BER | the international journal of bridge engineering management and research

Editorial
Vol. 2, No. 4 (2025) Issue of International Journal of Bridge Engineering, Management and Research (IJBEMR)

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, USA

Submitted: 01 October 2025 **Accepted:** 01 October 2025 **Publication date:** 10 October 2025

DOI: 10.70465/ber.v2i4.69

It is my pleasure to publish the October issue (4th issue) of Vol. 2 of the International Journal of Bridge Engineering, Management and Research. You can find detailed information about the journal in the inaugural issue published in September 2004 or at https://www.ijbemr.org. In this issue of the journal, we are pleased to bring to you six papers in innovative areas of bridge engineering.

Bridge deck deterioration poses a significant challenge to transportation infrastructure, resulting in costly maintenance and potential safety hazards. Traditional bridge deck assessments primarily rely on visual inspections, which can be subjective and fail to capture subsurface defects such as delamination, rebar corrosion, and concrete degradation. To enhance the accuracy of condition assessment, the paper entitled "**Clustering-Based Framework for Multi-Sensor Data Fusion in Bridge Deck Condition Assessment**" explores multi-sensor data fusion and clustering techniques for defect identification using Ground Penetrating Radar and Impact Echo. By integrating multiple nondestructive evaluation (NDE) datasets, a clustering-based framework was developed to automatically categorize bridge deck conditions. K-Means, Density-Based Spatial Clustering of Applications with Noise (DBSCAN), Gaussian Mixture Models, and Fuzzy C-Means clustering algorithms were evaluated to determine their effectiveness in grouping similar defect patterns. The optimal number of clusters is determined using the elbow method, silhouette score, and Davies–Bouldin Index. Results indicate that DBSCAN outperforms other clustering techniques in detecting defect hotspots while effectively handling noise and spatial inconsistencies. The clustered defects are mapped spatially to visualize regions of deterioration, enabling bridge engineers to identify high-risk areas and prioritize maintenance efficiently.

Edge fairing is often applied to box-girder bridge decks to improve their aerodynamic performance, particularly in long-span bridges. A thorough understanding of the aerodynamic response and flow behavior of bridge decks with edge fairings is essential for optimal design and ensuring wind-induced safety. The paper entitled "**Influence of Nose Position of Edge Fairing on Aerodynamic Characteristics of Box Girder Bridge Deck**" presents a numerical investigation into the influence of the nose position of edge fairings on the aerodynamic behavior of box-girder bridge decks. Two-dimensional unsteady Reynolds-averaged Navier–Stokes simulations were performed using the k-ω-SST turbulence model, supported by appropriate validation studies. Both static and dynamic simulations were conducted for two configurations: edge fairings with nose-up and nose-down positions. The static analysis showed that the nose-down configuration offered superior aerodynamic performance compared to the nose-up configuration. In the nose-down position, the deck experienced reduced static wind forces with smaller fluctuations. Flow features such as leading-edge flow separation and reattachment, as well as trailing-edge flow separation, played critical roles in influencing aerodynamic forces. The dynamic simulations further revealed that the nose-down fairing configuration had improved aerodynamic damping in both torsional and heaving modes. In particular, leading-edge flow reattachment was identified as the primary contributor to enhanced aerodynamic damping in the nose-down configuration. Further, the relatively larger bottom plate slope demonstrated better aeroelastic responses in the nose-down position of the edge fairing.

Seismic isolation is a well-established technique to protect structures against earthquakes, allowing to achieve a level of safety not possible with conventional systems. The Somplago viaduct on the Udine–Tarvisio highway, built in 1976, was the first seismically isolated bridge in Italy. Its good performance during the strong shocks, which hit the viaduct when it was still under construction, encouraged

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.

the use of seismic isolation in bridges. The development of applications in Italy was initially quite slow, due to the delays in considering this new technology in technical standards. Significant developments occurred following the major seismic events that affected the country. Today, seismic isolation is almost always used for new construction projects and, especially, in major cases, such as illustrated in this state-of-the-art review paper entitled "**Seismic Isolation in Newly Built Bridges in Italy: Historical Development, Regulations, and Recent Applications**."

Concrete bridge decks are susceptible to subsurface defects such as delamination, caused by aging, corrosion, and environmental stressors, underscoring the need for timely, reliable NDE. While traditional acoustic methods, such as hammer or chain drag, remain widely used, they suffer from subjectivity, inconsistent impact forces, and limited applicability on overhead or vertical surfaces. This study, entitled "**Smart Acoustic Sounding for Automated Delamination Detection in Concrete Bridge Decks**," introduces a novel smart acoustic sounding system that modernizes impact sounding through an integrated framework consisting of a broadband electronic chirp excitation source, high-sensitivity MEMS microphones with acoustic shielding, and a tracking camera for automated and location-aware inspections. Advanced signal processing techniques, such as empirical mode decomposition, power spectral density, and the Hilbert–Huang transform, are employed to filter noise, extract frequency-based features, and support machine learning-based defect classifications. Laboratory testing on a full-scale concrete slab embedded with known artificial defects (e.g., shallow and deep delamination, voids, and honeycombing), as well as a deteriorated concrete beam, confirmed the system's ability to accurately identify defect zones, particularly shallow delamination with characteristic frequency signatures in the range of 1–3 kHz. The system produced real-time defect maps with minimal human input, demonstrating its potential to improve the accuracy, repeatability, and efficiency of bridge deck inspections and support data-driven maintenance decisions.

The bridge crossing the Gesso River is a multi-span masonry arch bridge built in the 19th century in Cuneo, Piedmont, Italy. Due to extended local degradation and damage, the bridge recently underwent a significant strengthening intervention. Ambient vibration tests were performed both before and after strengthening to assess the effectiveness of the repairs. The paper entitled "**Dynamic investigations before and after the strengthening of a masonry arch bridge**" presents the results of the dynamic investigations, identifying the modal characteristics of the masonry bridge through different techniques. The pre-intervention analysis revealed clear anomalies, including a sort of "frequency splitting" phenomenon and irregularities in the mode shapes that were localized in the regions of maximum masonry decay. After the strengthening works, the identified modal parameters showed an increase in natural frequencies, along with the resolution of previously identified mode shape irregularities, indicating a clear improvement of the bridge's structural condition. As a final remark, the presented results highlight the value of operational modal analysis as a nondestructive tool for validating the effectiveness of rehabilitation measures.

The history of bridges is retraced as a witness to humanity's progress. The evolution of materials and structural typologies has enabled ever-longer spans to be overcome at sustainable costs. The availability of materials, such as reinforced concrete and steel, has offered new possibilities that were unthinkable using wood and masonry. Then girder bridges were built, and later cable-stayed and suspension bridges, but also long arch bridges. The race for long spans continues. Bridges have always been and always will be a monument to progress. The paper entitled "**History of Bridges: Materials and Structural Types of a Monument to Progress**" documents the progress in bridge engineering as monuments of the future are being created.

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 4 weeks of acceptance. We are also committed to completing our peer review process within 90 days of paper submission. You are invited to submit your papers to the next issue of the journal as soon as possible.