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Welcome to the November 2019 special issue of *Civil Engineering* on offsite and smart construction.

Smart construction – characterised by increased activity offsite, digital design and greater standardisation and automation – is helping to address the challenges of poor productivity, delays and shortages of skilled labour in the construction industry. This special issue focuses on methodologies, technologies and projects that showcase offsite and smart construction around the world.

The first paper, by Goodier *et al.* (2019), describes the development of an offsite decision-support tool for engineering construction. The authors worked with clients, contractors, consultants and suppliers from around Europe, after which they developed a tool that was subsequently piloted and validated with practising engineers. The tool enables informed and auditable decisions on using an offsite approach for project delivery.

The use of advanced manufacturing technology is then described by Griffin *et al.* (2019), who explain how lessons learnt from, and technologies developed for, the aerospace and automotive sectors could be transferred into the construction supply chain through horizontal innovation. The authors outline how robotics, automation and augmented and virtual reality could all have a role to play in construction.

Our third paper (Masters and Johnston, 2019) discusses a new platform approach to design for manufacture and assembly, which was developed and prototyped in the UK prison estate transformation programme. This paper discusses the lessons learned from the two prototypes that were trialled and the opportunities for the two platforms to be developed and applied on future programmes for prisons as well as housing, hospitals and schools.

We then move to a paper reviewing the evolution of offsite construction methods in UK housing over the past 15 years. Zhang *et al.* (2019) outline the challenges of labour shortages and skills, the desire to learn across sectors and a need to develop new business models.

Next, Hough and Lawson (2019) evaluate the state of the art of construction practice for medium- and high-rise modular construction. Their paper reviews the principles that have guided the design and construction of some recent high-rise modular buildings in the UK and suggests how, in the absence of specific design and execution standards for modular buildings, existing requirements for steel construction can be adapted for this new way of building.

Hayes (2019) also identifies that there is little guidance or consensus on design methods for modular buildings and provides guidance on the design of high-rise modular buildings, specifically those using modules made from hot-rolled steel members and tied to a separate stability core or bracing system.

In our seventh paper Shan *et al.* (2019) consider the feasibility of modular systems for high-rise buildings where wind action could

be a dominating factor in a structural design. They looked at how to adopt a modular system to withstand the strong wind and moderate seismic actions experienced in Hong Kong, based on an existing 31-storey reinforced-concrete building for student accommodation.

Finally, Weston and Livingston (2019) describe a case study of a water treatment works on a remote island in Scotland. Use of nanofiltration and an offsite modular approach cut costs and the programme by more than a third. The modules for the treatment building were designed, fabricated, assembled, tested and pre-commissioned offsite before delivery to site, where they were installed in just four weeks.

We thank everyone who has been involved in producing this special issue, particularly the authors for sharing their valuable knowledge with their peers. We hope that you enjoy the variety of the papers in this issue. Please remember you can access more recent papers in the Ahead of Print section on the journal home page.

References

- Goodier CI, Gibb A, Mancini M *et al.* (2019) Modularisation and offsite in engineering construction: an early decision-support tool. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 3–14, <https://doi.org/10.1680/jcien.19.00015>.
- Griffin A, Hughes R, Freeman C *et al.* (2019) Using advanced manufacturing technology for smarter construction. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 15–21, <https://doi.org/10.1680/jcien.18.00051>.
- Hayes P (2019) Smarter construction site management using structural design of high-rise volumetric building systems using hot-rolled steel. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 45–50, <https://doi.org/10.1680/jcien.19.00003>.
- Hough MJ and Lawson RM (2019) Design and construction of high-rise modular buildings based on recent projects. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 37–44, <https://doi.org/10.1680/jcien.18.00058>.
- Masters K and Johnston J (2019) Automated construction: boosting on-site productivity using a platform-based approach. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 23–28, <https://doi.org/10.1680/jcien.19.00009>.
- Shan S, Looi D, Cai Y *et al.* (2019) Engineering modular integrated construction for high-rise building: a case study in Hong Kong. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 51–57, <https://doi.org/10.1680/jcien.18.00052>.
- Weston S and Livingston M (2019) Delivering offsite modular construction in the water sector: a Scottish case study. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **172**(6): 59–64, <https://doi.org/10.1680/jcien.18.00057>.
- Zhang R, Zhou A, Tahmasebi S and Whyte J (2019) Long-standing themes and new developments in offsite construction: the case of UK housing. *Proceedings of the Institution of Civil Engineers – Civil Engineering*, **172**(6): 29–35, <https://doi.org/10.1680/jcien.19.00011>.