Guest Editor Preface

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The transition towards a sustainable and resilient built environment is reshaping research and practice across civil engineering. Reducing the environmental burden of construction, improving resource efficiency and circularity, increasing the resilience of structures and infrastructure, and making better use of digital technologies are no longer independent research objectives. Increasingly, they form interconnected elements of a broader transformation in how buildings and infrastructure are designed, assessed, constructed and managed.

This Special Issue brings together fourteen papers reflecting these developments across different scales and fields of application. Their diversity illustrates the increasingly multidisciplinary character of contemporary civil engineering, while a set of common research directions emerge across the collection.

The first concerns materials, resource efficiency and circularity. Contributions investigate recycled aggregate concrete and alternative reinforcement, the use of mine tailings in alkali-activated cementitious materials, moisture-related performance of timber–concrete systems, and the representation of circular-economy principles in green building rating systems. Together, these studies demonstrate the importance of combining reduced use of primary resources with rigorous assessment of material and structural performance.

A second theme is structural and infrastructure resilience. Research addressing nonlinear seismic behaviour, earthquake performance of steel structures, dam - reservoir interaction and deep soil mixing for tailings-dam cutoff walls illustrates the continuing need for robust experimental evidence, reliable numerical modelling and field validation. These studies show how improved representation of physical behaviour can contribute to safer and more resilient infrastructure.

A third direction concerns digitalisation and performance-based decision support. The Special Issue includes applications of machine learning to material behaviour, ontology-based BIM for construction cost management, and simulation-supported optimisation of daylight performance. These studies demonstrate how digital methods can move beyond representation and data storage towards supporting engineering analysis and decision-making.

Finally, several contributions broaden the understanding of sustainability by addressing existing buildings, heritage, stakeholder participation and environmental infrastructure. Studies of historic construction techniques and vernacular heritage highlight the importance of preserving cultural and material value, while research on stakeholder partnership demonstrates the role of institutional and community dimensions in sustainable development. The assessment of advanced wastewater-treatment alternatives further illustrates the need to integrate technical performance with economic and environmental considerations.

Across these research areas, an important common message emerges. Progress towards a more sustainable built environment cannot be achieved through a single technology, material or analytical method. It requires integration across scales and disciplines: from material development to structural performance, from digital information to engineering decisions, and from technical optimisation to environmental and societal value.

The papers collected in this Special Issue offer different perspectives on this transition and illustrate the breadth of innovation currently taking place in civil engineering. They also point towards several emerging research needs, including stronger links between experimental and field-scale evidence, improved life-cycle and circularity assessment, better integration of digital information, and engineering solutions capable of simultaneously addressing sustainability and resilience.

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