

Editorial

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It is my pleasure to publish the October issue (4th issue) of Vol. 3 of the International Journal of Bridge Engineering, Management and Research. In this issue, we are pleased to bring to you six papers in innovative areas of bridge engineering.

The design of reinforced concrete highway barriers is a safety-critical process that requires strict compliance with regulatory provisions such as the AASHTO-LRFD bridge design guidelines. Current engineering practice relies heavily on manual, iterative, and heuristic calculations to satisfy complex nonlinear material and mechanics constraints. Although large language models (LLMs) demonstrate strong generative capabilities, their direct application to structural engineering remains limited by hallucination risks and insufficient physical grounding. To address these challenges, the paper entitled “**A Lightweight Multi-Agent Framework for Automated Concrete Barrier Design**” proposes a novel “generation–evaluation–optimization” closed-loop framework for automated concrete barrier design using the multi-agent orchestration capabilities of AutoGen. Experimental results demonstrate that the proposed agentic framework achieves over 98% design accuracy, significantly outperforming standalone general-purpose LLMs. More importantly, the study reveals that design performance is not necessarily correlated with model scale, where an 8B-parameter lightweight model could outperform unconstrained 631B-parameter flagship models. This finding highlights the potential to substantially reduce computational costs while improving the accessibility of AI-assisted engineering tools for industry applications.

Tunnels are inherently resilient structures whose service life commonly extends well beyond the intended design period, resulting in a substantial number of tunnels that have been in operation for over five decades and more. From this perspective, addressing tunnel aging requires maintaining functionality and ensuring continued safe and reliable

operation. This involves a series of coordinated efforts in maintenance, risk management, and refurbishment to guarantee consistent service over extended lifespans. The paper entitled “**Refurbishment of Existing Tunnels: Common Practice and Future Perspectives**” aims to provide an up-to-date overview of the international framework for the management and refurbishment of existing tunnels. Relevant guidelines and standards adopted worldwide are examined and compared, highlighting common principles and distinctive features. Established techniques for maintenance, structural reinforcement, rehabilitation, and upgrading are then deeply reviewed, providing practical examples and illustrative images from construction sites. The paper concludes by discussing selected innovative approaches and emerging technologies shaping the future of tunnel management and refurbishment.

The paper entitled “**Behaviour of Reinforced Concrete-Filled Steel Tube Columns with External Socket Connections Under Seismic Loading**” evaluates a new external socket connection for reinforced concrete-filled steel tube (RCFST) columns intended for seismic applications. The connection incorporates a steel-tube discontinuity at the column-to-socket interface, where the main tube is intentionally terminated, and a thinner embedded sleeve is used to reduce moment transfer into adjoining elements and facilitate plastic-hinge formation away from the connection. Two full-scale specimens were tested under reversed cyclic loading to assess global behaviour, failure modes, strain demands, displacement capacity, and energy dissipation. The specimens had identical column geometry, while socket height, column concrete strength, and grout strength were varied based on analytical evaluations to intentionally induce different failure modes and examine their influence on seismic performance, although the analytical model used to guide these selections is not presented in this paper. One specimen exhibited flexural failure with hinge formation on the column outside the external socket, whereas the other developed shear failure on the column within the embedded region. Both tests confirmed that the connection components and

Discussion period open till six months from the publication date. Please submit separate discussion for each individual paper. This paper is a part of the Vol. 3 of the International Journal of Bridge Engineering, Management and Research (BER), ISSN 3065-0569.

footing or cap beam remained elastic, demonstrating that the proposed connection can maintain these adjoining components as capacity-protected elements. The results provide insight into the role of socket height and material strength combinations in governing failure mode and support the feasibility of achieving desirable flexural behaviour comparable to conventional cast-in-place columns.

Rollover stability is a critical concern for prestressed concrete bridge girders, particularly during handling, transportation, and erection when lateral restraint is limited. The growing use of long-span, slender sections has increased their susceptibility to rollover instability, especially under the combined influence of geometric imperfections, thermal gradients, eccentric loading, and inclination and deformation of bearing surfaces. Although these effects are well recognized in practice, current codes and design guidelines offer limited guidance, and many analytical and numerical models use simplifying assumptions that incompletely capture important nonlinear behaviors. Furthermore, experimental investigations remain scarce due to the complexity and cost of full-scale testing. The paper entitled **“Synthesis of Research on the Rollover Stability of Prestressed Concrete Girders Supported on Elastomeric Bearings”** presents a comprehensive review of rollover stability of prestressed concrete bridge girders supported on elastomeric bearings. The theoretical foundations and governing mechanisms are first summarized, including a discussion of the effects of geometric imperfections, temperature variations, wind, support conditions, and bearing rotational stiffness. Existing analytical, numerical, and experimental studies are critically examined, and key knowledge gaps are identified to guide future research and code development.

Chloride-induced corrosion of reinforcing steel in bridge decks, substructure elements, and marine infrastructure progressively deteriorates the bond at the steel–concrete interface, with consequences extending beyond local anchorage to the full member response: tension stiffening is reduced, crack spacing increases, and load-carrying capacity declines. The paper entitled **“Corrosion-Induced Bond Deterioration in Bridge Deck Concrete: Tension Stiffening, Crack Spacing, and Residual Bond Capacity in Fly Ash and Normal Portland Cement Systems”** reports findings from a direct tension test programme on thirty specimens, a legacy experimental dataset of enduring relevance given the persistent scarcity of direct tension data for corroded HVFA bridge deck concretes across three concrete types subjected to up to eight levels of accelerated corrosion, providing a structurally realistic characterisation of bond deterioration that complements the pullout test programme reported in the companion study. The results are interpreted within a six-stage cracking model and correlated with the Dickson Bridge field survey data, validating the laboratory results against field conditions. The data provided herein constitute a rare, structurally realistic specimen-scale dataset for three cementitious systems and support calibration of tension-stiffening models for corroded reinforced concrete members.

Resonances of rail bridges due to the passage of trains have been mainly investigated for single-span bridges. For multi-span bridges, it is important to determine whether

stronger resonance amplifications than those of a single-span bridge need to be considered. In the paper entitled **“Modal Analysis, Health Monitoring, and Train-Induced Resonance of Multi-Span Bridges”**, measurements of eight multi-span structures are presented with their natural frequencies and mode shapes: wooden floor beams, a concrete beam, a steel truss foot bridge, three road bridges, and two rail bridges. Typical effects such as multiple fundamental frequencies due to parallel beams and multiple spans, close eigenfrequencies of different mode shapes, clusters for simply supported or weakly coupled spans, regular separated frequencies for continuous beams and bridges are shown. The mode shapes are generally global, but sometimes more local mode shapes exist; for example, a longer mid-span is dominant in the first eigen mode. The consequences of multi-span bridges for train passages are discussed based on a frequency-domain theory where three spectra determine the resonance excitation, the axle-sequence spectrum of the train, the transfer function of the bridge, and the modal force spectrum. The method is applied to the two railway bridge examples: these are treated as single-span bridges at first and then the examples are extended to two-, three-, and multi-span bridges.

With this editorial note, it is also my pleasure to invite you to submit your papers addressing research with new and substantial contributions in bridge engineering to the International Journal of Bridge Engineering, Management and Research. The journal is committed to prompt peer review process and online publication of the paper within four weeks of acceptance. We also are committed to completing our peer review process within 90 days of paper submission. All accepted articles are generally published within three months of acceptance. You are invited to submit your papers to the next issue of the journal as soon as possible.