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Editorial
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It is my pleasure to publish the April issue (second issue) of Volume 2 of the *International Journal of Bridge Engineering, Management and Research*. You can find detailed information about the journal in the inaugural issue of the journal published in September 2004. In this issue of the journal, we are pleased to bring to you nine papers in innovative areas of bridge engineering.

The paper entitled "**A Vision on the Future of Resilient and Bridge Smart Infrastructure**" by Dr. Narayanan presents a vision on the future of resilient and smart bridge infrastructure. We want to thank Dr. Subramanian for his vision and support of the journal. The future of bridge engineering and management will witness the integration of smart technologies, sustainable and adaptive materials, and advanced maintenance strategies to enhance resilience, longevity, and efficiency. Challenges in modern bridge construction include managing costs, ensuring efficient maintenance, and adapting to climate change. Advanced technologies like 3D printing and advanced health monitoring systems based on the Internet of Things can help overcome these challenges.

Infrastructures such as bridges and viaducts are exposed to numerous natural hazards that can compromise their safety and stability over time. Among these risks, interactions with landslides can sometimes be critical, as landslides can introduce new loads onto the existing structure that were not accounted for in the original design. Landslides exert forces with a significant horizontal component that may impact the supports, piers, or directly the bridge deck, leading to deformations and, in extreme cases, collapse. In the paper on "**Understanding Landslide-Bridge Interactions through a Comprehensive Analysis of a Global Case Study**," Gabrieli et al. present the development of a database containing 41 international case studies on interactions between landslides and bridges or viaducts. These events are classified according to key parameters such as landslide velocity, volume, and the type of interaction with the infrastructure. The analysis of the cases reveals recurring patterns in interaction and damage mechanisms, offering a deeper understanding of the most common conditions under which these interactions occur. The study's findings highlight the importance of implementing preventive strategies and monitoring systems to mitigate the impact of landslides—whether slow-moving or rapid—on these infrastructures. Furthermore, the research underscores the need for more accurate risk assessment tools, considering that climate change may increase the frequency and severity of extreme weather events capable of triggering landslides.

In the paper entitled "**Estimation of failure costs of a bridge in Italy**," Contardi and Fortezza have presented a new approach to estimate the failure cost of bridges in Italy. The optimal maintenance strategy for aging bridges is one that minimizes the total cost to the community. For each bridge, this total cost is calculated as the sum of the costs of necessary interventions and damage resulting from exceeding limit states, multiplied by the probability of such exceedances. The most challenging and complex aspect of this calculation is estimating the damage, as numerous uncertainties are involved. These uncertainties, along with the variability of certain parameters, can significantly influence the results. Damages are typically divided into direct and indirect costs. Direct costs, such as rebuilding collapsed sections, addressing social consequences like injuries or fatalities, and dealing with environmental impacts, are relatively straightforward to calculate, but they tend to be less significant. On the other hand, indirect costs—such as disruptions to infrastructure and psychological effects—are harder to quantify but often have a much larger impact. By leveraging available research and learning from past accidents, estimation of indirect costs can be improved significantly. The economic and social consequences of many historical bridge failures are well-documented, allowing us to identify key factors that drive the costs and determine the true magnitude of different types

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. 2 of the International Journal of Bridge Engineering, Management and Research (© BER), ISSN 3065-0569.

of damage. This article offers valuable guidance for reliably estimating the failure costs of a typical bridge.

In the paper entitled "**Structural assessment, repair and strengthening of masonry arch bridges: modes of operation and open issues**," Niero et al. provide a comprehensive overview of structural assessment, repair, and strengthening methods applicable to masonry arch bridges, emphasizing the necessity for effective risk mitigation strategies. The study first focuses on current assessment methodologies used to evaluate the structural integrity of masonry arch bridges under various load scenarios, including traffic, seismic, and hydraulic influences. It highlights the importance of acquiring a thorough understanding of the structure under investigation by utilizing advanced surveys and diagnostic techniques. Several analytical and numerical methodologies aimed at achieving accurate assessments are explored, outlining their advantages and disadvantages. The paper discusses various repair and strengthening solutions aimed at restoring and enhancing the performance and safety of these bridges, respectively. These include traditional approaches such as repointing and arch ring reinforcement, as well as modern techniques like fiber-reinforced cementitious matrix applications. Additionally, the traditional technique of post-tensioning is analyzed in a modern context for the strengthening of masonry bridges. The effectiveness of these methods is assessed based on the advantages and disadvantages of each technique, providing comparisons among the commonly used methods. Overall, the paper identifies open issues within the field, such as the need for standardized assessment protocols, the integration of sustainability considerations into repair strategies, and the development of innovative strengthening techniques.

