Editorial

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The developments in digital computing and information technology (IT) that have taken place over the last few decades have had a pronounced impact on how we as a profession develop and deliver our solutions for the community. With the developments in personal computing, we now all have small powerful computers that enable us to solve the complex equations of solid mechanics using solution methods that have been developing since the mid-20th century. Academics within our professional community have been enabled to develop more sophisticated analytical models to describe our unique construction materials; for example, the more recent non-linear damage mechanics models for concrete. Our offices are now linked by networks enabling collaborative working between offices, meaning that we can very easily share work globally between our organisations' offices, enabling us to work at all hours for our clients. Building information modelling (BIM) is now mandatory for all projects funded by the public purse in the UK. Emerging technologies offer exciting prospects such as the use of fly-through goggles to communicate our design solutions to the public.

Out of the office environment, testing of scale model structures before construction to assess issues such as behaviour of bridges under wind using complex arrays of sensors is now relatively commonplace for light or long-span structures. Structural health monitoring systems that can be monitored remotely are becoming more prevalent in major bridges across the UK. The use of global positioning systems affords the construction industry a safe and simple alternative for some site-based activities. We are now able to undertake fast laser scans of existing infrastructure that we need to modify or strengthen and we can use drones for inspections, which reduces the impact of our investigative work on the public and enhances safety.

This edition of the journal brings a collection of papers that focus on specific applications of IT that benefit the delivery of infrastructure solutions for the community. We start with a paper by Hendy *et al.* (2017) that provides a summary of their work developing a BIM-based system to monitor and manage elements of the M4 elevated motorway in London, UK. They describe gathering site data using laser scanning techniques, undertaking complex non-linear finite-element assessment and strengthening design of reinforced-concrete crossheads,

implementation of cathodic protection and how they applied BIM to document design solutions as well as incorporate site measurements, including crack widths and chloride levels.

Displacement measurement for the purpose of validating effectiveness of remedial works to an existing lifting bridge using digital image correlation is presented by Hoag *et al.* (2017). Their need for an innovative technology-based approach to measuring displacements arose as they sought to find a means of validating whether their strengthening measures had been installed correctly in a manner that was safe for site teams to undertake.

Codes and standards from time to time present us with situations where we are unable to categorically prove compliance through pre-construction design. Giaccio *et al.* (2017) found that they could not demonstrate code compliance for overlapping frequencies between the deck and the cables on a steel cable stayed pedestrian/cycle bridge owing to non-prescriptive code provisions. They present their solution to the problem, which employed site data acquisition from velocity meters to ascertain cable damping ratios, which demonstrated code compliance.

This edition also includes two papers specifically looking at BIM. McKenna *et al.* (2017) apply laser scanning techniques to ascertain the full geometric profile of a historic viaduct in Ireland. Once calibrated using targeted site measurements, they describe the development of a three-dimensional model using the point cloud data generated from the laser scan. They then describe their method of associating attributes to complete a model that embeds all information necessary for ongoing management of the bridge. Delgado *et al.* (2017) focus on the fact that there are currently no prescribed standards for the implementation of structural health monitoring (SHM) data into BIM models. They present a rational method of embedding SHM data into a BIM model to explore benefits of such systems in regular structures for ongoing asset management.

In the final paper of this themed issue, Lydon *et al.* (2017) look at one of the older methods of SHM: bridge weigh-in-motion. This paper acknowledges that conventional strain gauge-based systems are often less reliable in remote areas

where mains power supply is not available. Their paper presents and tests a fibre optic-based system with lower power usage than the conventional system, which they developed and tested on a bridge in Northern Ireland.

I hope the readership find these papers as interesting and informative as I have in editing this journal. We would encourage readers to submit discussion pieces on these articles through the regular channel. Furthermore, we would acknowledge that innovation in this area continues on an almost daily basis. We would encourage the entire readership to share their applications by way of submitting an article to the journal in our regular editions.

REFERENCES

- Delgado JMD, Butler LJ, Gibbons N *et al.* (2017) Management of structural monitoring data of bridges using BIM. *Proceedings of the Institution of Civil Engineers – Bridge Engineering* **170(3)**: 204–218, <http://dx.doi.org/10.1680/jbren.16.00013>.
- Giaccio C, Caracul JM and Boothman D (2017) Design of the new pedestrian and cycleway bridge in Strabane, Northern Ireland. *Proceedings of the Institution of Civil Engineers – Bridge Engineering* **170(3)**: 181–191, <http://dx.doi.org/10.1680/jbren.16.00031>.
- Hendy C, Brock C and Nicholls T (2017) Management of the M4 Elevated Section substructures. *Proceedings of the Institution of Civil Engineers – Bridge Engineering* **170(3)**: 159–167, <http://dx.doi.org/10.1680/jbren.16.00006>.
- Hoag A, Hoult N and Take A (2010) Assessment of a bascule lift bridge using digital image correlation. *Proceedings of the Institution of Civil Engineers – Bridge Engineering* **170(3)**: 168–180, <http://dx.doi.org/10.1680/jbren.16.00022>.
- Lydon M, Taylor SE, Doherty C *et al.* (2017) Bridge weigh-in-motion using fibre optic sensors. *Proceedings of the Institution of Civil Engineers – Bridge Engineering* **170(3)**: 219–231, <http://dx.doi.org/10.1680/jbren.15.00033>.
- McKenna T, Minehane M, O’Keefe B, O’Sullivan G and Ruane K (2017) Bridge information modelling (BrIM) for a listed viaduct. *Proceedings of the Institution of Civil Engineers – Bridge Engineering* **170(3)**: 192–203, <http://dx.doi.org/10.1680/jbren.16.00007>.