Fast Track to Digital Railway

Delivering the vision

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Balfour Beatty

About Balfour Beatty

Balfour Beatty is a leading international infrastructure group. With 15,000 employees across the UK, Balfour Beatty finances, develops, delivers and maintains the increasingly complex infrastructure that underpins the UK's daily life: from Crossrail and Heathrow T2b to the M25, M60, M3 and M4/M5; Sellafield and soon Hinkley C nuclear facilities; to the Olympics Aquatic Centre and Olympic Stadium Transformation.

Balfour Beatty is a recognised leader in modern rail engineering. With a successful track record of implementing the latest digital technologies to improve efficiency across the rail infrastructure asset lifecycle, we have planned, designed and managed the construction of thousands of miles of railway systems. From feasibility studies and planning, design and implementation to maintenance and asset management, we provide rail infrastructure services across the lifecycle of rail assets. Our expertise covers track, power, electrification, civils, signalling and railway systems and technologies. Our digital capability includes asset data collection, evaluation and analysis coupled with survey and BIM enabled design and construction tools.

Balfour Beatty has been a part of digital railway journey since its inception. Our knowledge of the full rail asset life cycle puts us in a strong position to lead the development of engineering solutions and we are excited to be involved in the development of the Digital Railway programme.

Our Rail team also draws on Balfour Beatty's experience in the implementation of 'Smart' motorways and other nationally important gas, electricity and water infrastructures.

Executive summary

World-class transport infrastructure, with efficient rail systems at its heart, is acknowledged as being a key way of enabling and stimulating economic growth[1]. For this reason, the Government's Industrial Strategy[2] had a focus on rail modernisation. The railway network plays a central role in connecting areas of employment, getting goods to market, facilitating the growth of city regions and helping future-proof and strengthen the UK economy in advance of Brexit. It has been shown to aid the development of clusters of economic activity[3]. It is vital that the UK's rail network is able to meet the increasing demands being placed upon it.

The pressures on the rail network are well documented: passenger numbers have doubled since the mid-1990s[4] and are set to double again over the next 25 years[5], with significant future growth in both freight and passenger traffic. Key routes are already operating at, or beyond capacity - in some cases services are overcrowded by up to 200%[6]. Solutions such as building new lines, like High Speed 2 (HS2), Crossrail and Crossrail 2 (CR2) are key and sorely needed, but they are also expensive and disruptive. Alongside these major schemes, the priority must be to squeeze more capacity out of existing infrastructure. To achieve this successfully, all elements of the railway system will need to be optimised.

Digital Railway is a rail industry-wide programme, launched in 2014, which encompasses a complex 25-year package of digitally enabled interventions which aim to improve the way systems work together. To accomplish this, it will modernise train command,

control and signalling systems designed in a pre-digital age, faster than they would otherwise be upgraded. The intention is to significantly increase capacity at a much lower cost than new line construction. At the heart of the programme is the adoption of modern signalling technology that will allow trains to run closer together, achieving higher network utilisation and reducing the amount of infrastructure and associated maintenance and renewal cost. Similar technology has been successfully deployed internationally on projects such as the new French TGV line between Tours and Bordeaux, and is being pioneered in the UK through central London's Thameslink core lines.

In 2016 the Government made available £450m in the Autumn Statement[7] to enable work to begin, signalling its commitment to the supply chain (although the money has to be bid for via robust business cases).

Other industries, from aviation to roads have already unlocked significant additional capacity through digital control systems and the introduction of next-generation technology. The time is right for the railways to reap the same benefits.

The UK rail industry will need to be at its very best to deliver the programme safely, reliably and affordably. In this short paper, Balfour Beatty draws on its knowledge and expertise to suggest a handful of tangible steps to ensure that the benefits of a Digital Railway are realised.

Key points

1. To deliver increased capacity and reliability, all elements of the railway system need to be considered and integrated. For example, new and upgraded rolling stock; the installation of new signalling and control systems; enhanced railway infrastructure.

2. The relationship between Network Rail and its supply chain will have to evolve from being largely transactional, where suppliers compete to submit the lowest bid, to a partnership approach based on a longer-term strategic vision, with success measured in terms of value for money across the asset lifecycle and customer satisfaction.

