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Editorial

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Editorial

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As we continue to consider how best to deliver sustainable urban development there is an ongoing need to align cutting-edge research with an understanding of urban form. How we develop our cities, what form this takes, and how we plan for the inclusion of less carbon-heavy construction materials all impact on the resilience of urban areas. In addition, an awareness of and engagement with changes in climatic and demographic systems are key factors in understanding how cities need to develop in the future. There is also a growing call to move away from carbon dioxide intensive approaches to development. This has given rise to an emerging suite of alternative construction options, some established and some in development, that look beyond traditional construction techniques and incorporate innovative approaches to design and manufacturing.

The current issue of *Engineering Sustainability* (volume 174, issue 3) brings these divergent discussions together, discussing the role of materials, technology and development frameworks in the delivery of sustainable practice. The four papers in this issue illustrate both the complexity of this process and also a series of innovative avenues that can be pursued in the design and construction of urban areas.

The common thread in all four papers is the forward-thinking nature of research assessing sustainability. Aligning new construction techniques using alkali-activated processes with assessments of building configuration assessing energy needs illustrates the continuum of thinking needed, linking research directly with practice. Moreover, by reflecting on the ways in which construction activities are shaped by institutional sustainability and resilience frameworks, we can identify where complementarity between research, policy and practice can be identified.

The promotion of knowledge exchange between academic researchers and industry, as shown in these papers, is an essential element of a move towards a more sustainable approach to urban development. The need for research to respond to the needs of practitioners is known throughout the built environment; however, a lag time remains for transitioning innovation into practice, leading to ongoing concerns regarding the continuation of unsustainable building activities.

To address these issues the first two papers in this issue both examine the re-use of construction waste to evaluate the role of alkali-activation processes in the creation of more sustainable construction techniques.

Kejkar and Wanjari (2021) discuss an alternative process for the manufacturing of bricks using an alkali-activation process that repurposes fly ash. Their paper examines the potential of alkali-activated bricks baked at lower temperatures, and their suitability for the construction industry. Through strength and texture testing Kejkar and Wanjari argue that the bricks made by way of alkali-activating fly ash are as strong as other bricks but are made with 50% less embodied carbon dioxide. As a consequence, they argue that the reuse of construction waste, in this instance fly ash baked at lower temperatures, could be a significant step forward in lowering the carbon dioxide budgets of development.

The paper authored by Gok and Sengul (2021) acts as a companion piece to the work of Kejkar and Wanjari, examining the use of waste glass as an alkali-activation of slag mortars. Their paper evaluated whether waste glass could be used as an alternative silicate source that would be comparable to traditional industry materials. Gok and Sengul outline a range of experiments used to test the flexural and compressive strength, as well as sulfate and freeze–thaw resistance, and chemical and water absorption and resistance rates. The paper concludes that the reactions of bricks made with waste glass as an alkali-activator were of comparable quality to ordinary Portland cement bricks but were less carbon dioxide intensive.

Whilst Kejkar and Wanjari and Gok and Sengul present their approach to innovation thorough the reuse of waste materials, the paper authored by Xu *et al*. (2021) analyses a new modelling technique to assess high-rise building performance. Their paper examines the role of building massing, configuration and height on energy consumption and needs. The model presented suggests that building design in terms of height, floor space layout, construction materials and building spacing can influence energy needs by over 10%. Xu *et al*. discuss how the modelling of wind, heat and shade can be used to better configure high-rise residential buildings in urban areas. They also suggest that an appreciation of local climatic context and urban morphology are key to understanding the practical value of their model with respect to moderating energy consumption. The paper recommends that this approach to modelling could be used in the design and master planning stages of development to add a greater level of climatic data to the location of buildings.

The paper by Robbins and Chittoori (2021) takes a more theoretical view and proposes an innovative framework to install a more effective understanding of sustainability and resiliency in civil infrastructure projects. They argue that, as climatic events

become more extreme, urban areas need to be able to plan accordingly to avoid the negative catastrophic socio-economic and environmental impacts of these events. By reflecting on the inclusion, use and interaction of sustainability and resiliency thinking Robbins and Chittoori argue that their framework provides greater flexibility for engineers, and other civil infrastructure providers, to react more effectively to change. The proposed framework extends existing life-cycle and risk analysis to quantify the impacts of extreme events offering a novel logic-chain that could be used to modify behaviour. They do caveat their work, arguing that there is a continuing need for high-quality data and professional expertise to be embedded within their framework to achieve the most effective outcomes.

All four papers presented in this issue of *Engineering Sustainability* illustrate the breadth of innovation being undertaken. Although each paper examines a different aspect of development from the creation of less carbon dioxide intensive construction materials to new modelling techniques though to frameworks to promote resiliency in practice, they all focus on addressing the need for more effective practices to be established. Taken collectively the four papers provide a continuum of approaches that could be combined to engineer a greater level of sustainability in urban areas across the globe.

REFERENCES

Gok SG and Sengul O (2021) The use of waste glass as an activator in alkali-activated slag mortars. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **174(3)**: 120–130, https://doi.org/10.1680/jensu.19.00070.

Kejkar RB and Wanjari SP (2021) Sustainable production of commercially viable alkali-activated bricks. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **174(3)**: 109–119, https://doi.org/10.1680/jensu.20.00001.

Robbins TA and Chittoori BCS (2021) A practical framework to assess the sustainability and resiliency of civil infrastructure. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **174(3)**: 145–158, https://doi.org/10.1680/jensu.20.00010.

Xu W, Jimenez-Bescos C and Calautit JK (2021) Investigating the impact of surroundings on a high-rise residential block's performance. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **174(3)**: 131–144, https://doi.org/10.1680/jensu.20.00066.