Cite this article
Cashell KA (2024)
Editorial.
Proceedings of the Institution of Civil Engineers – Structures and Buildings **177(11)**: 941–942,
https://doi.org/10.1680/jstbu.2024.177.11.941

Structures and Buildings

Editorial

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In an era where resilience and sustainability are at the forefront of engineering innovation, this issue of *ICE Structures and Buildings* brings together important research on the use of advanced materials and predictive modelling approaches in structural engineering. The contributions in this edition provide valuable insights into how novel material applications and refined analytical techniques can enhance the performance and longevity of critical infrastructure. From fibre-reinforced polymers (FRPs) and laminated bamboo to innovations in sandwich panels, the articles in this issue underscore the transformative potential of modern materials in overcoming structural challenges.

One of the issues highlights is the exploration of externally prestressed steel–concrete composite beams (EPSCCBs), where the replacement of traditional steel tendons with carbon fibre-reinforced polymer (CFRP) tendons reveals promising results (Moscoso *et al*., 2024). The study demonstrates that CFRP tendons not only maintain performance standards but exhibit greater force increments under loading compared to other fibre-reinforced options. The finding challenges conventional assumptions on tendon friction, offering a new perspective on material behaviour at the steel-concrete interface. This research exemplifies how alternative materials can meet, and even exceed, the performance of traditional steel, suggesting a future where composite materials become mainstream in large-scale structural applications.

Another standout study investigates the ultimate strength of a light-rail hybrid cable-stayed bridge, with a focus on the concrete tension softening effect (CTSE) (Bai *et al*., 2024). This effect, often overlooked in traditional analyses, plays a crucial role in the ultimate load-bearing capacity of structures where concrete's tensile strength is disproportionately low compared to its compressive strength. By incorporating CTSE in a finite-element model, the researchers present a more realistic portrayal of failure mechanisms in complex bridge structures. The findings highlight the necessity of considering material-specific properties to ensure safety and resilience in critical transport infrastructure.

This issue also presents a very interesting experimental investigation into the reinforcement of slender steel plate girders using various FRP composites (Bhutto and Rafi, 2024). The application of GFRP pultruded sections and CFRP fabrics to strengthen web panels in girders resulted in notable gains in out-of-plane stiffness and ultimate strength. Such advances in web buckling prevention are crucial in optimising load-carrying capacities, especially in scenarios where weight and cost are primary concerns. This work emphasizes the potential of FRP composites in retrofitting and enhancing structural integrity, particularly in aging infrastructure where traditional reinforcements might be infeasible or cost-prohibitive.

The issue further extends its material innovation theme to sustainable materials with a study on laminated bamboo lumber (LBL) shear walls (Wang *et al*., 2024). As a renewable alternative to traditional wood products, bamboo's application in structural systems has gained momentum, particularly where environmental impact is a consideration. By investigating the mechanical behaviour of nailed connections under cyclic loading, the study contributes essential knowledge for practical applications of bamboo in seismic regions, offering insights into its resilience under varying load conditions. The findings reinforce bamboo's viability as an eco-friendly building material that does not compromise on strength and durability.

Finally, a simplified modelling approach for local buckling in metal-faced insulated sandwich panels (MFISPs) completes the collection (Tahir and Hamed, 2024). These panels, often employed in modern building facades, are prone to local buckling due to their thin metal face sheets. The study introduces an innovative finite-element method that estimates buckling without requiring a full three-dimensional analysis, reducing computational effort while maintaining accuracy. The research's practical applications span across industries where insulated panels play an integral role in both energy efficiency and structural design, showcasing how simulation tools can streamline design processes without sacrificing performance.

In a time when structural engineering is increasingly influenced by the need for sustainable, resilient, and efficient designs, the studies in this issue provide both practical solutions and theoretical advancements. By continuously exploring the frontiers of advanced materials, researchers and practitioners alike can develop a path toward infrastructure that is not only robust and adaptable but also aligned with the demands of our evolving world. I am sure that in this issue of *ICE Structures and Buildings* the insights will inspire further exploration and implementation of advanced materials and design methodologies in our field.

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