Innovative joints making buildings both resilient and robust

Description

Strong and safe connections for multi-storey timber structures

Professor Hans Joachim Blass received The 2010 Marcus Wallenberg Prize for his research on connections and reinforcements with high load transfer capacity for timber and laminates. He is now working on special joints for multi-storey buildings made of cross-laminated timber as well as timber structures in earthquake prone areas.

â??Connections are the vulnerable spots in any timber structure since they are nearly always weaker than the wood-based members to be connected. Traditional connections only introduce the loads close to the surface of timber members and hence cause stress peaks potentially leading to premature failure. Inclined screws with full thread along the shank can be arranged throughout the whole cross-section of even large timber members, thereby distributing the load to be transferred much more evenly, leading to higher load-carrying-capacities approaching the member capacities.

The research performed at Karlsruhe Institute of Technology led to the development, commercialisation and wide dissemination of fully threaded screws for timber structures not only in Europe, but also in North America, Australia and New Zealand. These screws are not only used to connect timber members, they also serve as reinforcement perpendicular to grain, where timber is especially weak. Even beams of glued laminated timber, glulam, with depths exceeding 2.0 m can be strengthened against tensile or compression failure perpendicular to the grain. The outcome of our research is timber structures being more economic and more robust.

While the research regarding large self-tapping screws aimed at the optimisation of the static load-carrying-capacity of timber connections, we currently look into another role of connections in timber structures, namely the energy dissipation in structures situated in earthquake prone areas. In the event of an earthquake, timber connections may plasticize and thereby become softer without losing their load-carrying-capacity. This behaviour of connections changes the behaviour of whole buildings in the event of an earthquake, making them more resilient and hence safer.

Especially connections for multi-storey buildings made of cross-laminated timber, CLT, are the focus of the present research, being performed in collaboration with the timber research group of Professor Quenneville at the University of Auckland in New Zealand. Receiving the Marcus Wallenberg Prize has undoubtedly contributed to being awarded the 2014 Julius von Haast fellowship of the Royal Society of New Zealand. This fellowship â??allows internationally recognized German researchers to spend time working collaboratively with their New Zealand colleagues, and to establish, or enhance collaborative research of benefit to both countries.â?• This enables me to spend six weeks per year for three years in a row at the University of Auckland, where we are presently looking into the behaviour of dissipative joints for CLT buildings. The outcome of this research will again make timber structures stronger and safer and hopefully lead to timber being increasingly used where today other building materials prevail.â?•

Hans Joachim Blass

Professor Hans Joachim Blass is trying to develop better joints for buildings made of cross-laminated timber.

Marcus Wallenberg Prize 2010

Laureate: Hans Joachim Blass, Professor of Timber Construction

Institution: Karlsruhe Institute of Technology, Karlsruhe, Germany

Research field: Mechanical timber connections for engineered structures