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Editorial
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Anil K. Agrawal, Dist. M. (ASCE), Ph.D., P.E.

Editor-in-chief, International Journal of Bridge Engineering, Management and Research,
Professor and Chair of Civil Engineering,
The City College of New York, New York, NY, 10031

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Abstract: The International Journal of Bridge Engineering, Management and Research (BER) is a fully open access online only journal. The journal serves as a forum for the publication of scientific and technical papers related to all aspects of bridge engineering and management, including structural, seismic, hydraulic and geotechnical risk analysis, structural health monitoring, static and dynamic assessments, structural retrofitting and resiliency enhancement. This issue of the journal presents six papers on artificial intelligence, low velocity impacts behavior of concrete, corrosion detection using Radar, load testing of bridges, prioritization of bridge interventions and chloride-induced corrosion initiation probability.

Issue Summary

It is my pleasure to publish the July issue (3rd 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.

As of 2022, there were 620,669 bridges in the United States. Each bridge is inspected according to the Federal Highway Administration's regulations to maintain safety and serviceability. These inspections are performed on varying schedules that are dependent on several factors. Over 100 types of characteristic data are collected during these inspections and are used to produce a structural evaluation rating (SER) for each bridge. These characteristics can include location, material, geometric features, and other types of information about a bridge. The paper entitled "**Use of Artificial Intelligence in Bridge Inspection and Management**" investigates the use of Pearson's correlations, decision trees, and random forest models to determine and show relationships between individual characteristics and the SER. These machine learning methods allow for fast and accurate predictions of the SER based on the selected individual characteristics over varying periods of time. These models also provide visual interpretations of the relationship information produced. Using these models in conjunction with current inspection scheduling methods may maximize efficiency and improve reliability. The models may also be useful for characteristic selection during the design process.

Reinforced concrete structures have been extensively investigated using ground penetrating radar (GPR) to qualitatively analyze corrosion-induced degradation. However, no reliable quantitative model exists for evaluating the corrosion of embedded steel rebars, which may significantly impact the strength, serviceability, and long-term durability of concrete structures. The paper entitled "**Experimental Detection of Embedded Rebar Corrosion in Concrete with Ground Penetrating Radar**" involved an experimental investigation to determine the relationship between the quantity of rebar corrosion and the maximum amplitude, as well as the two-way travel time (TWTT) of the GPR electromagnetic wave. A direct current was impressed into embedded steel rebars in concrete beams immersed in a 5% saltwater solution to induce accelerated corrosion. GPR data were collected before saline submersion and at 10-day intervals. The study proposed a multivariate linear regression model with high reliability to estimate corrosion-induced rebar mass loss.

Vehicle collisions subject reinforced concrete (RC) bridge piers to high strain-rate dynamic loads, producing complex material interactions and an apparent strength enhancement commonly quantified by the dynamic increase factor (DIF). During impact, the concrete cover, acting as a sacrificial layer, experiences initial damage during a car crash, subsequently transferring forces to the transverse

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reinforcement and altering the pier's axial and flexural behavior. The paper entitled "**Assessing Damage Behavior of Reinforced Concrete Bridge Piers under Low-Velocity Car Crashes: Experimental and Numerical Study**" presents an experimental investigation of low-velocity vehicular collisions involving sub-compact and sedan cars, with emphasis on cosmetic surface damage and global structural response. Finite element (FE) simulations developed in ANSYS are employed to reproduce the experimental behavior and to validate estimates of post-impact residual capacity. Damage levels are further quantified using a combined probabilistic and reliability-based framework to assess the likelihood and severity of cosmetic damage. The results offer valuable insights into impact-induced damage mechanisms, enable rational evaluation of residual structural capacity, and support informed decisions regarding repair or strengthening. Additionally, chaotic analysis has been further scrutinized in terms of chaotic risk amplification factor (CRAF) to reinforce the findings. This present study contributes to forensic assessments of RC bridge pier serviceability and resilience following vehicular impact events.

The paper entitled "**Load Testing and Rating of Prestressed Concrete Bridges Under Uncertainty**" introduces an approach for load testing and rating of prestressed concrete bridges when design information of the structure is not available. The paper uses testing of a bridge in New York for illustration of the proposed approach. The bridge was built in 1961 and consisted of five simply supported 70-ft-long post-tensioned bulb-T beams. No documents or plans for the structure were available at the time of the testing. In 1970, the structure was posted for 12 tons. Absence of the bridge plans coupled with the public's demand to accommodate school bus traffic on the bridge prompted the load testing and rating. A plan based on assumed design basis and investigation of bridge behavior under controlled truck loading was proposed to determine unknown design parameters and enable load rating of the structure. The bridge was then instrumented and load tested using trucks of known weights and configurations, positioned at specified locations on the deck to gradually increase their safe load effects on the structure. The results of the testing provided required information about the bridge and allowed for load rating of the structure.

The article entitled "**Theory and Application of a Method for Prioritizing Bridge Interventions**" presents a calculation method developed by the company Sina with the aim of establishing a priority ranking for interventions involving the improvement, upgrading, or demolition and reconstruction of a set of bridges. As a measure of the urgency of an intervention, the "cost of postponement" for the community is proposed, defined as the increased risk associated with maintaining the current state of the structure for one year. Following the standard logic of risk analysis, this cost is estimated by multiplying the probability of bridge collapse, calculated over a one-year period, by all the potential damage that such a collapse would cause. Although the calculation is affected by several sources of uncertainty, the proposed procedure, based on the collection of a few essential data points and a limited number of simple steps, allows for sufficiently reliable comparisons between bridges. It highlights which characteristics most significantly influence risk and which can reasonably be neglected.

Chloride-induced corrosion initiation is a major durability concern in reinforced concrete bridge infrastructure and can affect long-term structural performance. Reliable estimation of corrosion initiation probability is therefore important for durability assessment and maintenance planning. The article entitled "**Temporal Fusion Transformer Surrogate Modeling of Chloride-Induced Corrosion Initiation Probability in Reinforced Concrete Bridge Infrastructure**" investigates the time-dependent evolution of corrosion initiation probability under uncertain material, environmental, and geometric conditions, with particular attention to concrete cover depth. A diffusion-based stochastic reliability framework is used to generate simulator-derived corrosion initiation probability trajectories. Corrosion initiation is represented as a threshold-crossing event at the reinforcement depth, and population-level probability is estimated through stochastic simulation and ensemble aggregation. To reduce repeated simulation effort during inference, a temporal fusion transformer surrogate model is trained to reproduce simulator-derived probability trajectories from scenario variables and time. The results show that the surrogate closely follows the simulator-derived evolution of corrosion initiation probability within the sampled scenario space. The predicted trajectories preserve the expected influence of cover depth, with shallower cover associated with earlier initiation and higher probability levels. The model also provides low trajectory-level error relative to the probability scale and offers an inference-time alternative to repeated simulation-based evaluation. These findings indicate that simulation-trained sequence learning can provide a useful surrogate representation of time-dependent corrosion initiation probability under the assumed diffusion-threshold reliability framework. Further validation with field or experimental corrosion data is needed before practical implementation in reinforced concrete bridge infrastructure systems.

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 the online publication of the paper within four weeks of acceptance. We are also committed to completing the 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.

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