Transport Infrastructure Efficiency Strategy

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Contents

Foreword

Secretary of State,
Department for Transport

I am delighted to introduce the Transport Infrastructure Efficiency Strategy. My goal as Transport Secretary is to see the Department for Transport and its arm's length bodies put transport users at the forefront of their operations. If we are to succeed, we must pursue efficiency – making sure that transport users get the best possible return on every pound we spend on our transport networks.

So it's right that Crossrail, Highways England, High Speed Two Ltd, Network Rail, Transport for London and the Department for Transport have collaborated on this Strategy. It pools the vast experience of each of these bodies in delivering transport improvements and sets out clear recommendations for improving investment return. I am also pleased that the Strategy takes into account findings from other sectors including energy, water, oil and gas.

The Strategy's recommendations are presented as seven challenges to the transport industry. They call for greater consideration of strategic trade-offs; setting up projects to deliver better outcomes for transport users; benchmarking; more robust estimating in projects; collaboration with industry enabling greater innovation; the use of new technology; and adoption of modern methods of construction. Underpinning this, and linking to our Transport Infrastructure Skills Strategy, we also need to continue our concerted effort to invest in skills and capability.

It is now for the transport industry to rise to these challenges. As well as making taxpayers' money go further, they will also have additional benefits, such as a reduction in carbon, improvements in safety and enhanced supply chain productivity.

That's why I have asked Andrew Wolstenholme to Chair the Transport Infrastructure Efficiency Taskforce, which will support each of the bodies involved with implementing their own responses to the Strategy.

I am grateful to those who have shaped this Strategy, including the transport industry, subject-matter experts and academics and I commend the Strategy's vital findings to everyone involved in transport planning and spending.

Chris Grayling
Secretary of State for Transport

> ***If we are to succeed, we must pursue efficiency –*** *making sure that transport users get the best possible return on every pound we spend on our transport networks*

Foreword

Chair of the Transport Infrastructure Efficiency Taskforce

I am privileged to introduce the Transport Infrastructure Efficiency Strategy as the chair of the implementation Taskforce. I am delighted that Crossrail, Highways England, High Sped Two Ltd, Network Rail, Transport for London and the Department for Transport have come together to collaborate on this document.

Transport is one of the most exciting industries in Britain today. The mix of new cutting edge, world class transport solutions and the challenge of maintaining some of the oldest railways and roads demands that the transport bodies that make up the DfT family are high-achieving and well-functioning ones. It is my belief that the best organisations are also the ones that have clear plans to drive efficiency.

It is also clear that in a world where the pace of technology and innovation are influencing how people, businesses and communities interact and rely upon transport, that this is a time of change. That is why there is no better time for us to publish this Strategy.

In developing the Strategy, we have tried to ensure that the recommendations we are making in response to the identified challenges are clear and will be effective at driving change. We have also focused on activities that we believe will push the efficiency frontier within the transport sector.

In this Strategy we have focused on actions and activities that will drive change. We have looked at how we can collaborate across transport bodies and central government to deliver a step change in the way we drive out efficiencies from our investment programmes. We believe these activities will push the efficiency frontier within the transport sector.

Our work has also reconfirmed long-held views by academics and experts that inefficiency and cost are built into projects at the earliest stages of development. If we are to push the efficiency frontier in transport infrastructure, we have to seize the opportunity to work with industry to look at the opportunities to do things differently at all stages in the investment life cycle.

When we first started working on the Strategy we set ourselves the modest ambition of sharing lessons learnt and case studies from how we invest in transport infrastructure. Having done that, we have now set ourselves seven key challenges. Responding to these challenges will also support the Construction Leadership Council and wider construction sector to deliver better productivity by aligning incentives and ambitions between clients and the supply chain.

Andrew Wolstenholme
Chair of the Transport Infrastructure Efficiency Taskforce

> ***…there is no better time for us to publish this Strategy***

Back to start Next section

Executive summary

Transport matters. It connects people and businesses and allows society and the economy to thrive. Transport infrastructure is being used more than ever before and to keep pace with growing demand, investment is trebling. Ultimately, investment in transport infrastructure will drive growth and productivity across the UK and directly supports the National Infrastructure Commission's priorities[i] for roads, connected cities, as well as a myriad of wider benefits demanded by infrastructure users.

