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Editorial

Cracking due to distortion-induced fatigue in web gaps of steel girder bridges is a significant problem faced by bridge owners and is common in steel bridges built prior to the mid-1980s. As adjacent girders experience differential deflection under traffic loading, cross-frames carry secondary forces and impose stresses and deformations at the connection details. A commonly used retrofit technique involves creating new load path between a transverse connection plate and the top flange of the girder, by means of bolted angles on both sides of the transverse connection plate. This technique often requires removing portions of the bridge deck to create the bolted connection at the top flange, which is an approach that can incur significant expense and inconvenience to the traveling public. In "Innovative retrofit technique for distortion-induced fatigue cracks in steel girder web gaps", Hartman et al evaluate the effectiveness of a newly-developed retrofit technique, in which connection is made between the transverse connection plate and the girder web, through use of bolted angles on both sides of the transverse connection plate and a backing plate on the opposing face of the girder web. The retrofit was evaluated through extensive structural testing and finite element modeling. Testing was performed on a 9.1-m long test bridge system, comprised of three 910-mm deep girders and a concrete deck. The system was loaded to produce distortion-induced fatigue cracking, and then the bridge was retrofitted with the newly developed stiffener-to-web repair technique. The authors compare results of the testing to findings from finite element analyses, as well as findings from structural tests performed on 2.7-m long segments of similar girders tested under distortion-induced fatigue. The fundamental premise in contemporary design practice of steel I-girder bridges, using the theory of inelastic behavior, is that a beam-type member possesses sufficient ductility to attain full plasticization of the cross section under predominantly flexural action. Much theoretical and experimental research was performed on this subject for most of the previous century, and well-established rules have evolved to ascertain ductile behavior by limiting cross section geometries and bracing spacing requirements. "Compact and properly braced" girders are designed so that the maximum moment obtained from a linearly elastic structural analysis is equal to the "plastic moment M_p". This approach to design is universally employed in most of the world's design standards for steel structures, including the *Standard Specifications for Highway Bridges* of the American Association of State Highway and Transportation Officials (AASHTO). In "Whatever happened to autostress design?", Galambos reviews of the history of inelastic design criteria for steel girder bridges, and the AASHTO Specifications' evolution from Working Stress Design (WSD) to Load Factor Design (LFD) to Load and Resistance Factor Design (LRFD). On December 6, 1825, some 55 persons died, when a cable-stayed road bridge spanning the Saale River at Nienburg, Germany, collapsed during a public celebration. It was the first bridge with a fan arrangement of stays and the first with a carriageway for heavy team-drawn wagons and with two sidewalks for pedestrians. The timber deck was 7.5 m wide and it spanned about 80 m between centerlines of two towers. It had a double-leaf bascule at midspan for the purpose of enabling sailing vessels with tall masts to pass the bridge without unshipping the masts. G. Bandhauer was the designer. There were questionable design details and serious quality control problems during construction, especially with the wrought iron stays, but the bridge was load-tested twice and thereafter opened to traffic in September 1825. The bridge collapsed three months later during a celebration thanking Duke Ferdinand for the bridge during which youths tried to excite the bridge in time to the melody of "God Save the King." In his paper, "On the collapse of the Nienburg Cable-Stayed Road Bridge", Birnstiel provides analysis of the bridge collapse. For bridges, the term 'pedestrian' has become generic and is applied to a diverse group of active users including pedestrians, cyclists and equestrians. Pedestrian bridges occur in myriad locations; they cross roads and railroads, traverse waterways, link adjacent buildings, provide cross-void access within buildings, connect educational campuses and extend the experience of remote area walks. Although pedestrian bridges predate the modern road and rail bridge, the active user has been increasingly marginalized since the advent of the motorcar. In recent times, however, there has been a renaissance in construction of bridges that specifically cater for non-motorized modes. Coinciding with this resurgence, many national bridge codes have been revised within the last decade. Notwithstanding the non-motorized nature of pedestrian bridges, most are designed to allow some vehicle access, such as maintenance or emergency vehicles, as well as accidental vehicle access. Ultimate limit state load factors vary across national codes and depending on the facility being considered, can also be a dilemma within jurisdictions. In “Pedestrian bridge loads”, Rothwell reviews the historical genesis of international pedestrian bridge design load criteria as a prelude to a presentation of current practice of bridge design codes in Australia, the USA, Canada, Europe and Hong Kong. The author describes characteristic live loads, provisions for vehicle access, longitudinal effects, dynamic response criteria and deflection limits. The paper explores the effect of limit state design principles, particularly the load factors nominated in design codes, and the considerable differences that exist, internationally, in design criteria for pedestrian bridge loads. In Turkish design practice, slab on steel composite I-girder bridges have been designed to span between 50 and 80 meters. To date, modified versions of the AASHTO LFD, or ASD requirements are adapted in Turkey. The recent switch of the U.S. bridge codes to LRFD method necessitates the calibration of the Turkish LRFD design code that is under development. This calibration determined that the current Turkish design truck is not very appropriate to be used in design of bridges with span lengths in excess of 50 meters. In “Calibration of Turkish LRFD bridge design code for slab on steel plate girders”, Koç et al define a new type of live (truck) load to be used in the basic gravity load combination, as well as to develop the corresponding load factors to be implemented in the design of slab on steel composite I-girder bridges. In this scope, usually a target reliability index is selected to reflect the safety level of current design practice based on the uncertainties associated with the design parameters. For the basic gravity load combination, which includes the dead and live loads, a minimum target reliability of 4.00 is selected, instead of 3.50 that have been used in the U.S. In the statistical computations of the reliability index, the quantification of uncertainties is made based on local data supplemented by information compiled from relevant international literature. Condition assessment of concrete bridge decks using nondestructive evaluation (NDE) technologies concentrates on the assessment of corrosion, delamination and concrete quality. Various NDE technologies can be used for this purpose. To expedite the data collection and analysis process, a fully autonomous robotic system was developed that in a complementary way implements four NDE technologies and digital imaging. The NDE technologies include impact echo (IE), ground penetrating radar (GPR), ultrasonic surface waves (USW) and electrical resistivity (ER). The IE is used in detection and characterization of delamination. The GPR is used to identify bridge deck areas with likely deterioration and highly corrosive environment, to map all metallic objects and to measure the concrete cover. The USW provides information about the concrete quality through a measurement of concrete elastic modulus. Finally, the ER enables the assessment of a potential for corrosive environment. The application of the listed NDE technologies using a robotic platform allows data collection at far higher production rates than the manual collection using a group of technicians, and at a significantly reduced cost. In "Condition assessment of concrete bridge decks using a fully autonomous robotic NDE platform", Gucunski et al discuss the manual and robotic applications of NDE technologies.

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