3. The solution to funding the Digital Railway is not 'one size fits all' and the private sector has an important role to play. The success of pathfinder schemes, including the proposed development of the East-West Rail central section Design, Build, Fund, Operate and Maintain (DBFOM) concession, is important if private sector funding is to be unlocked.

4. For smaller enhancements to the network, innovative partnerships and financing mechanisms, such as the Network Rail / Resonate year-long trial of the 'Luminate'[8] Traffic Management System, are welcome and should continue to be explored and pursued where the opportunity arises.

5. Investment in new skills and in training a new generation of digital rail experts is imperative: more needs to be done, and faster, to ensure we have the skilled workforce we need.

[1] DfT, Eddington Transport Study, 2006
[2] HMG, Building our Industrial Strategy Green Paper, January 2017

[3] What is the contribution of rail to the UK economy?, Oxera, Prepared for the Rail Delivery Group, July 2014
[4] Rail Delivery Group

[5] Network Rail, Market Studies
[6] Network Rail, Discussion Pack, The Digital Railway Programme
[7] HMT, Autumn Statement 2016: Philip Hammond's speech, November 2016

[8] http://www.resonate.tech/UI/Content/Content.aspx?ID=60

An outcomes-led programme

Delivering the vision

Digital Railway is much more than a signalling upgrade programme – it is about delivering outcomes and ultimately providing a better passenger experience. To successfully deliver increased capacity and reliability, all elements of the railway system need to be considered and integrated, for example:

- **Rolling Stock:** New and upgraded rolling stock will be needed to meet the requirements of new signalling systems and increased levels of service.
- **New Signalling and Control Systems:** These need to be installed alongside existing conventional systems, before decommissioning. The new technology will require investment as well as re-skilling the workforce. For example, training operational and maintenance staff to work with digitally enabled processes and tools.

- **New Infrastructure:** To avoid bottlenecks and allow more services to run, many aspects of railway infrastructure are likely to require enhancing. These include, for example, track layouts, power supply and station layouts.
- **Train Operators:** Will be able to run more frequent services and develop new revenue maximising strategies that will either reduce franchise subsidies or increase premiums to the benefit of the tax payer. Of course, more trains will require additional staff who will need training and the stations will need to be ready for heavier passenger throughput.
- **Asset Maintenance:** As more services run, the rate of wear and degradation of assets will increase. As a consequence, train services become increasingly sensitive to delays if no action is taken. The case for renewing assets earlier, as well as investing in smart systems to predict and prevent failure will become stronger.

There are three key factors necessary to make Digital Railway a success:

1. **Ensuring the industry as a whole is engaged and that momentum is maintained.**

Delivering Digital Railway, in all its complexity and in the light of rapidly evolving technology and operational requirements, calls for a new behavioural approach. The status quo, where the relationship between Network Rail and its supply chain is largely transactional, will have to evolve to become a partnership one based on a longer-term strategic vision, with success measured by outcomes.

Early Contractor Involvement (ECI)

Digital Railway's Early Contractor Involvement Report[9] highlights that realising the goals of Digital Railway programme will require a fundamental change to the way the industry works. The ECI approach has made a major contribution to building confidence in the validity of the business case and deliverability of the Digital Railway Programme. Changing the way projects are currently initiated, and ensuring a more collaborative approach between suppliers, clients and other stakeholders, will deliver significant benefits for Britain's rail industry.

A fresh approach calls for new collaborative contractual mechanisms and the development of new alliances including Network Rail, TOCs and suppliers to achieve effective programme integration. Contracting arrangements will need to be modernised – something which is currently under discussion across the industry. Network Rail now aims to involve suppliers in writing the specifications, rather than developing them in-house and then putting contracts out to competitive tender.

We welcome this new approach, which will better allow the knowledge and expertise of rail systems contractors to be captured from concept development to optimise cost, scheduling, specification and risk variables.

Digital Railway Partnerships

Balfour Beatty can offer most value to the Digital Railway, in terms of cost reduction, schedule optimisation and increased certainty, as a service delivery partner in the infrastructure space, which provides whole life support to both Network Rail and train operating companies.

The industry must move from an approach which sees suppliers competing to submit the lowest bid, to a series of incentivised partnerships that take a system-wide view across the asset lifecycle, encouraging ongoing investment in innovation and skills, and offering greater value for money.

