Introduction

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Welcome to this special issue of *Civil Engineering* on programme managing the £14.8 billion Crossrail project to deliver the new east–west Elizabeth line railway across London. Jointly published by the Institution of Civil Engineers and the Association of Project Management, it is part of an initiative by the delivery team to share its experiences and learnings for the benefit of the industry and future projects.

The first two papers (Bennett, 2017a, 2017b) in this publication cover the lengthy, iterative process undertaken by Cross London Rail Links between 2001 and 2008 to gain agreement on what has become the engineering project of a generation. The papers explain the process from the identification of route options, through public consultation to the deposition of the hybrid parliamentary bill, amendments and its subsequent royal assent.

Getting the UK's largest transport project into reality was only possible through innovative funding, which saw London businesses and future passenger revenues contribute approximately two-thirds of the cost. Buck (2017) explains how, taking international precedents and new ideas on funding and finance, as well as optimising plans and interrogating costs, the Crossrail business case was agreed with a funding envelope that could deliver the scope affordably.

Once approved, the set up and delivery of the delivery organisation – Crossrail Limited – and its key partners was vital. Delivering a project of this size would require an organisation with appropriate governance, programme controls and a project management structure to support thousands of people in their delivery of the railway. The structure established and the tools utilised to guide, monitor and assure the delivery of the railway are outlined in the paper by Wright *et al.* (2017).

Representing over £11 billion of capital spend in one of the largest regulated procurements of its time, the procurement strategy and its outputs are explained in detail in the paper by Lloyd-Davies and Rowark (2017). The six pillars of procurement helped deliver best value, fair and objective, compliant and ethical procurement aligned with sponsor requirements. The procurement strategy ultimately met the scope to deliver the new railway within budget requirements and without any successful challenges (as at July 2017). It led to 96% of contracts being awarded to companies within the UK and 65% to UK companies outside of London.

Choosing the right commercial arrangements between Crossrail and contractors was fundamental to the programme. Morrice and Hands (2017) outline the programme's use of *NEC3: Engineering and Construction Contract* (NEC, 2013) and the key amendments that were made to standard form. The NEC3 contracts have benefitted the project by giving the client full visibility of costs, encouraging dispute resolution and positive, proactive relationships focussed on getting the job done.

Paris *et al.* (2017) then cover the application of the Environmental Minimum Requirements as outlined in the Crossrail Act 2008 to deliver best practice environmental standards on the project through the setting of ambitious targets, monitoring and engaging the supply chain. The minimising and mitigation of environmental impacts and the beneficial management of waste reuse and archaeological investigation have been key to delivering wider benefits on

Crossrail, including its significant contributions to building wildlife reserves and enhancing London's archaeological archive.

Finally, the scale and complexity of the Crossrail programme created a huge data challenge, whereby large numbers of people needed secure access to data to ensure different components of the project would integrate on site. The creation of a virtual railway has been fundamental to this process, and Crossrail was also the first major project in the UK to use the collaboration process defined within BS 1192 (BSI, 2008). Taylor (2017) describes the development of the building information modelling environment explains the principles adopted to manage and share data throughout project delivery.

More papers on the delivery of the Elizabeth line can be found in the May 2017 special issue of *Civil Engineering* and numerous other *ICE Proceedings* journal papers, as well as volumes of *Crossrail Project: Infrastructure Design and Construction* published by ICE Publishing (Black, 2016; Black *et al.*, 2015a, 2015b; Williams and Black, 2017) and on the Crossrail Learning Legacy (2017) website.

References

- Bennett S (2017a) Crossrail project to deliver London's Elizabeth line: from options to parliamentary bill. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 3–9, <http://dx.doi.org/10.1680/jcien.17.00006>.
- Bennett S (2017b) Crossrail project to deliver London's Elizabeth line: the parliamentary bill process. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 10–14, <http://dx.doi.org/10.1680/jcien.17.00014>.
- Black M (2016) *Crossrail Project: Infrastructure Design and Construction*. ICE Publishing, vol. 3, London, UK.
- Black M, Dodge C and Lawrence U (2015a) *Crossrail Project: Infrastructure Design and Construction*. ICE Publishing, vol. 1, London, UK.
- Black M, Dodge C and Yu J (2015b) *Crossrail Project: Infrastructure Design and Construction*. ICE Publishing, vol. 2, London, UK.
- BSI (2008) BS 1192:2007+A2:2016. Collaborative production of architectural, engineering and construction information. Code of practice. BSI, London, UK.
- Buck M (2017) Crossrail project: finance, funding and value capture for London's Elizabeth line. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 15–22, <http://dx.doi.org/10.1680/jcien.17.00005>.
- Crossrail Learning Legacy (2017) learninglegacy.crossrail.co.uk (accessed 07/09/2017).
- Lloyd-Davies K and Rowark M (2017) Crossrail project: procuring infrastructure for London's Elizabeth line. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 35–41, <http://dx.doi.org/10.1680/jcien.17.00002>.
- Morrice D and Hands M (2017) Crossrail project: commercial aspects of works contracts for London's Elizabeth line. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 42–47, <http://dx.doi.org/10.1680/jcien.17.00003>.
- NEC (2013) *NEC3: Engineering and Construction Contract*. Thomas Telford, London, UK.
- Paris R, Myatt C and de Silva M (2017) Crossrail project: environmental management during delivery of London's Elizabeth line. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 49–55, <http://dx.doi.org/10.1680/jcien.17.00021>.
- Taylor M (2017) Crossrail project: building a virtual version of London's Elizabeth line. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 56–63, <http://dx.doi.org/10.1680/jcien.17.00022>.
- Williams RV and Black M (2017) *Crossrail Project: Infrastructure Design and Construction*. ICE Publishing, vol. 4, London, UK.
- Wright S, Palczynski R and ten Have P (2017) Crossrail programme organisation and management for delivering London's Elizabeth line. *Proceedings of the Institution of Civil Engineers – Civil Engineering* **170(6)**: 23–33, <http://dx.doi.org/10.1680/jcien.17.00016>.