Intelligent infrastructure

By definition, intelligent infrastructure is a bit complex. An easier way of understanding things is to look at what the delivery of intelligent infrastructure involves and the kinds of business outcomes that can be achieved. London’s AUS24bn Crossrail project is undoubtedly the biggest and best current example.

The importance of intelligent infrastructure and the journey to achieving this was a central theme to come out of a recent series of thought leadership meetings hosted by Bentley, a global leader in software solutions, with over 250 senior executives from large engineering firms, owner operators and academia.

Stakeholders identified that there are a number of challenges that organisations face, including rail, when working in infrastructure in the current economic climate. According to Bentley Systems senior industry solutions director, Brian Middleton, today’s complex project landscape has evolved to the point where distributed and multi-disciplined project teams are the norm, data abounds and finding the right information is a major challenge.

“Information used to make decisions for the effective operation of infrastructure assets not only needs to be precise, accurate, relevant, and in context, it must be accessible by whomever, wherever and whenever they need it,” he says. “But currently, this is not being easily achieved.”

During a project’s design build phase, a significant amount of time and money is spent looking for and validating project data or information. According to research conducted by the Institute of Change Management (ICM), when information integrity drops by just 8%, employee effectiveness drops by 50%.

“For the operations and maintenance phase of a project, the absence of a proper strategy for managing asset information across the lifecycle can lead to quite staggering additional costs, both in financial terms – ARC Advisory Group estimate this at 1.5% of revenues each year – as well as increased risk of incidents,” he adds.

“The end result is that projects experience inefficiencies, schedules slip and as an industry we suffer increasing incidents of rework, meaning costs inevitably will go up.”

Middleton believes that with the demand for faster start-ups for rail projects, the need for intelligent design, project collaboration and smart data handover across the complete project lifecycle has never been more important.

“Easy access to accurate, up-to-date, approved information and related supporting information is essential to reducing the risk of non-compliance and minimising unplanned rework and schedule slippage,” he says.

BIM the key

Intelligent infrastructure is therefore the ability to leverage information modelling through integrated projects for the creation and operation of better-performing assets. The journey to delivering intelligent rail infrastructure needs to involve intelligent design, mobility and control of information across the entire asset lifecycle, along with collaboration across and between multi-disciplined teams.

“Information can then be accessed with the surety that it is current, accurate and approved and that when changes occur, it is communicated in a timely fashion to those who need to know,” Middleton says.

And information modelling, or Building Information Modelling (BIM) is the key to achieving this.

“BIM empowers designers, builders, and owner-operators to simulate the performance of an asset before it’s built and ensures the asset can be constructed, will perform according to design intent and performance requirements, as well as maximising its useful life and realising its full potential.”
Crossrail

London's Crossrail project – the most significant infrastructure project ever undertaken in the UK – is undoubtedly the biggest and best current example of intelligent rail infrastructure that is being achieved through a journey of linking intelligent design and construction information through integrated project delivery.

Crossrail's project team recognised very early on that delivering intelligent rail infrastructure through effective partnerships would be best achieved through the use of collaborative BIM. In fact, the project team is pioneering the use of BIM in Europe on a scale that has not been undertaken before.

As a digital resource of reliable information for all decisions – from initial conception to final disposal of the asset – BIM is fundamental to the project's delivery. Indeed, a key concept embraced on the project from day one was that everyone, whether part of a Crossrail design team, a consultant or contractor, would as a core contractual requirement, work in the same collaborative 3D environment.

Working in this way has enabled the Crossrail project team to build a high quality, fully coordinated, 3D information model that is currently being used by all construction contractors. Importantly, the 3D model will ‘move across’ as a package of ‘valuable information’ to the organisation responsible for operating and maintaining the railway in 2018.

With the aim of intelligent rail infrastructure ‘top of mind’, together with the UK Government’s Construction Strategy (2011), which mandates BIM on all government procured projects by 2015, Crossrail and Bentley recently launched an ‘Information Academy’.

According to Crossrail head of technical information Malcolm Taylor, the Academy develops and shares BIM best practices with the Crossrail supply chain, enabling all of the project's contractors to get hands-on learning on the latest software, best practices and processes used.

“This offers our supply chain a unique advantage of working in a simulated Crossrail environment so they learn detailed technical knowledge about the project processes and systems in a virtual world,” Taylor says.

Best practice approach

The project team's adoption of the British Standard, BS1192, establishes the methodology for managing the production, distribution and quality of construction information, including that generated by CAD systems.

Following business analysis of the different solutions available globally, Crossrail's project team selected Bentley's ProjectWise as the engineering content and collaboration system for the project.

Information Management (ALM) platform to ensure that access to its ‘single source of truth’ on project information is provided to approved contractors. This dramatically reduces the risk of lost information and rework between contracts, across disciplines and throughout all project stages.

Ultimately this means that the management and control of documents during the design and construction phases – as well as the identification of all controlled information – can be handed over to the operator; something that Middleton says is “business critical.”

Worthwhile journey

The bottom line of delivering intelligent infrastructure is that significant business outcomes can be achieved. For Crossrail, these include saving thousands of man hours over 12 months through the automated creation and updates of CAD drawings, improved decision making through 4D Modelling leading to millions of pounds in quantifiable reduced costs, and improved safety through a target zero policy aided by seamless information integration.

“Fundamentally, leveraging information modelling through integrated projects to deliver intelligent rail infrastructure means that the ongoing cost of running the railway in years to come can be reduced,” Middleton says.

The approach to intelligent infrastructure at CrossRail has been so successful that nearly 80% of the project and process templates are being reused on new phases and the system has now been ported across onto the UK’s High Speed 2 (HS2) project. Indeed, Middleton says any rail project worldwide, whether new build or upgrade, can achieve similar benefits and Bentley is able to deploy these rail specific templates globally.