

DEVELOPMENT OF ADHESIVE FREE ENGINEERED WOOD PRODUCTS FOR ADHESIVE FREE TIMBER BUILDINGS

Zhongwei Guan^{1*}, Adeayo Sotayo¹, Dan Bradley¹, Marc Oudjene², Imane El Houjeiri², Van Diem Thi², Annette Harte³, Sameer Mehra³, Peer Haller⁴, Siavash Namari⁴, Ahmed Makradi⁵, Salim Belouettar⁵, Francois Deneufbourg⁶

¹ School of Engineering, University of Liverpool, Brownlow Street, Liverpool L69 3GQ, United Kingdom,
zguan@liverpool.ac.uk

² LERMAB, Université de Lorraine, 27 rue Philippe Séguin 88026 Epinal, France. marc.oudjene@univ-lorraine.fr

³ Department of Civil Engineering, NUI, Galway, Ireland, annette.harte@nuigalway.ie

⁴ Technische Universität Dresden, Germany, peer.haller@tu-dresden.de

⁵ Luxembourg Institute of Science and Technology, Esch-sur-Alzette, Luxembourg, ahmed.makradi@list.lu

⁶ Office Economique Wallon du Bois, Belgium, f.deneufbourg@oewb.be

ABSTRACT

Over 5 million m³ of engineered wood products (EWPs) are produced in the EU annually and the market is rising. However, EWPs have a high degree of petrochemical use in their manufacturing. In addition, throughout the life span of these EWP products from manufacture to disposal, they emit formaldehyde and other volatile organic compounds (VOCs), which make reuse and recycling very difficult. In order to tackle the above problems, an alternative and more environmentally friendly method of connecting wood laminates and joining structural members would be to use compressed wood (CW) dowels and fasteners. This form of connection and joining systems helps to deliver low impact buildings whilst potentially increasing the market for thousands of hectares of sustainably managed farmgrown timber. There are many other advantages which include: reductions in VOCs during manufacturing and CO₂; easy to reuse, recover and recycle; improved fire resistance due to CW dowels being hidden inside wood; improved joint tightness (due to moisture-dependent swelling and spring-back of compressed wood). Therefore, a consortium with members from six European countries was formed to develop adhesive free engineered wood products (AFEWPs) and connections throughout a joint project supported by the Interreg North-West Europe (NWE) Programme. The aim is to achieve novel use of natural fibre building materials and to tackle sustainability of the fundamental building materials to help deliver sustainable future built infrastructures. The outcomes of the research work will help re-naturing cities with the above benefits and significant added-value to tackle various societal challenges such as climate change, air pollution on human health and resource management. In this paper, experimental work on Adhesive Free Engineered Wood Products is presented, which covers (1) manufacture of compressed wood (CW) dowels, (2) fabrication of adhesive free laminated beams, panels and connections, (3) structural testing of AFEWPs. Also, three adhesive free timber building demonstrators will be constructed in Liverpool, Lorraine and Dresden to show the real applications of the adhesive free timber structures.

Corresponding Author: Zhongwei Guan

KEYWORDS: Compressed wood fastener; adhesive free laminated beam; adhesive free timber connection; adhesive free cross laminated timber panel; adhesive timber building