TALKING TIMBER

CURRENT CHALLENGES FOR TIMBER ENGINEERS

On July 5, the Wood Technology Group (WTG) of the Institute of Materials Minerals and Mining (IOM3) held its Timber 2022 conference at the IOM3 HQ in London. In a summary of their keynote lecture, ***Matt Caldwell*** *and* ***Natasha Watson*** *from Buro Happold, Bath, discuss current challenges for practising timber engineers*

Matt Caldwell and Dr Natasha Watson are both associate engineers at Buro Happold, specialising in timber engineering and embodied carbon respectively

Timber as a structural material for larger buildings is undergoing a rapid increase in popularity. This is undoubtedly based, at its heart, on its credentials as a renewable and low impact material. Where exposed, it allows architects and designers to make a visual statement of this intent.

This does, however, raise questions around green-washing and architectural fashion; adopting timber without adjusting the basics of the design will not get us to where we need to be. There is, of course, a valid argument that going taller, spanning further and other eye-catching headlines are actually unsustainable by their nature.

As practising engineers, we have to walk the tightrope between the various project aspirations and parameters and push the right decisions early in the process. A key part of the conversation is quantitative evaluation of design decisions with regard to embodied carbon.

The level of detail required for a credible evaluation of embodied carbon has evolved quickly over recent years. Proper consideration of the impact of connections, particularly metallic ones, can be a critical aspect, as can the knock-on effects on other building systems. An increase in the depth of structural beams may increase the storey height and therefore quantity of carbon-intensive façade systems.

Fire is a key issue for consideration early in the design process. Any timber that is not fully encapsulated adds potential fuel load and fundamentally changes the fire dynamics of the building. The possibility of the self-protective char layer falling away from CLT slabs and walls further complicates the dynamics. Full scale fire testing of complete assemblies and development of more heat-resistant adhesives are showing promising opportunities for solutions to the char fall-off problem.

The process of realising a timber structure faces many challenges during the design process, each of which threatens to trigger a switch back to the general default of steel or concrete. The issue of obtaining buildings insurance can be one such hurdle.

Statistically, the most prevalent, and costly, source of insurance claims is damage from exposure to water and moisture. This may originate from water being trapped during construction, escape of water from plumbing, interstitial condensation, ingress through the building envelope or other subtle processes. Currently, the overall viability of mass timber construction projects can be largely dependent on the approval of insurers, so consideration must be given to this from the very early stages.

With the rapid rise of the large-scale mass-timber building, the unconscious transferring of principles from other building materials raises the possibility of problems. An example is the application of tie forces for robustness and disproportionate collapse directly across from steel or concrete frame construction. Due to timber connections potentially not having sufficient rotational ductility to develop a catenary, the horizontal tie-force method may miss one if its fundamental assumptions.

In the situation that an accidental event does occur, in-situ repairs will be required. A reasonable number of successful repairs have been made to engineered timber structures, but there is a very small amount of knowledge-share across the commercial and research communities. It would be very useful to see trade bodies or academia helping to assist in this field, so that commercial and liability considerations can be removed from the equation.

Looking to the future, the field of bio-based materials, composites and 3D printing potentially offer a way of further reducing the embodied carbon of structural elements and toward renewable sourcing of the base materials in many industries, including construction. The automotive and furniture industries are already grasping this opportunity and construction needs to make sure we don't miss the party. ■

Below: Kingswood Preparatory School, Bath. Buro Happold & Stonewood Design. CLT and glulam superstructure
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