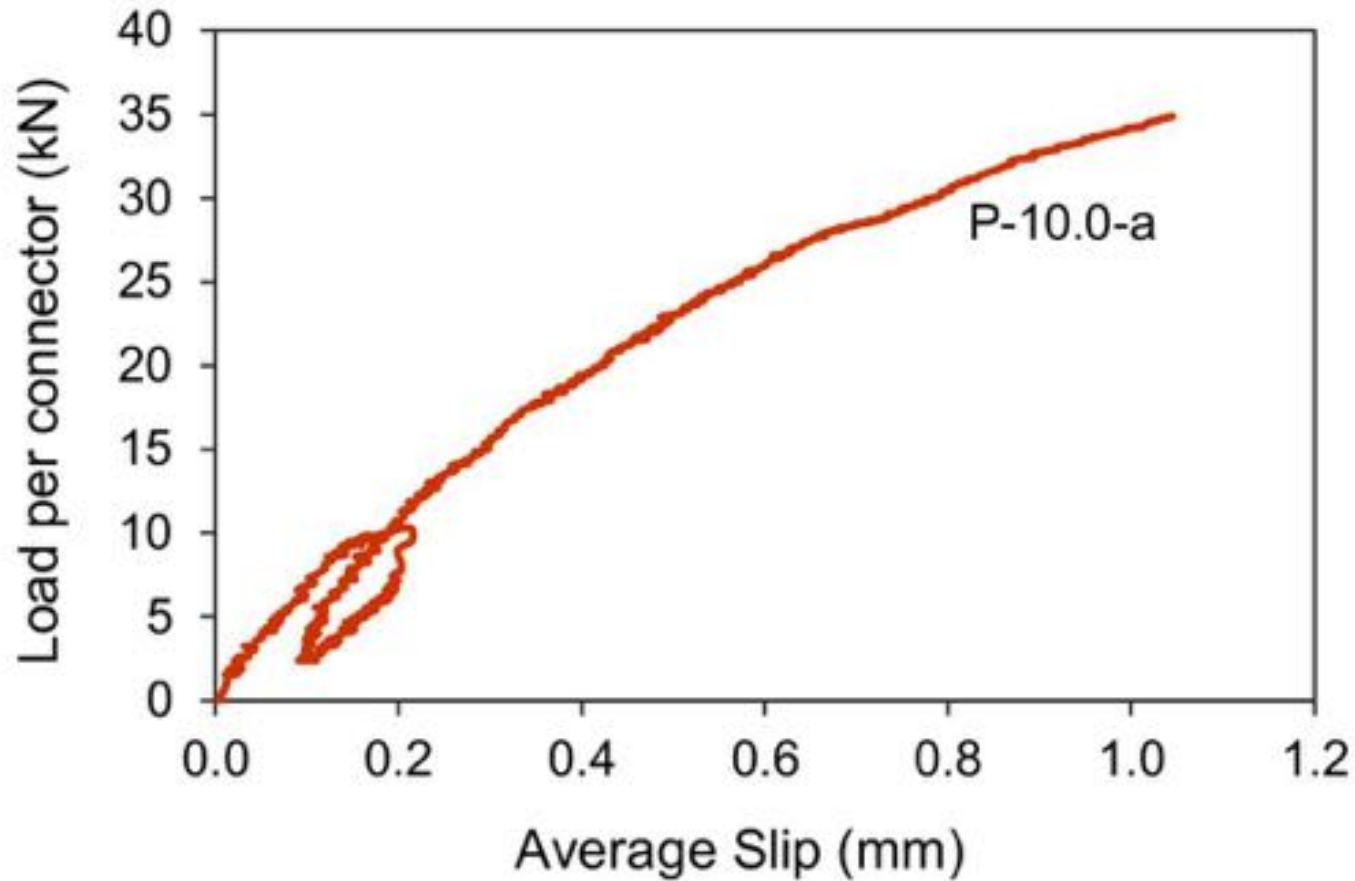
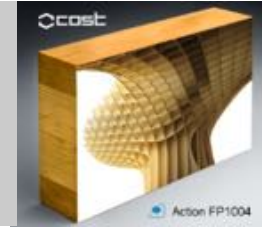


EN 26891:1991 Timber structure-Joints made with mechanical fasteners-General principles for the determination of strength and deformation characteristics

