Editorial

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This is the first *Bridge Engineering* Editorial that has had the opportunity to comment on the tragic collapse of the Morandi Bridge in Genoa, Italy. We now know that on 14 August 2018, one of the cable-stayed towers and its adjacent spans collapsed, killing 43 people. The collapse occurred during adverse weather conditions, with reports that lightening hit the tower. At the time of writing, we do not know the cause of the collapse and I am reluctant to speculate until the facts are established and the official report is available. The Morandi Bridge, constructed 1963–1967, was considered an advanced form of construction for its time. Morandi had previously designed the Maracaibo Bridge in Venezuela to a similar structural form. The innovations of the Morandi Bridge were the early use of prestressed concrete and cable-supported spans. Over the past half-century, we have learned a lot about the use of these technologies. Two particular design aspects that bridge engineers of today are much more aware of are durability and robustness. The collapse 33 years ago of the Ynys-y-Gwas Bridge in South Wales (Woodward and Williams, 1988) taught bridge engineers about the importance of making prestressed concrete bridges easier to inspect and to ensure that the steel prestressing components were adequately protected against corrosion. Robustness is now a priority in any structure; modern cable-stayed bridges usually adopt multi-cable arrays, which offer alternative load paths in the event of a loss of capacity of any one cable. These developments should make a tragedy such as the one in Genoa less likely; however, bridge engineers must be aware of time-related deterioration and increased loading conditions.

This issue of *Bridge Engineering* includes seven technical papers that cover a wide range of topics from the design of new bridges and adapting existing bridges to the inspection and assessment of in-service bridges. The geographic spread of the authors contributing to this issue clearly demonstrates the truly international nature of bridge engineering, as well as the readership of *Bridge Engineering*.

In the first paper, Zhang *et al.* (2018) describe the design and construction of the Ohmi–Odori Bridge in Japan. This is a

495 m long four-span bridge with a multi-cell prestressed composite deck construction. Extradosed cables support the two longest spans (140 m and 170 m). It is claimed to have the world's first extradosed bridge deck with corrugated steel webs. A definition of an extradosed bridge was put forward in a previous paper in *Bridge Engineering* by Collings and Gonzalez (2013). Corrugated steel webs, where flat steel plate is formed to provide much improved out-of-plane stiffness, have been used in a number of girder bridges in Japan and elsewhere, but this is its first application in combination with extradosed cables.

The precast concrete FlexiArch system, previously described in the pages of this journal by Long *et al.* (2013), now has a wide range of applications for both new and replacement bridges. Long *et al.* (2018) now describe a further development of the use of the FlexiArch system to widen an existing masonry arch bridge. FlexiArch units were installed on both sides of a 175-year-old bridge over a cycle way in the suburbs of Bristol, UK. The paper describes the design and rapid construction of this cost-effective widening solution.

In an interesting paper, Esteves *et al.* (2018) describe a rational design model for the connection regions between concrete and steel composite sections of bridge decks. The use of lighter steel composite decks in longer main spans connected to heavier concrete slabs in the side spans is becoming increasingly popular. This paper proposes an improved method for the design of these difficult connections, illustrated with a helpful case study assessment.

The assessment of the dynamic behaviour of railway bridges often shows a marked difference between theoretical calculated behaviour and that measured by inspection. Typically, this would be in the form of lower measured natural frequencies than calculated by the structural analysis. This is often attributed to additional stiffness provided by the ballast and the track that are usually not included in the strength model. The paper by Bigelow *et al.* (2018) proposes a method for making allowance for these additional stiffnesses. A potentially useful

formula for the quick assessment of the fundamental frequency of single-span railway bridges is proposed.

The next paper also considers the behaviour of railway bridges. Augusthus-Nelson *et al.* (2018) describe experimental and numerical analysis studies of the influence of railway loading on soil-filled masonry arch bridges. Two large-scale masonry arch bridge set-ups were designed and built in the laboratory. These were loaded in ways to represent both highway and railway loading. The masonry arch arrangements were then modelled using advanced ultimate limit state methods, using the LimitState:GEO software to model the experimental set-ups numerically. The results of this work come to quite a surprising conclusion on the relative strengths of similar structures when subjected to railway rather than highway loading. These results could have important implications on the assessment results of existing masonry arch bridges subjected to railway loading.

Desnerck *et al.* (2018) present a very comprehensive study of the history, reported problems and current inspection regimes of reinforced-concrete bridges that include half-joints in England. The half-joint was a popular feature of reinforced-concrete bridges in the 1960s and 1970s, but once the potential durability and maintenance problems associated with them were realised, their use was discontinued. The paper describes the inspection and visual assessment techniques put in place by Highways England to manage the risks of their stock of 424 reinforced-concrete half-joint bridges that are still in use. Reference is made to how other nations' highway authorities are managing their stocks of similar bridges.

The final paper by Griffin and Sivaji (2018) describes the methods used to manage the assessment of the UK's huge stock of railway bridges owned by Network Rail. This includes tens of thousands of bridges with a wide range of ages, sizes and structural forms. The paper explains the special problems associated with managing an asset base of this size. The original three levels (Levels 1, 2 and 3) of bridge assessment are described along with measures taken to tackle the pressing need to quickly assess many thousands of bridges in a short time period. The development and introduction of a new rapid Level 0 assessment is described.

I hope you find these papers interesting and useful. Comments on the content of any of the papers are always welcome.

Details on how to contribute your comments can be found at the end of each paper. Additionally, there are many fascinating bridge-related projects being constructed around the world, so if you are involved with one of these projects then consider submitting a paper to this journal.

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