Crossrail, Highways England, High Speed Two Ltd (HS2 Ltd), Network Rail, Transport for London (TfL) and the Department for Transport (DfT) are committed to delivering world class transport infrastructure that supports economic growth and maximises value for money for taxpayers, passengers and road users. Each organisation has ambitious targets, including for efficiency. The Transport Infrastructure Efficiency Strategy (TIES) complements existing efficiency targets and business plans. As well as efficiency, the TIES supports wider business objectives like boosting supply chain productivity, adopting new methods of construction to reduce project delivery time and reducing carbon emissions.

The TIES presents examples of efficiency initiatives that offer scalable opportunities. Drawing on examples from across transport and other sectors, including energy, water, oil and gas and defence. The TIES considers the findings from previous reports that have looked at transport, infrastructure and construction, to identify how these could be applied to help boost productivity and drive efficiency. The Government's wider agenda to harness the spending power of publicly funded infrastructure to boost productivity in the supply chain is also supported by the TIES.

This strategy will also support the objectives of the Government's Industrial Strategy to increase innovation, develop skills, grow business and drive productivity and earning power across the UK; ensuring that for publicly funded infrastructure these wider interests are taken into account at the earliest stages and highest levels of decision-making.

Through this Strategy, Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT are also pledging to support the vision and leadership of the Construction Leadership Council (CLC) to transform productivity within the construction sector. The Construction Sector Deal, which the CLC have spearheaded, aims to achieve a 33% reduction in whole life costs, a 50% reduction in project time, a 50% reduction in carbon emissions and a 50% reduction in the trade gap from built assets[ii].

The seven challenges identified in TIES focus on different aspects of the investment life cycle for infrastructure delivery. Addressing these seven challenges will support Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT to deliver their individual efficiency targets and support the CLC in achieving theirs within the construction sector.

Back to start Previous section Next section

Our Strategy has seven core challenges which we address to deliver efficiencies

1 Judge strategic choice and trade-offs

— based on whole life costs and wider benefits.

Investment decisions need to be based on the value of whole life cycle costs and benefits including consideration of broader outcomes such as building skills and capacity within the supply chain, innovation, regional re-balancing and clean growth. Advice to Ministers, investment boards and sponsors should enable them to judge strategic choices and trade-offs within investment programmes. By providing whole life cost information, more effective decisions can be made about how to balance short and long-term trade-offs, including disruption to our transport network. To underpin this, transport bodies need to harness knowledge about underpinning asset bases to improve asset management.

2 Improve the way we set up our projects

— to maximise value and prevent inefficiency throughout delivery.

Projects must have clear objectives, defined sponsor remits, defined delivery structures and the capabilities needed for clear governance if inefficiency during the later design and construction stages is to be avoided. Greater consistency and a higher degree of assurance needs to be provided to governance boards at initiation stage about how projects will be managed to cost and time, whilst securing defined outcomes. Building internal capabilities within transport bodies around sponsorship, intelligent clienting, commercial and risk management and project delivery are crucial. As is empowering sponsors and clients to challenge and be accountable for the successful delivery of projects. The Government will also continue to support a system of independent economic regulation, recognising the role this plays in driving efficiency.

3 Create a transport infrastructure performance benchmarking forum

— to share best practice and innovation.

Investment decisions need to be informed by high-quality performance data from similar, comparable domestic and global projects. Accurate and complete project performance information provides better assurance of what projects are likely to cost and helps identify drivers of cost in individual projects, which in turn can highlight best practice and drive innovation.

4 Establish a common approach

— to estimating to improve cost confidence and assurance.

Cost estimates are a critical input into effective decision making. Sponsors need an approach to estimating that enables them to make value-driven decisions, balance trade-offs and risks and enable them to manage projects to cost. Robust and consistent estimates will better facilitate this. Equally, estimators need to be able to draw on a range of benchmarking techniques to produce robust estimated 'should costs'. To drive change and create a culture of cost-led design, capability in estimating and cost planning services needs to be a priority.

5 Promote long-term, collaborative relationships

— with industry to reduce transaction costs in procurement and maximise innovation.

