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Editorial

The Ohnaruto Bridge, one of the Honshu-Shikoku Bridges in Japan, is a three-span two-hinged stiffening-truss suspension bridge, with multi-column foundations adopted for its towers. In the original seismic design of the Ohnaruto Bridge, an inland near-field earthquake was not considered for the design seismic force. In order to grasp the seismic performance, seismic performance verification was conducted, which concluded that the seismic capacity of the multi-column foundations was not sufficient. Steel pipes had been used as concrete formwork for the construction of the columns and they were left as protective member of the columns. In "Seismic verification and retrofitting of multi-column foundation of the Ohnaruto Bridge", Kawatoh et al. conclude that the seismic capacity could be achieved if the steel pipes were considered as structural members. Therefore corrosion protection of steel pipes has been carried out to keep the pipes in good condition and ensure they continue to serve this purpose. In "Ultimate strength and collapse process of cable-stayed arch bridges", Miyachi and Nakamura propose a new type of cable-supported bridge, the cable-stayed arch bridge. This new bridge is a combination of a cable-stayed bridge and an arch bridge, and the girder is supported by both stay cables and arch ribs. Its static behavior, sectional forces and deflections, under the design load are compared with those of conventional cable-stayed bridges and arch bridges. The authors conduct elastic-plastic large deformation analysis to clarify the progressive collapse process and the ultimate strength. The paper concludes that the cable-stayed arch bridge has smaller sectional forces and deformation under the design load and also has sufficient ultimate strength. AASHTO highway live loads are sometimes increased to idealize more realistic traffic conditions. Certain regions in the Middle East require increasing the AASHTO HL93 live loads by a 1.5 factor based on comparisons with the British Standards HA+HB live loads. Even in the US, the AASHTO live loads may not always represent modern state-legislated truck configurations. In "Impact of using higher strength concrete on the design of prestressed concrete bridges", Gergess and Sen show the impact of using higher strength concrete on the design of precast, prestressed girders subjected to stringent loading and environmental conditions. To that end, the authors conduct a parametric study that relates the girder size and spacing to the span length for HL93 and 1.5 × HL93 live loads as a function of the concrete 28-day strength and environmental classifications. The authors conclude that increasing the 28-day concrete strength from 40 MPa (5800 psi) to 50 MPa (7200 psi) allow increasing the HL93 live load by 50% and reducing the service load tension stress limit from $0.5\sqrt{f'_c}$, MPa ($6\sqrt{f'_c}$, psi) to zero without drastically changing the precast girder size and configuration. In September 2011, the I-64 Sherman Minton Bridge over the Ohio River between New Albany, IN and Louisville, KY was closed due to the detection of cracks in fracture-critical tie chord members. The bridge remained closed for over five months while non-destructive testing and repairs were performed. Applied Technical Services, Inc. (ATS) conducted metallurgical evaluations on 21 cores extracted from fracture critical members of the bridge. The cores were reported to contain rejectable indications as identified by visual inspection, magnetic particle inspection, ultrasonic testing and/or radiographic testing. Jendrzejewski et al. conduct "Metallurgical evaluation of flaw indications in tie chord transition butt welds from the I-64 Sherman Minton Bridge" to determine the nature and cause of the flaws and if there was any evidence of active propagating cracks. Of the 21 cores examined, 11 contained surface flaws within the vertical butt welds or heat-affected zones. One core contained a major subsurface planar discontinuity. Five cores contained minor subsurface indications. The base metal properties were consistent with high yield strength, quenched-and- tempered low alloy steel, i.e. "T1®"/ASTM A514. The weld metal properties were also consistent with low alloy steel. All flaws and other weld discontinuities observed both at and below the surface of the web members were associated with the original tie chord welds or subsequent early weld repairs. These flaws were formed during or shortly after welding while in the fabrication shop. Fracture mechanics calculations determined that at a critical flaw size, temperatures below 30°F (−1.1°C) could possibly result in failure of the bridge. Metallurgical analysis of the flaws revealed no evidence of active crack growth due to fatigue, corrosion fatigue or stress corrosion. The flaw surfaces exhibited intergranular separation along with mixed mode brittle and ductile features characteristic of hydrogen-induced cracking. The fracture critical members of the tie chords box girders were reinforced by bolted steel plates and the bridge placed back in service in February, 2012. Owner agencies and state transportation departments have expressed concern over costly inspection requirements for short-span steel truss bridges due to the potential designation of members as fracture-critical. This designation has a direct impact on future implementation of these structures as well as perceived inherent safety in existing bridges of this type. Throughout the years, researchers have developed methodologies to determine the degree of load-path redundancy that such structures exhibit, which, once employed, may eliminate the potential for fracture-critical designation, alleviating inspection costs and promoting these types of structures in highway bridge applications. In "Assessment of redundancy protocols for short-span steel truss bridges", Barth et al. present the results of a nonlinear finite element investigation of the load-path redundancy of a representative short-span steel truss bridge, which is benchmarked against physical load testing of the bridge. Once validated, the model will undergo a series of severed member analysis to determine the inherent levels of load-path redundancy.

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