Editorial

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The efficient management of construction projects, in regard to design, construction, operation, maintenance or retrofitting, highly relies on (a) adequate and suitable data acquisition from multiple sources and in diverse formats, (b) employment of rigorous information technologies to combine, interpret and prioritise data elements that fit to a particular analysis, and (c) utilisation of sound optimisation techniques to support managers and stakeholders in analysis and decision making. In fact, data related to construction management are quite fragmented and diverse in content and format, result from multidisciplinary sources, and are provided at various levels of detail and usability. The research and practitioner effort is then to determine the significance of each piece of information and, most importantly, ways that this information can be presented and handled in a simple and flexible manner to support different project management processes. Further, project management decisions often require the use of advanced optimisation tools and techniques to account for the necessary multi-parameter analysis and multi-objective type of decision making.

The present journal issue of the *Proceedings of the Institution of Civil Engineers – Smart Infrastructure and Construction*, titled ‘In Focus: EC³’, groups two themed issue papers from the 2019 European Conference on Computing in Construction (2019 EC³) and one general paper submitted to the Journal. The presented EC³ papers have been selected among the top conference relevant papers and, after substantial enhancement and thorough peer review by distinguished international experts, have come to fill the current themed journal issue focusing on multidisciplinary data integration and use as well as on decision-making optimisation in large-scale projects. The papers included in this issue cover a wide range of topics related to smart infrastructure and construction research field, from the utilization of nanomaterial-based load sensors for real-time performance monitoring of building structures, techniques for combining disparate information sources to serve the information needs of a project, to automated processes for scenario generation and optimisation in large-scale building retrofitting projects. In particular, the papers included in this issue provide research advancement to the following topics.

The first paper aims to explore ways that disparate information sources need to be combined and data to be merged in order to inform simulation and other decision support systems within a project management framework (Hoare *et al.*, 2019). The paper describes an approach that employs a lightweight central server to investigate the effectiveness of loose federations of information sources to serve the information needs of a project. The central

server provides both a common context through which relationships among information sources can be expressed and a data register to enable information discovery. An ontology is developed to capture the context along with a software architecture to support its use. A renovation case study project illustrates the use of the context model and the server ability in marshalling data. The proposed approach is expected to assist new projects in combining data from different sources while operating with limited technical and funding resources.

The second paper deals with the automation of scenario generation and optimisation in large-scale building retrofitting projects (Martin-Toral *et al.*, 2019). Building renovation is of high importance in reducing carbon dioxide emissions and decision making needs to evaluate energy-efficient retrofitting solutions at a building-stock level, considering individual stakeholders’ priorities in an efficient manner. The paper presents an ‘Optimised Energy Efficient Design Platform for Refurbishment at District Level’ solution, which enables the automatic generation of retrofitting scenarios, along with the assessment of energy conservation measures, and their simulation and optimisation, based on data provided by the users. The proposed solution enables important retrofitting design information and multidisciplinary data from diverse sources to be integrated into a single framework, employs diverse evaluation indicators (environmental, economic and social), and develops a multi-objective optimisation module to evaluate alternative retrofitting scenarios at a district level. The implementation allows testing of a wide set of solutions in an efficient (timely, inexpensive, and error-free) way, identification of best retrofitting configurations, and stakeholder engagement and confidence enhancement.

The last paper is concerned with nanomaterial-based load sensors for use in building structures (Xuereb and Parkin, 2019). Load sensors can allow real-time performance monitoring of structural frames, provide information on structure residual capacity, and effect decisions on further use, refurbishing or demolishing a building. The study analyses three types of sensors based on an extrinsic carbon-nanotube-enhanced cement grout with a polycarboxylate polymer used as a dispersant. Among the three, type II (Sandwich CNT/polycarboxylate polymer film sensor lying between two layers of non-CNT cement grout) was found to be of superior performance in terms of efficiency (it presents the strongest correlation between the change in electrical resistance and in loading) and reliability (no significant drift in resistance measured before and during the load tests is observed). The relatively high gauge factors obtained by type II sensors potentially indicate their ubiquitous use in building structures.

REFERENCES

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