The way that transport bodies are set up to engage with the supply chain defines how suppliers subsequently structure themselves for delivery. Shifting practices away from asset-focused transactional contracts towards collaborative approaches, such as alliancing, will require effort and commitment. Transport bodies can support the supply chain to maximise innovation opportunities and greater productivity through delivery models that promote early collaboration, align incentives, offer strong leadership and are characterised by more effective management of risk. The structure of the supply chain will also impact on aspects of delivery like bid, transaction and overhead costs, which occur at each level of the supply chain and are ultimately paid for by the client.

6 Challenge standards

— to enable innovation and drive efficiencies.

The safety of the transport users and those who work on the infrastructure is paramount and standards help us achieve this. Standards provide a framework and the ability to manage safety and technical risks in the design, construction and operation of transport infrastructure. Standards prevent short-term imperatives from resulting in longer-term operational cost or unacceptable asset performance. However, whilst standards must address our core statutory, regulatory and performance requirements, they should not stifle innovation or efficiency. The supply chain should be supported to develop new solutions and not held back in terms of innovation by historical norms.

7 Exploit digital technologies and standardise our assets

— to enable the adoption of best practice from the manufacturing sector, such as off-site construction.

Digital technology and lessons from manufacturing present considerable opportunities to industry to innovate, invest and upskill in order to boost productivity. Suppliers need to be supported and incentivised to accelerate the use and application of Building Information Modelling (BIM) and digital technology in the design and project delivery of transport infrastructure. Digital tools will enable a more extensive adoption of modern construction methods, such as off-site construction and standardisation of assets, which will unlock industrial capacity across the UK.

Back to start Previous section Next section

Collaboration across transport bodies

Successfully addressing these seven challenges will better enable Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT to meet efficiency targets. It will also increase the certainty offered to the supply chain about how transport bodies want their infrastructure to be delivered. This certainty will enable suppliers to take a longer-term view and be confident to invest in new methods of construction, technologies and skills across the UK.

One of the biggest risks to modernising the way transport infrastructure is delivered will be overcoming status quo behaviours and creating capacity and capability. That is why these seven challenges are linked to specific activities that can drive change. Addressing these challenges will require collaboration between and individual action within, each transport body. This is not the first time that we transport bodies have collaborated. We have worked together to support the Transport Investment Strategy[iii] and Transport Infrastructure Skills Strategy[iv]. This is, however, the first time we have reviewed our collective spending power to drive efficiencies and productivity.

This Strategy is aimed at wider Government and other public institutions who work alongside us to meet the expectations of transport users and which often sponsor infrastructure projects, as well as partners in industry. In developing this Strategy, the advice received from industry, subject matter experts and, above all, the people who work in the transport bodies has been invaluable. These contributions have helped to develop and test the practicality, ambition and credibility of the seven challenges and supporting activities. The Strategy has also benefited from the counsel of an Independent Challenge Panel, which has provided insight and experience to help anticipate evolution and change in infrastructure, the supply chain and the expectations of transport users.

Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT have already begun the on-going work to tackle the challenges in this Strategy. Delivering change will not be a one-off endeavour; it will be a rolling programme that adds to and enhances individual organisational efficiency plans. A delivery taskforce has been established to coordinate implementation, which Andrew Wolstenholme will chair.

Andrew Wolstenholme
Chief Executive Officer

Jonathan Moor
Director General

Jim O'Sullivan
Chief Executive Officer

Mark Thurston
Chief Executive Officer

Mark Carne
Chief Executive Officer

Mike Brown
Commissioner

Mathew Duncan
Finance Director

Kamal Patel
Director – Corporate Finance

Vanessa Howlison
Chief Financial Officer

Steve Allen
Chief Financial Officer

Jeremy Westlake
Chief Financial Officer

Simon Adams
Head of Commercial for Crossrail 2

David Hughes
Director of Strategy and Network Development

Back to start Previous section Next section

Why develop a Transport Infrastructure Efficiency Strategy?

Crossrail, Highways England, High Speed Two Ltd (HS2 Ltd), Network Rail, Transport for London (TfL) and the Department for Transport (DfT) already have efficiency plans and targets in place. However, the coming year will witness a wave of transport infrastructure projects completed or committed to and ground work will be undertaken to set future financial settlements. To maximise the opportunities to drive efficiency in these new projects, in the short and long-term, we will learn from each other's experiences and collaborate with our shared supply chain.