In the paper entitled "**A Novel Quantitative Approach for Multi-hazard Risk Assessment of Linear Infrastructure: A Geological-Geotechnical Index**," Salvatore et al. have introduced a novel quantitative approach for multi-hazard risk assessment of linear infrastructure, by introducing the Geological GeoTechnical Index (GETI). GETI aims to address the limitations of existing methodologies by incorporating the cascading effects of multiple hazards and providing a comprehensive quantitative assessment tool for stakeholders. This study highlights the challenges in maintaining linear infrastructure, such as bridges and viaducts, and the necessity for standardized procedures to assess their exposure to natural hazards. Current approaches often fail to account for the interconnected nature of multiple hazards, potentially leading to underestimation of risks. The GETI is conceptualized as a two-level analysis process. Level 1 involves assessing hazard susceptibility through a literature review and preliminary surveys, whereas Level 2 encompasses advanced analyses using geological and geotechnical data. The index primarily addresses seismic risk and its secondary effects, including ground motion amplification, soil liquefaction, and landslides/rockfalls. This methodology employs conditional probability to express the concept of "cascade effect" in mathematical terms. The GETI is formulated as the probability of damage given the occurrence of an earthquake, considering various magnitudes of damage, from low to severe. This approach allows for a more nuanced understanding of risk compared to qualitative or semi-quantitative indices. This study acknowledges the potential limitations of the GETI, including its dependence on data availability and accuracy, as well as the current focus on seismic hazards. Future research directions are proposed, such as expanding the index to include a broader spectrum of natural hazards and extending its applicability to other types of linear infrastructure. The GETI represents a significant advancement in multi-hazard risk assessment for linear infrastructure. By providing a quantitative measure that accounts for the interrelated nature of natural hazards, it offers stakeholders a valuable tool for prioritizing risk-reduction measures and ensuring the safety and resilience of critical infrastructure. The ongoing practical application of GETI in case studies in Italy and the United States aims to verify its real-world functionality and effectiveness in infrastructure management.

In the paper entitled "**Experimental Investigation of the Grouted Stud Connection and a Mechanics Based Model for Minimum Connection Capacity**," Jayaprakash et al. have experimentally investigated the grouted shear stud (GSS), which is a ductile detail suitable for the seismic design of pile to cap-beam connections in bridges, piers, and marginal wharves. It is constructed by inserting the pile into an external socket attached to the cap-beam, and subsequently, grouting the annular void thus formed. Previous research has shown that the GSS connection can successfully relocate damage to the columns in the form of plastic hinge formation, thereby mobilizing the full strength and ductility capacity of the system. However, no prior studies have investigated the force-transfer mechanism inside the connection. As a result, a standard approach for designing an optimum connection does not exist. To better understand the force-transfer mechanism, an experimental study was undertaken. Four large-scale two-column steel bridge bent specimens were structurally tested under cyclic lateral loading. It was found that the embedment length of the column inside the connection is the most critical parameter for a successful design. An a priori model based on a truss-mechanism was developed to calculate the lower bound capacity of the GSS connection. A comparison with experimental results shows that the model can be used to ensure that the GSS connection remains capacity protected under seismic loading.

In the paper entitled "**Modal-based multi-criteria optimization of sensor placement techniques for dynamic monitoring of bridges**," Masciotta et al. have addressed the problem of optimal sensor placement (OSP) for a multi-span concrete bridge aiming to maximize the informational value of structural health monitoring data so that the structural dynamic behavior can be fully characterized while equipment installation and maintenance costs are minimized. To this end, eight distinct OSP techniques are examined. Six of these are individual sensor ranking algorithms, whereas the remaining two exploit metrics that evaluate sensor interaction to determine their relevance. Within the first category of algorithms, an enhanced ranking approach based on local maxima is investigated as a promising alternative to improve placement performance and estimate the required number of optimal sensors. The effectiveness of this method is then compared against the second category of algorithms, which are known for their better performance. Extensive experimental data from a well-known benchmark bridge structure are employed to validate this approach, enabling the exploration of a data-driven solution to the OSP problem. By analyzing the advantages and limitations of each algorithm, a modal-based multi-criteria optimization is ultimately applied to drive the selection of the final best sensor configuration for the investigated bridge across multiple scenarios.

In the paper entitled "**Effects of connections on the behavior of bridge decks under solitary waves**," Cai et al. have proposed a new approach to evaluate the reliability of connections of the coastal bridges. The numerical model was established to investigate this multi-physics problem involving fluids, structures, and their interactions. Four common controllable structure parameters that influence structural flexibility have been selected and discussed. The combination of the Taguchi method and Grey relational analysis is first applied to find the optimal combination of structure parameters. It is concluded that increasing structure flexibility could put connections at a higher risk of failure. Besides, the analysis results reveal that the retrofitting method by stiffening the connection may receive limited efficiency in preventing connections from failure.

In the paper entitled "**A methodology for deriving a probabilistic braking force model from traffic data**," Behzadi et al. have presented a methodology for deriving a probabilistic model for estimating the braking force, which is, on the contrary, traditionally based on deterministic approaches in bridge design codes. The stochastic model resorts to the Weight-In-Motion dataset collected from a provincial road bridge for observing the real traffic load probabilistic distributions in terms of vehicle gross weight and length, and inter-vehicle distance. Using Monte Carlo simulations, traffic convoys are generated for calculating the resultant braking force, by assuming deceleration profiles available in literature and different scenarios, to take into account different braking combinations among the vehicles within a convoy. Starting from the obtained Empirical Cumulative Distribution Function thus calculated, the probabilistic model provides the resultant braking force associated with a given return period, incorporating dynamic amplification factors, as well. Comparisons done highlight that, within the span lengths investigated, the probabilistic model proposed provides higher resultant braking forces than the ones given by the deterministic model adopted by the Eurocode and the Italian Standards, in the case of high return periods and low nominal lives (i.e., in the case of high no-occurrence probability). Values in agreement or lower than the ones calculated with the deterministic models considered are obtained in the other cases. Finally, some simplified design equations for the resultant braking forces are proposed for three different nominal lives, useful in assessing existing bridges or designing new ones.

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 a prompt peer review process and online publication of the paper within four weeks of acceptance. We are also committed to completing our peer review process within 90 days of paper submission. The next issue of the journal in July 2025 will be **focused on artificial intelligence, data analytics, and deep learning in bridge engineering**. You are invited to submit your papers to this issue by April 30, 2025.