



Crossrail Whitechapel Station – lower concourse

Data: the heart of Crossrail

Data may seem like a dull topic for a story, but the company in charge of the biggest rail project in Europe says that data and information are at the very heart of London's Crossrail, and the biggest challenge facing the project team is creating a data and information management regime to support the delivery of a world class railway. Jennifer Perry reports.

Crossrail Ltd (CRL) was established in 2001 as a 50/50 joint venture company between Transport for London (TfL) and the Department for Transport (DfT) and in 2008 became a fully owned subsidiary of TfL.

Crossrail was in the planning phase for some 20 years, however, the project stalled during the mid-1990s when it was rejected by parliament.

CRL head of technical support services Malcolm Taylor, who presented a keynote address on the project at Bentley's Be Inspired Thought Leadership in Infrastructure event in Amsterdam last year, says that while the team was clearly disappointed at the time, there were a lot of lessons to be learned.

"We concentrated on engineering and we really didn't bring our stakeholders along with us," Taylor said.

The key lesson from this experience that Crossrail is now applying to the project according to Taylor, is the way information and data is now used to manage processes to make sure that stakeholders have this engagement.

In 2008 the project went on to gain parliamentary approval with the passing of the Crossrail Act. CRL has since focused on delivering the detailed design with the involvement of many different multi-discipline framework contractors (MFC), drawn from the "who's who" of architectural and engineering companies in the UK.

The challenge

According to Steve Cockerell, civil marketing director for EMEA and Asia at Bentley Systems – which is providing CRL with over 30 different software products for the project, – Crossrail's size and complexity created major problems for the project team.

"And not just the management, coordination and collaboration of the large number of people, teams, organisations and disciplines involved," Cockerell says.

If data is the "blood" that flows through Crossrail, then managing the volume of information created throughout the project's life is equally challenging.

"With projects such as Crossrail, the sheer number of 'bits of information' in a system can run into the hundreds of thousands," Bentley rail and transit solutions executive Ted Stephens explains.

"It's no small task to manage information and get this passed through the system reliably in each and every case, delivering the right information to the right person at the right time."

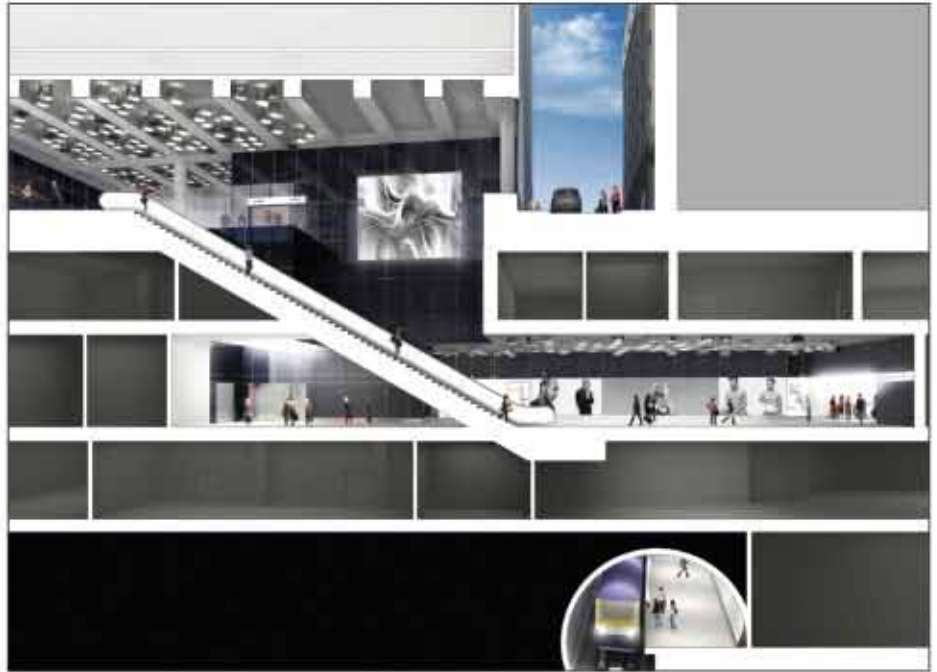
The key to developing a world class information management regime according to Cockerell, is to achieve multi-discipline collaboration between all of the various parties throughout the life of the project.

"Then you need to make sure that data and information gets handed over to the operators who will maintain Crossrail in the years to come so that they a complete picture of the asset and the underlying engineering," he said.

The solution

As a first step, CRL developed a consistent set of procedures and data standards based on industry best practice, incorporating the latest thinking on collaboration for construction information, as described in British Standard 1192:2007 (BS1192).