This strategy will support the delivery of efficiency in infrastructure projects by:

- identifying key challenges we face in being able to drive greater efficiency throughout the design, build and operations of our infrastructure
- setting out practical recommendations and activities to respond to these challenges
- identifying where we need to build our capabilities
- providing case studies demonstrating activities we can replicate or scale up to improve efficiency
- providing a basis for collaboration and shared learning
- setting clear commitments to encourage and reward investment in innovation, skills, capacity and capability building throughout the transport infrastructure supply chain

The TIES will support Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT to deliver the same or greater beneficial outcomes for less cost. Efficiency is key to ensuring Value for Money[v] for taxpayers and being able to describe how we are delivering efficiencies provides confidence to the public and Government that our costs are under control and that our investments will keep pace with what passengers and transport users want.

This Strategy targets key stages in the asset investment life cycle where we can best influence decisions to deliver greater efficiency savings. As figure 1 shows, TIES targets opportunities during project initiation to drive greater efficiency and, in doing so, higher productivity in the supply chain.

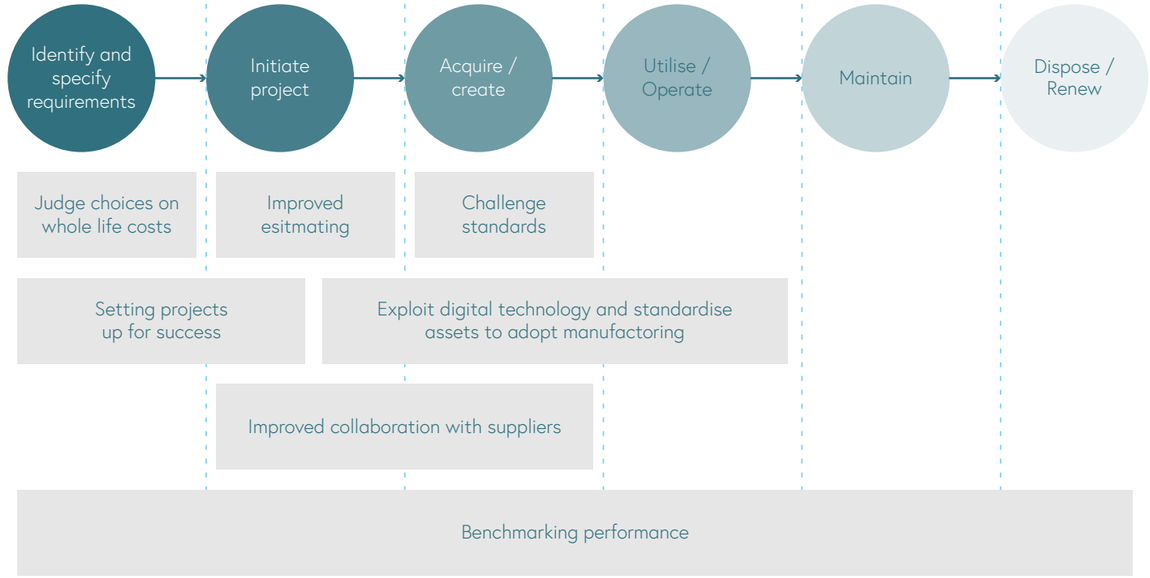


Figure 1: Investment life cycle and challenges to improve efficiency.

The greatest opportunities for us to drive efficiency are during the early stages of investment planning. That is why the seven challenges in the TIES concentrate on early stages: requirement setting, project initiation, procurement and commercial delivery models and design.

Birmingham New Street Rail Station

Back to start Previous section Next section

Infrastructure Investment Milestones in 2017-18

Opening of the Elizabeth Line, after £14.8bn investment over nine years by the Crossrail Programme, supporting regeneration in London and adding £42bn to the economy.

Following the announcement that £48bn will be made available for rail between 2019 and 2024, Network Rail will set out its draft plans about how it will invest in Control Period 6.

The roll out of the Mayor of London's Transport Strategy to upgrade and improve existing services, improve accessibility through strep-free access schemes, provide new services and harness technology to improve the passenger experience.

The agreement of Highways England's Road Investment Strategy 2 which will build on the largest investment in road improvements for a generation.

The start of construction for Phase One of High Speed Two and commencement of the parliamentary process for Phase Two.