We have successfully adopted a similar approach with Transport for London over the last seven years, where our combined Track Partnership team, which delivers the Underground's track and drainage upgrade programme, has delivered measurable outcomes. For example, in 2016/17, our integrated team delivered a 10% saving to forecast expenditure and a four-fold reduction in Lost Customer Hours (LCH) when compared to the previous two years. We are proud to have made a real difference to passengers in London.

As a logical next step, Balfour Beatty, as a leading railway systems expert and infrastructure contractor, will actively support early engagement in a specific geographical area to develop a deliverable and well-defined business case.

[9] Digital Railway, Early Contractor Involvement Report, Delivering Digital Train Control Technology Efficiently - to drive capacity and performance on the railway, December 2016

2. The funding must be in place

Over the next 10 years there will be significant competition for Treasury funding to support infrastructure development. Only half of Digital Railway projects are expected to receive short-term funding and the level of long-term commitments (the Government's Control Period 6 settlement) are uncertain. Significant capital investment will also be needed to build new control centres and to retrofit existing rolling stock for example.

The cyclical nature of Network Rail's control periods has meant that the rail industry has suffered in the past from a stop-start funding landscape. Although difficult to quantify, this has led to an increase in costs and the loss of skilled people to other countries and other industries.

To address this issue, the DfT should consider whether Digital Railway, or elements of it, should be placed outside of the five-year control period process, as recommended in the Bowe Report[10].

Private Sector Funding

Beyond this, given the scale and complexity of Digital Railway as a capital investment programme, it would be logical to conclude that the private sector has a role to play in bridging the funding gap. Nicola Shaw recommended in the Shaw Report[11], that more third party private funding should be brought into the railway. Following this, Balfour Beatty has formed part of an informal cross industry working group to explore how private sector funding and financing could be unlocked in the rail industry.

Over the past year, the group developed and debated the advantages and disadvantages of a number of different models that included:

- An 'enhancement concession' model, where a concessionaire is appointed to fund, finance, deliver, operate and maintain digital railway assets in a given route;

- A full 'infrastructure management concession' model, similar to the HS1 Ltd. 'toll road' model, where the concessionaire is remunerated on the basis of train path provision.
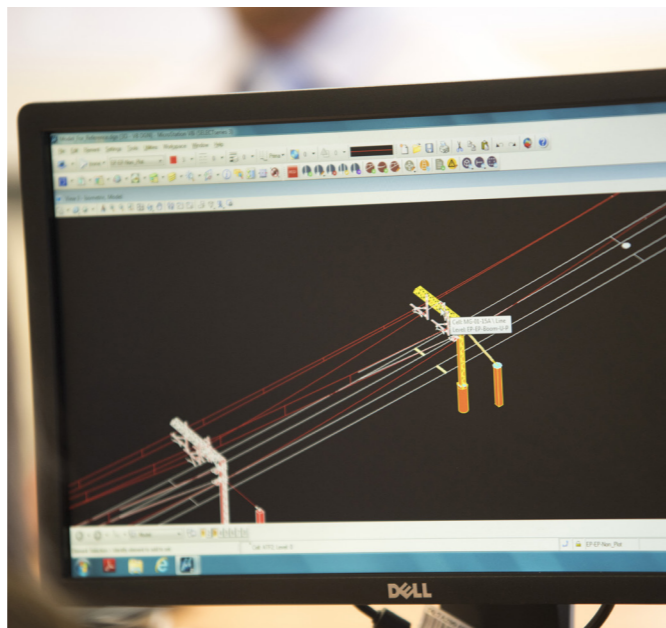
The group's conclusions align with the Hansford Review[12] findings, in that we believe a case can be made for financing and funding digital railway projects, on the basis of transferring risk associated with new technology and the complex interfaces to the private sector.

We recognise that the structure of the industry makes it difficult to fully evaluate and allocate risks: multiple stakeholders, regulations and the separation of train and track all being blockers that need to be overcome. For this reason we believe it is not a one size fits all solution that is required and that only certain schemes will be suited to private investment.

