

Editorial

Vehicles traveling on long span bridges are subjected to strong winds. Therefore the designer must consider the actual performance of the bridge at the operation level, and the safety and comfort of the drivers. However, reliability analysis on a vehicle-bridge-wind system is a time consuming process that it is usually considered infeasible in actual practice, especially when dealing with highly non-linear cable-stayed bridges. This issue of *Bridge Structures* leads off with a paper by Chan and Cheung on “Performance and operational allowable speed limit for vehicle on cable-stayed bridges”. The authors construct a general vehicle stability analysis framework which makes possible the estimation of the maximum allowable vehicle velocity on cable-stayed-bridges subjected to different wind intensities. Non-linear properties such as the cable sag, geometrical non-linearity and wind induced buffeting and fluttering effects are studied and implemented into the analysis framework. In addition, the numerical simulation procedure is optimized using the partial iterative process (PIP) and the continuous simulation technique (CST), which can significantly reduce the time needed for performing the reliability analysis. The result of the numerical example demonstrated that both high-sided vehicles and small vehicles are likely to undergo vehicle instability problems on cable-stayed bridges subjected to wind loading. It is also suggested that the allowable speed limits for vehicles traveling on cable-stayed bridges are significantly lower than the limits on box-girder bridges. Under serviceable wind loadings, the stability of a vehicle depends very much on the speed of vehicle, the roughness conditions on the deck and the degree of the coupling effect between the bridge and the vehicle. Non-destructive evaluation is growing into an established tool for the special investigation of concrete and masonry arch bridges. These trends are driven by Advisory notes from the Highways Agency, in the United Kingdom and by the American Concrete Institute. In “International practice using NDE for the inspection of concrete and masonry arch bridges”, Forde identifies key problem areas of concrete and

masonry arch bridges and discusses appropriate NDT techniques. Some of the techniques used on concrete are capable of being transferred to new masonry, but not necessarily to old stone masonry arch bridges, with their special features such as large stone block size and the use of lime mortar. For stone masonry arch bridges, the paper suggests that the most useful techniques are low frequency sonic echo, sonic transmission and sonic tomography. The paper discusses the role of ground penetrating radar (GPR) in the evaluation of masonry arch bridges. In the case of concrete bridges, Forde concludes that techniques of ultrasonic tomography, impact echo, impulse response and ground penetrating radar (GPR) are particularly relevant and that GPR has only a limited role in the investigation of post-tensioned concrete bridges, where the tendon ducts are metallic. Structural health monitoring techniques provide experimental readings of strains and displacements under service loads. Those measurements are compared with design loads and used to make decisions about the performance of structures and forecast of safe service life. Usually the experimental measurements are read from a discrete set of selected points on the structure, whose overall response should be obtained by means of interpolation of the point-wise set of sampling data. For safety and efficiency sake, these measurements should be continuously assessed during the lifetime of the structure. In recent years, readings of strains over the whole structure have been possible by distributed optical fibre (OFS) measurements based on the Brillouin scattering effect. The principle, on which Brillouin distributed optical fibre sensors are based is the occurrence of light wave scattering into the optical fibre when two counter-propagating incident waves encountered within the fibre itself. The two light-waves exchange energy, and this amount of energy transfer depends on the wavelength difference and on sound velocity into the fibre around the point where the waves collide. This effect, called Brillouin scattering, is resonant when the wavelength difference between the two light-waves matches the so-called Brillouin fre-

quency shift. It is proportional to the fibre strain, as effect of the induced deformation in the fibre that produces a variation of density and then a changing of the sound transmission properties of the medium. One important application of the concept of Optical Fibre Sensors is the detection of damage on the surface of high strength steel bridge wire. Bridge wire is the essential structural component in suspension cables and stay cables. The presence of cracks and corrosion emphasizes the significance of developing non-destructive technology for the detection of cracking or corrosion damage on the wire surface. Joint research efforts are currently underway between the University of Naples "Federico II" and Bridge Technology Consulting in the United States. The goal of the research is to establish a non-destructive experimental procedure for the identification of cracks and corrosion damage on the wire surface. In "Distributed optical fibre sensor measurements on rods and bridge cable wire: Part I: Theory", Nunziante et al. present the theoretical basis for the concept. In "Distributed optical fibre sensor measurements on rods and bridge cable wire: Part II: Experimental", the authors present the laboratory experiments on a long aluminium rod subjected to axial force and the experimental work for bridge wire. Objective decision making processes are emerging as indispensable tools for bridge operators. Objective relationships between traditional bridge management efforts and management decisions are needed to ensure cost effectiveness and

adequate performance. Such tools include conventional decision-making theory, qualitative and quantitative risk management, and life cycle analysis. The advent of high cost demands due to recent natural and man-made disasters have led to an interest in a modern decision-making concept known as "Infrastructure Resiliency". In "Resiliency of bridges: A decision making tool", Alampalli and Ettouney explore the application of resiliency concepts to bridge structures. This concept has great potential to assist infrastructure operators with multiple asset types to reduce overall risk through appropriate decisions after specific hazards faced by their network. The available live load models were developed for short and medium span bridges. In contrast to short and medium spans, long span live load must consider the presence of multiple trucks. "The development of live load for long span bridges" by Nowak et al. treats loads as random variables, with regard to magnitude and frequency of occurrence. Based on the analysis of traffic records (weigh-in-motion and videos) taken on selected bridges, the design live load has been developed and a recommended design live load has been formulated for consideration in the bridge design code.

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