Infrastructure plan

Ian Prosser
Director of Railway Safety, ORR

The article and the infrastructure report both highlight the extensive proposals to enhance the existing network, with transformational mega-projects such as Crossrail and High Speed 2.

It is very heartening for me to see the railway not just continuously improving its health and safety, but also developing and growing to take some big leaps into the 21st century through transformational projects - such as at King's Cross, which is now completed.

However, while the railway gears up for enhancements, electrification and the large-scale projects, all of which are great news for the travelling public, I believe the critical issue is ensuring that the duty holders fully consider and secure 'safety by design' benefits at the very very early stages - in a complete and full sense, and not just bare minimum compliance with the requirements of the new Construction and Design Management (CDM) Regulations 2015.

I believe this will not only improve safety operation, such as in the case of stations safety design, it can also have a positive impact on cost reduction and the passenger experience.

This is not about "gold plating" - quite the reverse, in fact. This also includes the need to maintain the systems on an ongoing basis, as well as managing whole-life costs.

I am always struck by the example of the Shinkansen in Japan. This was designed as a complete system with safety uppermost in everyone's mind right from the start, including managing future maintenance needs. So it has signalling systems that protect trains completely, enabling it to operate lightweight trains and minimise infrastructure and maintenance costs. The outcome is a railway that for 50 years has had a zero passenger fatality record (a performance that everyone else around the world aspires to) and high customer satisfaction and growth levels.

This has been achieved by looking at how the passenger is treated - from how they get to the station (including cross-model transport system integration) to how they are then treated in the station, to ensure not just safety, but also consistently great customer experience. Stations' people flow and capacity are proactively optimised, minimising the number of platforms required, and hence capital costs. Key potential safety concerns, such as the platform train interface, are managed effectively.

In some of the industry projects, such as electrification, we as the regulator have seen a lack of 'safety by design' thinking at the very front end. Disappointingly, in some cases, it has been necessary for us to enforce, to try and ensure legal requirements have been met. Often these are at the basic, rather than the excellent level demonstrated by the likes of the Japanese.

So although it is very pleasing to see sustained strategic investment in Britain's railways following decades of under-investment in areas such as electrification, it is very important that as an industry we make the very best of the opportunity to provide cost-effective developments that improve safety, efficiency and customer satisfaction. The way of achieving this is through 'safety by design'.

Malcolm Taylor
Head of Technical Information, Crossrail

As an Engineer, the National Infrastructure Plans have always made good reading for me. Several industry trends have emerged since the first plan in 2010, most notably the development of the Information Economy and the concepts for a digital Britain.

The strategic and political difficulties of choosing and planning major infrastructure were highlighted by the 2013 Armitt Review. Where the need for significant investment in infrastructure is identified, there will always be big planning and implementation issues to resolve. But once decided, we then have to ensure that what is wanted can be effectively delivered. That's where the concepts of a digital-built Britain and BIM (Building Information Modelling) can help in improving efficiencies and reducing construction costs.

The Government Construction Strategy (2011) had a series of objectives, including the need to deliver a structured sector capability to "derive significant improvements in cost value and carbon performance through the use of open shareable asset information". And so the world of BIM was born, which recognised the benefits to be gained from using advances on computer systems and developed new delivery processes to maximise those gains.

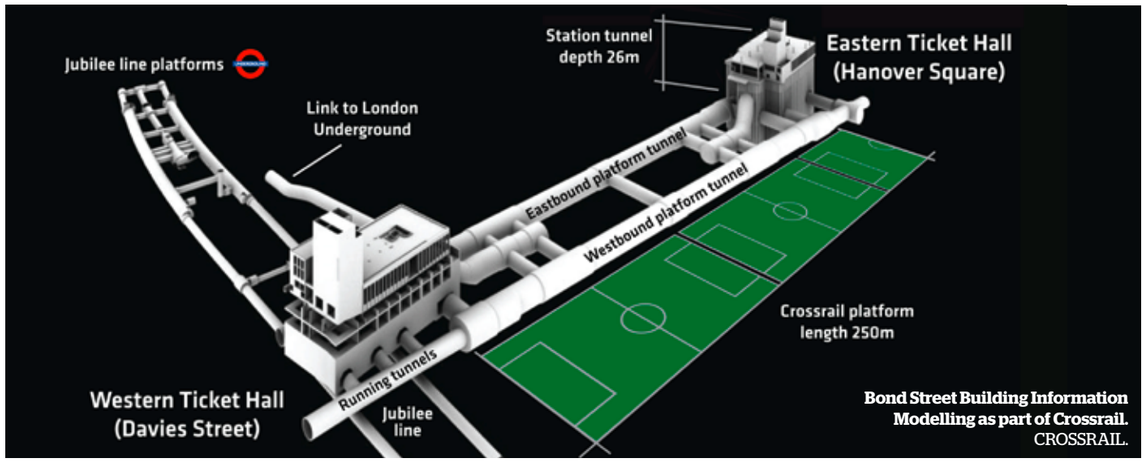
In the planning and design stages, the use of 3D BIM models help the owners and designers to work together and test them in the computer before they are built. In construction, the 3D models can be used for ensuring things fit together and are built in the right way. As construction moves into testing and commissioning, yet more BIM information is collected about the assets in data models. All of this information then gets used by the operators and maintainers.

