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Editorial: Infrastructure maintenance and monitoring for sustainable cities

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Editorial on the Research Topic
Infrastructure maintenance and monitoring for sustainable cities

1 Introduction

As cities continue to grow and evolve, maintaining and monitoring their infrastructure becomes an increasingly challenging problem, requiring multidisciplinary approaches. This problem is as critical for developing countries that are rapidly building their infrastructure (Gurara et al., 2018; Ede et al., 2019) as it is for already developed countries with aging infrastructure (Van Breugel, 2017). Researchers have recognized the pivotal opportunity this problem presents to reshape the future of cities safeguarding sustainable and equitable societies. Research has demonstrated that such transformation can be achieved through the integration of innovative solutions such as green mobility infrastructures (Kleisarchaki et al., 2022), big data and IoT enabled large scale infrastructure monitoring systems (James et al., 2022; Belli et al., 2020), and via constructing sustainable infrastructures from the ground up (Colangelo et al., 2021). A significant obstacle in large scale sustainable city development is the unreliability of physical infrastructure due to engineering defects or aging. To incorporate such infrastructure often requires constant monitoring (McKenna et al., 2021) and development of specialized infrastructure-health aware methods and policies (Kassa et al., 2024).

Such developments can also be integrated into digital twinning–a technology approach that creates virtual replicas of physical infrastructure elements, systems, and cities–that offers a dynamic framework for real-time monitoring and predictive maintenance through data integration and simulation. The ability to connect insights across these scales–from individual components to entire cities–makes digital twinning a transformative tool. It enables holistic urban management, ensuring that decisions at the micro-scale align with broader sustainability goals. This interconnected approach has the potential to revolutionize how cities evolve in response to growing environmental, social, and technological challenges.

This editorial introduces the Research Topic "*Infrastructure Maintenance and Monitoring for Sustainable Cities*," which brings together four recent works on infrastructure research conducted both in developed and in developing nations. The four research articles showcased in this topic explore pressing and practical challenges

in sustainable cities and possible solutions from multiple dimensions. The articles cover the continuum from societal to physical aspects, offering valuable perspectives for policymakers, practitioners, and researchers. These articles underscore that effective evaluation and monitoring strategies are essential for ensuring the resilience, efficiency, and sustainability of urban systems.

2 Overview of contributing articles

The article titled "*Policy evaluation and performance assessment for sustainable urbanization: a study of selected city corporations in Bangladesh*" explores the interplay between urban governance and sustainable urbanization goals in line with the sustainable development goals (SDG) (Hossain et al.). Taking Bangladesh as a case study, the paper focused on investigating how urban governance impacts the "sustainable cities and communities" goal of the SDG agenda. Based on a comprehensive analysis of data collected from primary and secondary sources, the study revealed significant disparities between stakeholder expectations and current state of urban governance. To fill the identified gaps in the study, the paper has proposed several recommendations that can be helpful for policymakers, urban planners, and other stakeholders.

The second article titled "*Evaluating the feasibility of constructing shopping centers on urban vacant land through a spatial multi-criteria decision-making model*" studied localization feasibility of a public infrastructure placement, specifically shopping centers, in the context of sustainable urban development (Khosravian et al.). This study aimed to inform urban development decisions by introducing critical socioeconomic and political dimensions, such as accessibility to public infrastructure and economic indicators, as evaluation criteria in the spatial multi-criteria decision-making problem (SMCDM).

On the other hand, the paper titled "*Quantifying thermal variation around gray infrastructure in urban India*" investigated thermal variation around sewage treatment plants (STPs) in mega cities of developing countries, taking Mumbai as a case study (Subramanian). The findings in the study showed the cooling potential of STPs in densely built urban areas. The paper concluded that synergizing green strategies within the design, construction, and operation of proposed STPs would further aid sustainable urban development by alleviating urban heat challenges.

The article "*Mycelium-wood composites as a circular material for building insulation*" focused on studying environmental benefits of incorporating innovative composite biogenic materials, mycelium-wood composites in particular, for building construction and maintenance for sustainable building practices (Candido et al.). This study has demonstrated that mycelium-wood composites have a good potential to make buildings act as carbon sinks and reduce emissions in the construction industry, thus playing a significant role in sustainability.

3 Conclusion

The research articles presented in this Research Topic have shown significant potentials of multidisciplinary approaches for informed infrastructure maintenance and monitoring strategies in sustainable cities. By adopting such findings into maintenance and monitoring strategies, cities can enhance their resilience against climate change, extend infrastructure lifespans, and improve public safety and quality of life in general. Furthermore, these research articles emphasize the need for informed policies and governance strategies to enable a more equitable and environmentally conscious urban growth.

Author contributions

YK: Writing – original draft, Writing – review & editing. SE: Writing – original draft, Writing – review & editing. DK: Writing – review & editing. BR: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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