Crossrail station in Canary Wharf

The wider economic benefits of transport, which are described in the Transport Investment Strategy, are well understood. Investment in transport delivers significant economic returns and has a "major bearing on how productive we are as a nation"[vi]. These wider benefits are not explored in detail in the TIES. Instead, this strategy argues that harnessing the influence and spending power of client organisations can support a transformation in the productivity of the transport infrastructure supply chain, especially in construction.

Productivity in the construction sector globally has lagged behind other sectors for the last 20 years[vii]. The ability of Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT to deliver long term continuous efficiency will rely on our ability to support our construction supply chain to transform its productivity. Especially in capabilities like digitalisation and lean manufacturing methods. That is why the supporting activities in the TIES target areas should stimulate growth, as well as investment in skills and innovation, in our supply chain.

The construction industry recognises the challenge of 'Modernise or Die'[viii] (as described in the Farmer report). In response to industry, the Construction Leadership Council (CLC) has developed a strategy to drive digitalisation, manufacturing approaches and greater performance in construction. The CLC has ambitious targets to deliver built assets for 33% less cost (covering initial and whole life costs), reduce project time by 50%, reduce carbon emissions by 50% and reduce the trade gap by 50% by 2025. Through the TIES, Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT will support and contribute towards these ambitions.

Collectively, Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT, are one of the biggest client groups of the construction sector. The pipeline of planned transport projects presents a significant opportunity to catalyse transformation in the supply chain.

Construction Leadership Council

33% Lower costs

50% Faster delivery

50% Lower emissions

50% Improvement in exports

Learning from our efficiency programmes

Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT have already delivered significant efficiency savings. This chapter illustrates some examples of the ways we have prepared for and achieved efficiencies in capital projects in recent years and draws out lessons that have informed the seven core challenges in this strategy.

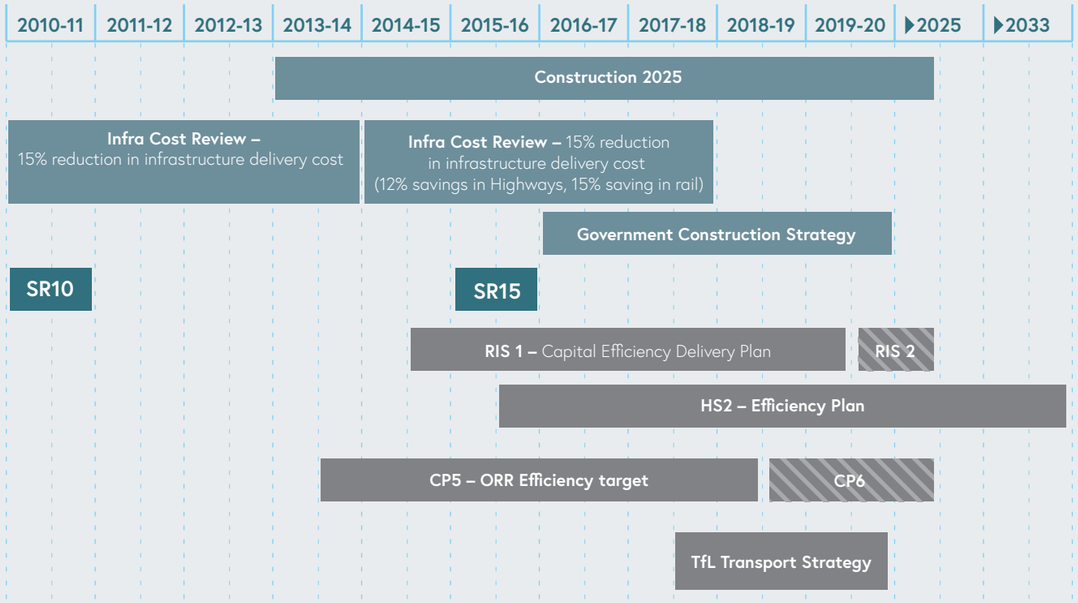


Figure 2: Transport Body Efficiency Plans over SR10 and SR15.

Robust estimating to drive efficiency

The costs of Crossrail escalated by almost £2bn in 2009. To bring costs back under control, the sponsors reviewed project estimates and took a strategic decision to extend the schedule by one year to reduce the additional financial risk that an earlier completion date created.

