Editorial

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The UK government's 2050 net zero target dictates that a focus on environmentally friendly structures is essential for built environment and infrastructure applications. To that end, this May 2020 issue of the *Structures and Buildings* international journal presents research on two forms of low carbon construction.

First, the Briefing (Sebastian 2020) is a commentary which fixes the spotlight on glass fibre reinforced polymer (GFRP) road bridges, in which the low carbon credentials emerge from the low weight, modularity and corrosion resistance of the GFRP components. The article highlights the urgent need for research into the performance of GFRP bridge decks under tyre load fatigue, which otherwise threatens the sustainability of this promising low-carbon innovation.

The focus then switches to another low carbon material, namely timber. Six papers are presented which reflect advances in research on different structural applications of timber. The first three papers are on floor systems comprising timber joists acting compositely with a topping, while the fourth presents the key detailing and assembling features of a 24 m long timber grid-shell, with the closing two papers focusing on the structural action of cross-laminated timber (CLT) panels in buildings.

The opening paper, by Schober (2020) from Germany, presents an experimental investigation into the structurally enhancing effects, on timber joists, of thin epoxy-based polymer concrete (EPC) toppings in the context of renovation and restoration of historical building timber floors. Only a commercial primer, laid onto the spruce timber members used in the study, was necessary before casting the EPC. This approach ensured penetration into and adhesion with the timber, sufficient to create a high strength, rigid, continuous, chemically-based timber-EPC shear connection. Alongside tests on 2.5 m span timber joists, predictive analyses including rheological models for the EPC show that both short-term and long-term behaviour are improved by the EPC, with 50% increase in load capacity and with the observation that creep can be significant.

The second paper, by Richard *et al.*, (2020), is a collaboration between authors from Belgium, China and Dubai. It focuses

on experimental characterisation of the shear transfer between timber joists and concrete slabs incorporating industrial waste additives, via novel micro-notch connectors cut into the timber. The test data show that smaller gaps between the micro-notched connectors and the use of a superabsorbent polymer to enhance curing within the concrete both led to improved slip stiffness and shear strength of the connection. The use of ground granulated blast furnace slag in the concrete led to reductions in connection performance that were considered to be offset by the associated environmental gains.

In the third paper, by Monteiro *et al.*, (2020) from Portugal, the transverse load distribution capabilities of timber-concrete composite (TCC) floors are investigated by way of numerical analysis. This paper follows a previously published experimental study by Mudie *et al.*, (2019), which itself demonstrates that midspan moment sharing (that was inferred using innovative strain gauge layouts) can differ significantly from the more commonly and directly measured support reaction sharing in TCCs. The numerical study (Monteiro *et al.*, 2020) concludes that the floor span has the dominant influence on load sharing, with longer spans improving load sharing capability.

The fourth paper, by Lara-Bocanegra *et al.*, (2020) of Spain, describes the world's first permanent gridshell made of the timber species *Eucalyptus globulus* Labill. The structure covers a plan area of 24 m × 6.5 m and is supported on its short sides, not on its entire perimeter as in previous long gridshells. The authors describe a network of interlinked algorithms used to define all geometric and structural details. Now due to the material's rheological behaviour, over time there is relaxation of the initial bending stresses in the permanently curved timber members. The paper describes *ad hoc* testing to quantify this relaxation, give the absence of relevant guidance in the codes or in the scientific literature. Other tests to determine glued finger-joint behaviour, along with simple but effective nodal joints based on six-layer laths with M12 bolts, and a rapid erection scheme based on low-power craning of the assembled gridshell into position are also described. In closing, the authors hint at further research on this gridshell form in the wider context of sustainable modular roofs.

Of the final two papers, both focused on CLT buildings, the first is a collaborative effort between Canada and Italy. Mestar *et al.*, (2020) present a simplified frame model to predict the complex lateral load responses of CLT walls with different layouts of door or window openings and of hold-downs. Results from the simplified model are shown to agree reasonably well with previously published test data by other researchers, and to correlate to varying extents with results from a more sophisticated numerical model using shell elements. Finally, the closing paper of this themed issue is by Huber *et al.*, (2020) from Sweden. They use nonlinear static finite element analysis, results of which were inserted into a simplified dynamic model, to understand alternate load paths in an existing multi-storey CLT building. The resistance mechanisms identified, including arching of the walls and catenary action of the floors, can lead to improved building design approaches. This can in turn put methods for preventing disproportionate collapse of timber buildings on par, in terms of refinement, with those for their concrete and steel counterparts.

We hope that you find this issue an informative read from both practical and research perspectives. As always, discussions on these illuminating papers are welcomed.

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