Test Setup

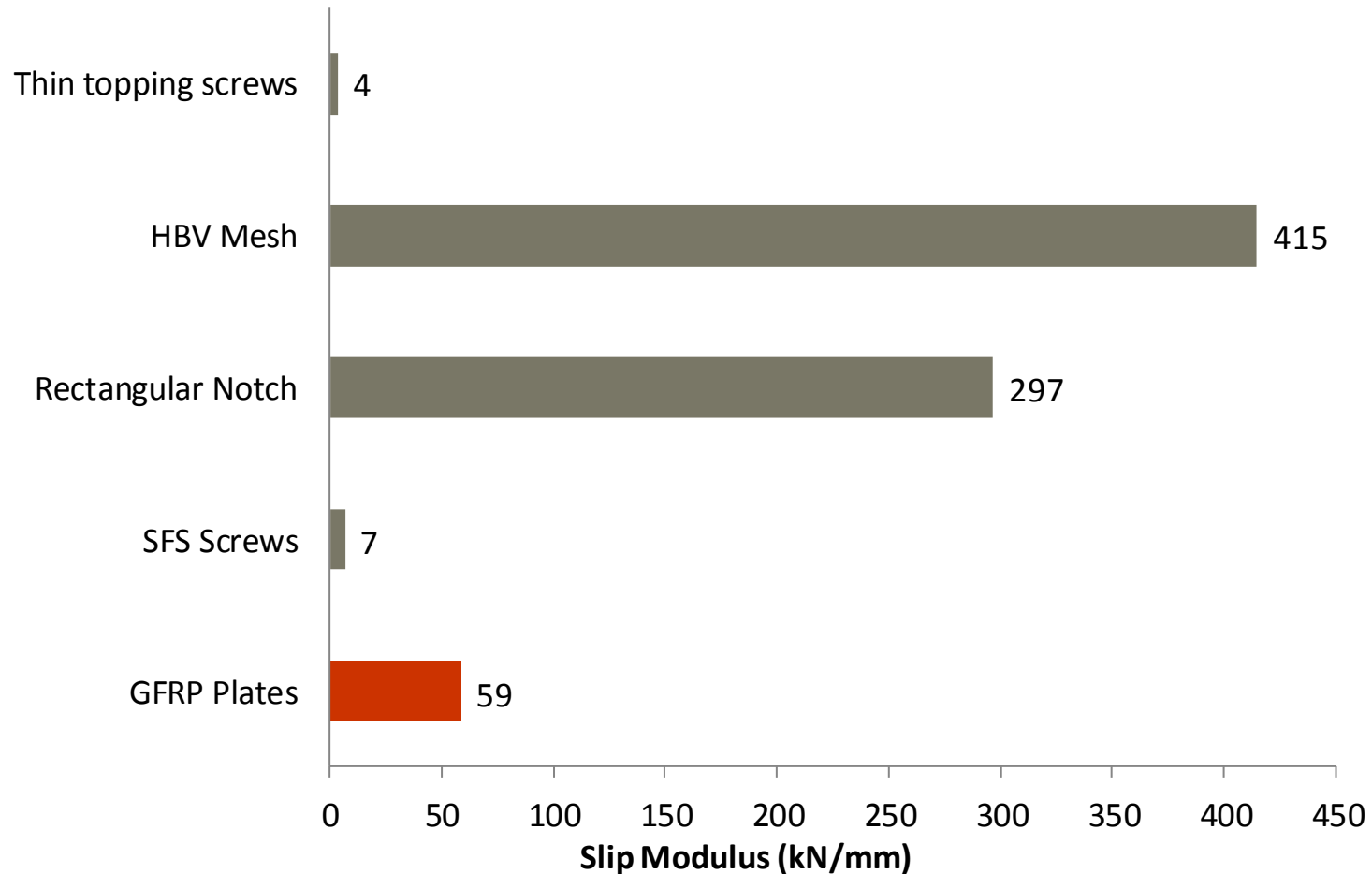


Typical Load-Slip Behaviour

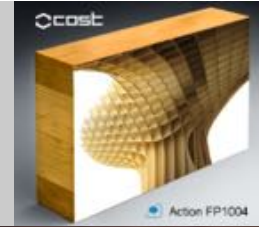


Mean $K_s = 58.8\text{kN/mm}$ Mean $F_{\max} = 29.9\text{kN}$

Slip Modulus Results



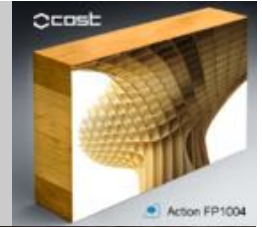
Failure



Tension Failure



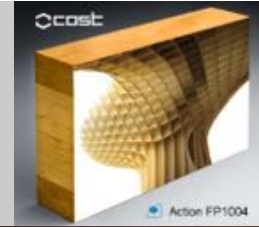
Failure (cont.)



Poor preparation of adhesive area led to rotation of GFRP plate



Future Work



Local reinforcement to prevent premature tension failure



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Thank you

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Jonathan.Skinner@ramboll.co.uk

Structural Engineer, Ramboll UK