

Editorial

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Bridge engineering continues to evolve rapidly in response to the growing demands of ageing infrastructure, increasing traffic loading, digitalisation and sustainability requirements. The papers presented in this issue highlight a broad spectrum of contemporary research and practical developments across bridge engineering, ranging from advanced sensing and structural health monitoring (SHM) to bridge maintenance, numerical modelling and developments in design standards.

The issue opens with a study by Trias Blanco *et al.* (2026) on bridge deck construction quality assurance and performance prediction using point cloud data analysis. The paper explores the application of terrestrial laser scanning (TLS) technology for bridge deck condition assessment and construction quality control. Two application scenarios are presented, including bridge deck construction monitoring and the evaluation of in-service bridge decks using detailed geometric profiling. The study demonstrates how TLS-derived point cloud data can accurately characterise longitudinal and transverse deck profiles associated with water ponding and deterioration risks. The integration of point cloud data with non-destructive evaluation methods such as electrical resistivity and ground-penetrating radar further highlights the growing role of remote sensing technologies in bridge assessment and SHM.

Zhu *et al.* (2026) present a numerical analysis of splicing temperature differences in welded steel box girder segments. Steel box girders are widely used in long-span bridge construction; however, environmental temperature variations during field welding and splicing operations can significantly affect construction quality. Using finite-element modelling, the authors simulated the welding–splicing process and examined the influence of temperature variation, boundary conditions, segment length and welding sequence on splicing temperature differences. The study provides valuable insights into the formation mechanisms of thermally induced deformation and highlights the importance of temperature control during bridge construction to minimise locked-in stresses and long-term deformation effects.

The next paper, by Hendy and Gowda (2026), presents an overview of technical improvements introduced in the second-generation Eurocodes for steel and concrete bridge design. Since the implementation of the first-generation Eurocodes in 2010, significant efforts have been made to improve usability, reliability

and consistency across the new generation of standards. The paper discusses important technical developments in both steel and concrete bridge design, including updated approaches for shear resistance, crack control, buckling, anchorage, fibre-reinforced materials and robustness considerations. In addition to improving clarity and encouraging innovation, the second-generation Eurocodes aim to better address sustainability and resilience requirements within modern bridge engineering practice.

Cai *et al.* (2026) present a methodology for analysing vehicle-induced vibration in half-through tie-arch bridges. A three-dimensional vehicle–bridge coupled finite-element model was developed considering both geometrical and contact non-linearity. The authors investigated the influence of vehicle speed, surface roughness, driving mode and vehicle type on the dynamic response of bridge suspenders. The results demonstrate that existing code-based dynamic impact coefficients may not adequately represent the behaviour of tie-arch bridges under traffic loading. The findings further emphasise the importance of vehicle–bridge interaction modelling in accurately assessing the vibration behaviour, serviceability and long-term durability of long-span bridge structures.

The issue continues with a paper by Cole and Saunders (2026) on the effective management of masonry arch bridges on the Isle of Wight, UK. Masonry arch bridges remain a critical component of many transport networks, particularly within historic infrastructure systems. Traditional empirical assessment approaches, such as the Military Engineering Experimental Establishment method, have recognised limitations, especially for short-span and multi-span arches. This paper demonstrates how advanced numerical modelling and limit analysis techniques can provide more reliable assessments of masonry arch bridge behaviour and load-carrying capacity. Through several case studies from the Isle of Wight bridge network, the authors illustrate how data-driven assessment approaches can support informed maintenance, strengthening and asset management decisions while preserving historic bridge infrastructure.

Thabit *et al.* (2026) propose a novel damage identification technique based on frequency sensitivity functions. Vibration-based SHM techniques have received increasing attention due to their potential for rapid and cost-effective damage detection. The proposed methodology uses natural frequency sensitivity functions to

identify both the location and severity of structural damage without requiring extensive modal information. The technique was validated experimentally using steel beams and numerically using the El-Salam cable-stayed bridge in Egypt. The study demonstrates the potential of frequency-based approaches as practical tools for SHM of large-scale bridge infrastructure.

Javadian *et al.* (2026) address bridge maintenance prioritisation using fuzzy logic approaches. With limited maintenance budgets and ageing bridge infrastructure, effective prioritisation of maintenance interventions remains a major challenge for bridge authorities worldwide. Focusing on urban bridges in Tehran, Iran, the authors applied fuzzy decision making techniques to identify and rank the most influential parameters affecting bridge maintenance. The research highlights the importance of integrating structural, environmental, safety, traffic and budget-related factors within bridge management systems. The proposed framework offers a practical decision-support tool for improving maintenance planning and resource allocation in complex urban transportation networks.

The final paper in this issue, by Rao *et al.* (2026), examines sustainability chain assessment in construction companies using a novel grey-based approach. Sustainability and performance assessment are becoming increasingly important within infrastructure delivery and asset management. The paper proposes a grey performance importance index methodology for evaluating sustainability chains within construction industries in the United Arab Emirates. By integrating strategic, quality and operational indicators into a grey-system framework, the study provides a methodology for assessing organisational sustainability performance and identifying improvement opportunities. Although broader than bridge engineering alone, the paper highlights the growing importance of sustainability-driven management approaches across the infrastructure sector.

Collectively, the papers presented in this issue demonstrate the increasing integration of digital technologies, advanced numerical

modelling, data-driven assessment and sustainability considerations within bridge engineering. The contributions reflect the multi-disciplinary nature of modern bridge engineering practice and provide valuable insights for researchers, practitioners and infrastructure owners involved in the assessment, monitoring, design and management of bridge assets.

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