BS1192 establishes a common methodology for managing the creation, sharing and publishing of information. Prior to the standard being published, each of the project's participating companies had their own processes and standards, which were perfectly valid in their own right, however, were all slightly different.



Crossrail Tottenham Court Road Station – cross-section

On a multi-organisation, multi-discipline project such as Crossrail, this would have inevitably led to confusion, hence, CRL adopted an industry standard which would be acceptable to all involved.

CRL then implemented their data management system using Bentley's ProjectWise software and, with the help of Bentley, configured this to follow the BS1192 workflow.

This enabled the whole project team to create, name, manage and find design information in a consistent and reliable manner.

Stephens says in 2008 all the "stars aligned" for Crossrail.

"The standards were in place, with the technology and processes all fitting together, and suddenly this all kicked into gear, delivering a very practical solution to managing vast amounts of information for a very large project team," he said.

ProjectWise is available to everyone involved in Crossrail's design, regardless of whether they work for CRL directly or for one of the MFCs. The system manages the access rights to information – who can read or change information – and also deals with the issue of version control as the design evolves.

There are now in excess of 1400 ProjectWise users working with the system.

"Each person is required to adhere to standards and a common set of procedures regardless of their location, discipline or the contract they're working on," Cockerell said.

This then ensures that design, CAD data and associated information are not only coordinated, but approved and consistent before moving onto the next stage of the workflow.

"Consistency is the key here. It is the key to saving time at every step of the way and to ultimately improving the overall quality of design and ensuring that reliable information is delivered for construction," he said.

CRL went on to win the 2010 Connecting Project Teams Award at the Be Inspired Awards in Amsterdam.

3D world

From the outset, CRL decided to model everything in 3D so that they could deal with the complex nature of sub-surface London which has a long history of development for building cellars, foundations, underground railways, sewers, water mains and many other obstructions.



Crossrail Tottenham Court Road Station – Centrepoint entrance



Crossrail Whitechapel Station – bird's eye view

The only way to effectively “thread” a brand new railway through central London was to use an accurate 3D model.

Taylor says that producing information in 3D means people can make decisions to “ensure the fabric of London remains safe”.

To tackle this, CRL created a survey control network and mapping for the entire length of the project, with all existing infrastructure, underground structures and utilities surveyed, recorded and stored in DGN format using Bentley's MicroStation software.

This data was then used by design applications such as Bentley Rail Track for the alignment design of the track and tunnels and Bentley Architecture for station design.

“The 3D model that they have created allows CRL to virtually construct every part of the project,” Cockereil said.

“The team can ensure that everything fits together with existing infrastructure

and between different disciplines for the new infrastructure, long before they get on site where any errors in design inevitably lead to delays and additional costs.”

One of the project's key sections – the 21km of new tunnel being built under London – presents significant logistical problems.

“Trying to do this under a city that we need to keep moving all at the same time is challenging, and what holds this all together is making sure we manage information and data in the right way,” Taylor said.

“Visualisation helps us understand in 3D what's already there underground and what's going to be there.”

Taylor says that over the next few years as CRL moves into construction, the company's main challenges will be to build Crossrail safely, on time and to budget, and to meet its sponsor's requirements as well as the needs of society.

The delivery of a world class information management regime gives CRL the ability to build right first time. ■

Crossrail at a glance

At a cost of £15.9bn, Crossrail involves many delivery partners including Crossrail Central, London Underground, Network Rail, Docklands Light Railway (DLR), and the Canary Wharf Group.

Crossrail will provide passenger services along a 188km route from Maidenhead and Heathrow in the west through new twin-bore 21km tunnels under central London to Shenfield and Abbey Wood in the east.

The project includes eight new underground stations connecting to the existing London Underground and rail networks, nine new subsurface stations, four over-ground spurs including a 7km subsurface railway to Heathrow airport and five permanent ventilation shafts.

Preliminary works commenced in 2009, with main construction works commencing throughout the central section since 2010.

When it opens for passenger service in 2017, Crossrail's high frequency service will increase London's public transport network capacity by 10% and carry more than 1500 passengers in each train during peak periods.

CRL estimates that about 20,000 people will be using the new rail network every day with approximately 200 million journeys to be taken in its first year of opening.

Crossrail will reduce crowding on the Tube by 45%, will take 30,000 cars off the road each year and will save between 10,000 and 20,000 tonnes of carbon each year.

TfL will run and operate the completed system and will retain fare revenue.

The project will create 14,000 jobs during construction. ■



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