The maintainers include more real-time information from remote condition monitoring sensors that tells them about how their assets are performing. The operator adds more real-time information about trains and passengers to tell them how their service is performing. So it's all about information becoming a valuable resource, and treating it as such.

BIM has been identified as a significant contributor to the savings of £804 million in construction costs in 2013/14 that were recently announced by the Cabinet Office. It often seems to be thought of only as advanced 3D modelling, whereas the concepts actually apply to all types of information and data, and use information technology to redefine and optimise business processes. Key elements to BIM are creating a Common Data Environment (CDE) as a single source of truth for data (collecting only the data you need to collect - not whatever you can), and creating a collaborative environment where you can share data between relevant parties.

It works. The emerging technologies and systems can indeed transform a construction project or engineering company from the inside out, but only if you make the effort to understand how it improves your project/business operating model, rather than just thinking of it as a change to some data management processes.

And it makes a difference - in Crossrail, we use 3D modelling extensively. But we also simplified our IT software applications by (for example) using workflows in a relational database for document management and contract administration. This eliminated the need for two expensive software applications and helped create (part of) our CDE for managing the project. This CDE will then be handed over to the future operator/maintainer.



Bond Street Building Information Modelling as part of Crossrail. CROSSRAIL.

Standing back for a moment - the more infrastructure we provide, the more we need to maintain. So when you consider that for typical infrastructure capital expenditure is often only 20%-40% of its whole life cost, it can be argued that it is more important to get value for money in operations and maintenance than in construction. The maintenance market in the UK is some £100 billion, so the more improvements we can make to this, the more money we will have to spend on new or replacement infrastructure.

So, where does the world of operations and maintenance fit in to the National Infrastructure Plan and the digital-built Britain BIM Level 3 Strategic Plan? It doesn't - the emphasis is all on new build and construction.

We should be addressing this *now*. The reason? The whole life cost benefits of going digital and of working in a BIM environment are significant - they will reduce maintenance costs, freeing up money that is being soaked up by legacy systems and old-fashioned ways of working.

BIM concepts need to be pushed into the world of operations and maintenance with the same degree of vigour as they have been in design and construction, to generate these benefits.

Will this happen? Unlikely, as most BIM proponents are tucked up nicely working in consultancy and construction. So it will end up with the businesses needing to make this happen if it wants to.

No one has ever really defined what the BIM 2016 Government mandate really means in practice. But some of the signs are good: Network Rail is making significant progress towards creating a digital railway, but what that actually means in terms of asset management is yet to fully materialise. Transport for London's rail businesses are seeking to rationalise their suite of separate asset management systems, and are looking at how the concepts of a CDE might work with the aim of realising the benefits of a single system.

Why is all of this important? Moving into the Information Economy with BIM processes, the digital railway describes a modern, best practice railway that uses integrated common data systems, real-time information systems and knowledge to enable everyone interested to make the best decisions possible in making it all work. From customers selecting a train and operators managing the service, through to programme teams and infrastructure managers selecting, installing and managing assets, and finance teams securing appropriate funding to renew assets, a digital railway provides real-time, actionable knowledge from a single shared source, to consistently inform decision-makers.

Traditionally, railways have used an analogue approach with multiple and disparate sources of data, often managed via paper-based or electronic representations of paper, with manual or unconnected electronic processes. This leads to duplication and divergence in data sets, onerous and inefficient management processes and ill-informed decision making, generally leading to waste and further costs.

Digital railways rely on advanced computing and data storage solutions, which are commonplace in today's business environment. Modern technologies take advantage of information mobility and modelling simulations, using asset information intelligently to deliver a responsive and effective service.

If we look at the benefits achieved by other organisations through the use of more integrated data systems and a collaborative management process, we can offer evidence of significant benefits. For example, after a disastrous fire, SSB in Switzerland went digital and delivered a 20% reduction in unit maintenance costs, identification and repair of more than 50% of issues before they affected service, thereby reducing delays by 33 hours per month. McNulty (DfT, Realising the Potential of UK Rail) also cited Network Rail's ORBIS programme, Scottish Power and Ausgrid as other organisations who have achieved or were proposing big savings in operational expenditure through improved data and information management.

Taking a fresh look at the way we currently tackle asset management systems and processes is not a comfortable or easy issue for asset managers, as it challenges many traditional practices and customs, yet it is absolutely necessary. Just because we've done things in the past with simple spreadsheets and 2D drawings does not mean that it's the best way to do it now.

So the infrastructure world has a number of choices. Carry on constructing new projects as best we can and then maintain them in legacy systems? Start trying to understand the world of BIM Level 3? Or simply recognise there are significant cost benefits to improving the way we currently manage our existing infrastructure?

The highways sector has begun to recognise the maintenance benefits in using BIM technologies and processes, and it's important we do so in rail. Investment in this area will ultimately help fund more renewals and new infrastructure itself, as well as delivering improved reliability and customer service.