The project estimates were refreshed and used to align scope, cost, schedule and risk, set a control baseline and identify efficiencies. New governance boards and project controls were set up to actively review and scrutinise costs. These actions will result in Crossrail opening in 2018 at under £15bn, £1bn less than initially planned for in 2007.

In addition, Crossrail adopted lessons from other major schemes like Heathrow and the London Olympics in 2012, to develop a collaborative relationship with its supply chain. This has optimised value engineering opportunities and driven performance improvements. Crossrail is the latest in a line of projects that offer lessons to other organisations about effective ways to drive efficiency.

Crossrail has established an innovation programme and learning legacy programme to share learning. This has provided the basis for the Infrastructure Industry Innovation Platform (i3P) and Major Projects Association Knowledge Hub.

Crossrail

Supply chain collaboration and innovation

Highways England are working to deliver £1.2bn of efficiency savings in their Road Investment Strategy (RIS), which spans 2015-2020[ix]. This programme represents a step change in the way investment is planned and delivered. The RIS has also provided funding certainty which has supported investment in innovations that deliver greater whole life value and collaboration with the supply chain.

Smart Motorways Programme (SMP) has seen Highways England invest around a quarter of its £12bn budget to deliver better outcomes by standardising assets, embracing innovation and working collaboratively with the supply chain to reduce time and cost. By adopting standardisation, Highways England were able to use Building Information Modelling (BIM) to manage out design 'clashes' and optimise logistics management. Highways England have also delivered these upgrades via a 12 hour rotating shift pattern to minimise disruption to road users. The SMP delivered £21m in savings in its first year.

There are other examples of innovations that complement bigger initiatives including a new approach to road markings, which has delivered £9m of efficiency savings in the first year by drawing on new materials (in this case thermoplastic as an alternative to traditional screed lining). New materials have enabled increased output per shift and doubled the lifespan of the road markings. Another has been the adoption of technology to enable in-situ recycling of road surfaces. This approach enables greater efficiency savings in road resurfacing, with reduced waste to landfill, delivering savings of £8m a year.

highways england

Use of benchmarking to drive design to cost and supply chain efficiency

High Speed 2 Ltd (HS2 Ltd) is in the early stages of project delivery but is already using benchmarking to develop and assure its estimates. The setting of project budgets based on this insight is driving a design to cost approach. This includes the early implementation of an innovation programme to reduce cost and encourage the challenge of requirements.

HS2 Ltd have looked at differences in practices of other high speed rail projects. This has helped identify drivers such as supply chain efficiencies and design requirements which could be addressed to deliver efficiencies. HS2 Ltd has used benchmarks at asset level to challenge estimates, resulting in the setting of a more reliable design cost of £65m per route km for Phase 2b (Crewe to Leeds and Manchester).

This has driven a procurement approach which encourages collaboration and longer-term relationships with suppliers, echoing the principles of allianc-ing identified by the Infrastructure Client Group. HS2 Ltd has consulted the supply chain to inform the way contracts will be managed. This has been particularly successful in building skills with a commitment to the National College of High Speed Rail.

Setting up programmes for success

Network Rail (NR) started Control Period 5 (CP5) with an efficiency target of £3.5bn. However, the high-level savings targets will not be fully delivered. Following a re-budgeting exercise, Network Rail now need to deliver £2.3bn of savings, deferments and asset sales to live within the new, tighter, cost ceilings in CP5.

The revised business plan will deliver the following:

- **Improvements in train performance:** £150m
- **Operations and maintenance improvements:** £125m
- **Additional efficiency programme:** £300m
- **Enhancement deferrals:** £400m
- **Deficit qualifying asset sales:** £800m
- **Renewals deferrals:** £500m

To manage cost pressures and support Route Directors, sponsors and clients within the business, the Network Rail Board have appointed an Executive Director to lead the NR transformation and efficiency programme. That programme's aims will directly respond to the challenges set out in TIES, building on the activities included in this strategy to provide a holistic change programme that will ensure transformation and efficiency initiatives are delivered and cost consciousness is embedded across the organisation.

Learning from the way the planning and regulatory settlement was managed for CP5, Network Rail are ensuring that CP6 is planned for and delivered differently.

Transport for London – standardisation driving efficiency savings forward

In 2016 TfL launched a Transformation Programme to drive £4bn of savings and efficiencies through a new operating model, improved procurement and renegotiating contracts.

