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Editorial

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The Bronx-Whitestone Bridge was designed during the 1930 s in an era of suspension bridges with decks stiffened by shallow plate girders, many of which were subsequently found to be vulnerable to aerodynamic instabilities such as vortex shedding and flutter. Following the occurrence of mild and benign wind-induced oscillations in the first several years after opening in 1939. The stunning collapse of the first Tacoma Narrows Bridge in 1940 [1], led to a series of retrofits at Bronx-Whitestone Bridge. These ranged from structural solutions such as stay cables, stiffening trusses, and a steel orthotropic deck, to aerodynamic enhancements such as a tuned mass damper and wind fairings. Wind tunnel studies in 2015 confirmed the improved aerodynamic performance due to the recently installed wind fairing system and stiffer orthotropic deck. A subsequent rehabilitation project gave the opportunity to assess measures to further improve the aerodynamic performance of the bridge. A 3 ft (0.91 m) tall solid screen added on top of the median barrier was found to act as an above-deck vertical baffle plate, disrupting the alternating pattern of vortices, reducing the susceptibility of the bridge to instabilities. This led to the conceptual design of a Median Barrier Extension comprised of 3 ft (0.91 m) solid transparent acrylic panels fixed to the top of the existing median barrier posts, supported by a tubular steel frame. To ensure this unique barrier modification met current industry safety standards, the MBE design was iterated through a crash analysis study using non-linear finite element models before the final design proceeded to a full-scale physical crash testing program, per the *AASHTO Manual for Assessing Safety Hardware* [2], commonly known as MASH, Test Level 4. In their paper, “Bronx-Whitestone Bridge: Vertical median barrier extension enhances aerodynamics”, Daly et al. present the full timeline of the retrofit project, from conception during wind tunnel testing, through to design, crashworthiness studies and final construction in 2020. The application of Fiber Reinforced Polymer (FRP) materials has risen and implemented for strengthening and repairing of existing concrete structures, as internal reinforcement in the form of strands, bars, and tendons. Although higher durability and performance are associated with the FRP material in some respects compared to steel, concerns remain regarding damages and defects in this material, many of which are related to their unique features. Importantly, debonding of FRP materials from a concrete surface or within a concrete element has always been an issue resulting in the premature failure of the structure. To this end, concrete elements strengthened or reinforced with FRP materials must be inspected periodically to detect potential issues and hence prevent any premature failures. In “Applicability of available NDT methods for damage detection in concrete elements reinforced or strengthened with FRP”, Malla et al study potential damages and anomalies attributed to FRP reinforced/strengthened concrete (FRP-RSC) elements. The paper investigates Non-Destructive Testing (NDT) methods that can be applicable to the inspection of FRP-RSC elements from a literature survey of past studies, applications, and research projects. The authors then evaluate the ability of two of the most used NDT methods, Ground Penetrating Radar (GPR) and Phased Array Ultrasonic (PAU), in detecting FRP bars/strands embedded in concrete elements. GPR and PAU tests were performed on two slab specimens reinforced with GFRP (Glass-FRP) bars, the most used FRP bar, with variations in their depth, size and configuration, and a

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slab specimen with different types of available FRP reinforcements. The results of the study propose the most applicable methods for detecting FRP and their damage/defects in FRP-RSC elements. The study investigates the feasibility of two proposed methods for improving the detectability of embedded FRP bars. The minimum flexural reinforcement requirement has been used in the current bridge design specifications to protect the member from brittle failure after the formation of the first flexural cracks. Several variables have been reported to affect this requirement, such as concrete strength, amount of prestressing in the member, and type of cross section. Recently, the Precast/Prestressed Concrete Institute (PCI) developed a new type of beam section (NEXT beam) to accelerate bridge construction and enhance the sustainability of bridges. Huang (2022) conducted a parametric study on the shear design of 48 NEXT beam bridges, which indicated that providing the minimum transverse shear reinforcement could offer a sufficient safety margin for shear for NEXT beam bridges [3]. However, as a newly developed beam section, no research on the minimum flexural reinforcement has been reported for NEXT beam bridges. In “Evaluation of minimum flexural reinforcement for precast prestressed concrete NEXT beam bridges”, Huang examines the minimum flexural reinforcement requirements in the current AASHTO LRFD Bridge Design Specifications for NEXT beam bridges. A parametric study was analytically conducted with various parameters, including bridge section, beam section, concrete strength, and span length. Bridge rubber bearings play an important role in the transfer of loads from the superstructure to substructure and foundations. Once the rubber bearing is damaged, it could affect the stress state of the bridge and compromise the safety of vehicles and pedestrians. Therefore, the detection of rubber bearing deterioration is essential in bridge maintenance.

The traditional detection of bearing deterioration depends mainly on visual inspection. Recently, automatic detection methods based on image processing, including wavelet transform, threshold segmentation, direction difference, edge algorithm and histograms, have been proposed. These methods improve the detection efficiency and avoid the impact of human error. Deep learning-based algorithms detection methods have rapidly developed. The detection algorithm based on deep learning is divided into two-stage target detection algorithm and single-stage target detection algorithm according to whether there is a candidate box. The two-stage target detection algorithm selects the candidate regions of the image in the input stage, and then uses the convolutional neural network to classify and regress the candidate regions to obtain the detection results. The single-stage target detection algorithm does not extract the candidate box, while the input image is directly transported into the model. The target category and position information are obtained by referring to the regression analysis. In “Study on Deterioration Identification Method of Rubber Bearings for Bridges Based on YOLOv4 Deep Learning Algorithm”, Gao et al examine the effectiveness of the algorithm in detecting crack damage, shear deformation, and bearing voids.

References

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