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Editorial

The central span length, which is the most critical part of a cable-stayed bridge, has almost reached the technical limit for traditional materials, and construction technology. Chan et al. explore the use of fiber-reinforced polymer (FRP) as new material for ultra-long span cable-stayed bridges in their paper "Nonlinear dynamic analysis of fiber reinforced ultra-long span cable stayed bridges." The new system leads to reduction in deck weight and critical stresses in the pylon zones by using a hybrid advanced composite deck. The authors utilize a multi-scale modeling technique, which represents material design at the micro/macro-level. The paper investigates dynamic performance under wind and seismic excitations, and the vulnerabilities of such a bridge system via computer simulations and large-scale dual shaking table experiments. The investigation results demonstrate that adopting a fiber reinforced polymer deck system can efficiently reduce internal deck stresses due to the high strength of FRP materials and the tubular type of lay-up structural system. The hybrid system also increases the load carrying capacity of cable-stayed bridges and hence pushes out the limit of the central span length. The investigation points out that due to the relatively low Young's modulus and shear modulus of fibrous materials, deflection at full loading and torsional resistance should be carefully controlled by using a convex initial configuration with sufficient internal bracing. Additionally, the investigation results suggest that wind induced coupling excitation is likely to occur in such a light-weighted system with low shear and torsional stiffness. The evaluation of safety during the service life for a segmental prestressed concrete bridge is a fundamental consideration in its conceptual design. This evaluation is a function of percentage of prestressing, erection sequence, materials properties and the delayed deformations due to creep and shrinkage. Structural safety and serviceability have to be considered on the basis of stress and strain levels as well as durability of the structure with time. The time determines two aspects: the first is related to the prediction of creep and shrinkage effects on the structural response. The second is related to the decay of structural characteristics, or in general terms, to the durability of the structure. The static behaviour of prestressed concrete bridges is strongly influenced by creep and shrinkage, time-dependent phenomena, which depend on the intrinsic properties of concrete and steel, and on the quality of cast process, prestressing operations, etc. Granata and Arici investigate "Serviceability of segmental concrete arch-frame bridges built by cantilevering." The paper shows differences between prediction models for creep effect given by prediction codes. The paper concludes that particular attention must be paid to the effects of delayed deformations in these structures, because of the stress redistribution due to the change in the static scheme. The case study in the paper shows that the safety degree can be achieved in the arch structure with a significant reduction of the upper and bottom prestressing. After the collapse of the Tacoma Narrows Bridge in Washington State on November 7, 1940, there was a worldwide interest in analyzing motions of suspension bridges subjected to high winds using analytical and experimental methods. One of the findings, using John Roebling's words, was "there is no bridge in the world, neither of stone cast or wrought iron, which is free from all vibrations." These long-span bridges are subject to aerodynamic forces generated by structural motions. In "Wind study for City Island cable-stayed bridge over Eastchester Bay in the Bronx, New York City," Raggett et al. study the aerodynamic forces on this cable-stayed bridge in New York City. The wind study indicates that the bridge is stable for all wind speeds and angles anticipated at the City Island Bridge site for a return period of 10,000 years. All predicted motions of the bridge, for the comfort of the people on the bridge, were well below the assumed motion criteria. Some of the forestays with longer lengths may require damping, and provisions should be made in the design to accommodate the damper at a later date, if necessary.

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