In many cases, project risks will be so significant (either to individual projects or to the rail network overall) that they will need to be retained by the system operator and backed by government. Longer franchises may also be required to achieve investment paybacks, with funding underwritten by forecast revenue flows.

Pathfinder projects to prove that cost effective private sector investment can be unlocked are critical if we are to make progress. Some advances are already being made in this area, for example, the development of the East-West Rail central section Design, Build, Fund, Operate, Maintain (DBFOM) concession.

On a much smaller scale, the Network Rail / Resonate, year-long trial of the 'Luminate'[13] Traffic Management System is seen as welcome commercial innovation. Installation and operation costs of an improved traffic management system are being carried by Resonate, with benefits being shared between Resonate and Network Rail.

Forward thinking partnerships and financing mechanisms such as these are welcome and should continue to be explored and pursued where the opportunity arises.

3. Skills need to be ready at the right time

The UK rail sector employs around 87,000 people[14]. That number is expected to increase dramatically: HS2 alone will create around an additional 25,000 jobs during construction.

The skill level of those working in the industry will also need to increase. In relation to Digital Railway, workers will of course need to be fully trained in how to manage the technology. The majority of construction workers have level 2 skills, yet more advanced skills will increasingly be required. For example, HS2, estimate that 50% of the HS2 workforce will require skills at, or above, Level 3[15] (equivalent to A level or advanced apprenticeship): 80% of the current UK construction workforce only train to Level 2. A similar shift in skills will be required in the national rail workforce over the coming decade.

Not only will they need to be more highly skilled: workers will also need to be multi-skilled to succeed in the industry. In rail vehicle and signalling engineering for example, people will need a mixture of analytical and vocational skills, combining a strong grasp of engineering principles together with digital skills, such as internet-based protocols and telecommunications networks, to join the infrastructure and the operational railway together. On top of these skills, a culture of continuous improvement will be crucial to ensure that workers stay on top of fast-evolving technology.

The rail industry is in competition for skills with many other sectors, for example the nuclear industry with its £48bn investment, and the automotive and aerospace industries, both of which have higher-tech images which may appeal to those with the exactly the skills the rail industry needs.

The next decade will be critical in delivering the skilled workforce to manage railway innovation and capability as the market continues to grow and demand for high-tech engineering jobs increases. The Government have committed, through their Transport Infrastructure Skills Strategy[16], to 20,000 apprenticeships in rail by 2020.

While we welcome the use of immersive new technology that is being used to recruit railway workers of the future by the National College for High Speed Rail and HS2, and the Digital Railway training being offered by the National Training Academy for Rail, more needs to be done, and faster.

At Balfour Beatty, we are actively responding to this challenge. In 2016 we acquired Omnicom Engineering Ltd. to further strengthen our digital engineering capability and we are actively growing our export sales to develop our digital capability in railway asset management.

We are also proud members of The 5% Club, an initiative established by our Group CEO, Leo Quinn, which commits our business to having 5% of our workforce in apprentice or graduate roles. Investing in graduate and apprentice programmes, as well as sponsoring school initiatives to attract new talent, is essential to build a sustainable talent pool.

We need to get the message out there that, with so many exciting projects underway using cutting edge technology, now is an ideal time to start a career in the rail industry.

[10] DfT, Report of the Bowe Review into the planning of Network Rail's Enhancements Programme 2014-2019, November 2015

[11] HMG, The Shaw Report: The future shape and Financing of Network Rail, March 2016

[12] https://thehansfordreview.co.uk

[13] http://www.resonate.tech/UI/Content/Content.aspx?ID=60
[14] hhttps://www.gov.uk/government/speeches/women-in-rail

[15] HS2 Ltd commercial director, Beth West, Rail Technology Magazine, April 2016
[16] DfT, Transport infrastructure skills strategy: building sustainable skills, January 2016

Conclusion

Digital Railway will be transformative, bringing the UK's railways into the 21st century. However, making it a reality calls for a shake-up of the industry and the way it does business. To deliver the promised increased capacity and reliability, all elements of the railway system also need to be considered and integrated. This will require both robust planning and coordination; and of course, funding. Above all, the new approach will have to be more collaborative and more inclusive.

Although the challenges are significant, the potential prize is great. The industry must come together to unlock the benefits of the Digital Railway and Balfour Beatty is committed to making this happen.

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