At least £1bn of these savings and efficiencies will come from capital projects. One initiative that TfL has adopted to achieve these savings is a new procurement model for station stabilisation works. By engaging directly with the lower-tier, smaller companies, TfL is able to use its sizable work bank to support the supply chain in driving improvements in quality and reducing costs through standardisation. TfL's contracting also focused on rewarding suppliers to increase productivity by investing in people and equipment.

The Access Transformation Programme (ATP) improved the way the Underground plans and controls access to its key assets. Through challenging historic practices, a new fit for purpose access regime was developed which improves worksite productivity and maximises efficient and safe use of the railway for all engineering work. This has improved the planned use for engineering projects as well as extensive asset renewal and maintenance activities, without compromising either train or customer service.

As a result of this learning, this Strategy identifies areas of best practice which can be scaled-up across Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT:

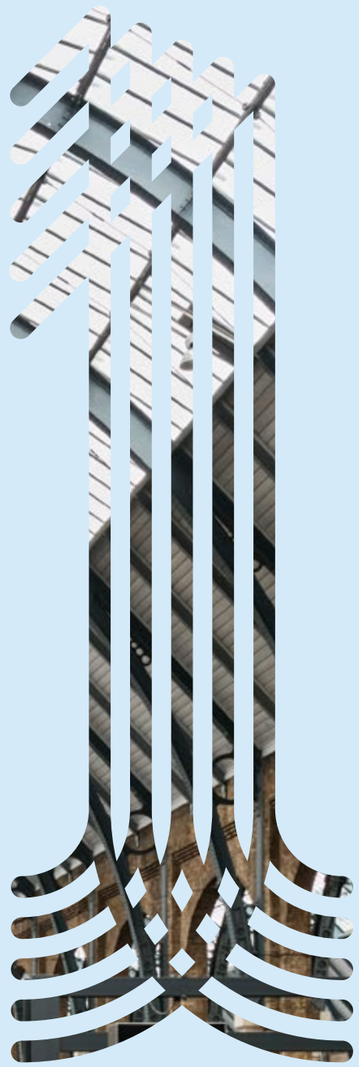
- as TfL has illustrated, greater asset standardisation and better collaboration deeper into the supply chain drives innovation
- the robust approach that Crossrail has taken in estimating and wider project controls has driven efficiencies and reduced risk
- Highways England has shown the innovations that can be delivered with earlier involvement of the supply chain and how keeping standards updated can drive improved performance
- Network Rail has demonstrated the importance of setting-up projects and programmes for success at the outset of a funding period; and
- HS2 Ltd has demonstrated how more reliable estimates can be constructed by using benchmarking information

More broadly, our organisations have significant experience of identifying and delivering efficiency savings, from this we have learnt:

- each organisation has tried different approaches to drive out inefficiencies and we know what can work given our own set of circumstances
- recommendations should range from the high-level strategic choices we make right down to incremental and repeatable innovations
- the information we use to inform outcomes and set up projects have a profound impact on how costs are controlled; and
- projects are more efficient when we support the supply chain to unlock innovation

Taking the lessons from existing efficiency programmes, as well as findings from other reports, the next sections of the Strategy focus on the core challenges.

King's Cross Station



Judge strategic choice and trade-offs

— based on whole life costs and wider benefits.

The Challenge

Investment decisions need to be based on the value of whole life cycle costs and benefits including consideration of broader outcomes such as building skills and capacity within the supply chain, innovation, regional re-balancing and clean growth. Advice to Ministers, investment boards and sponsors needs to enable them to judge strategic choices and trade-offs within portfolios. By providing whole life cost information, more effective decisions can be made about how to balance short and long-term trade-offs, including disruption to our transport network. To underpin this, transport bodies need to harness knowledge about underpinning asset bases to improve asset management capabilities.

Context


HS2 Curzon street station

High-Speed Rail – catalysing growth

When HS2 Ltd was first proposed, a strong case was made that investment in a new London to the North railway would unlock unprecedented benefits, including lifting the economy by over £15bn and providing 400,000 jobs nationally. Despite the scale of opportunity, it has had to challenge the relatively narrow criteria provided under current investment rules in order to make the case to invest in designs that maximise the whole life value of public investment. For similar reasons, it took a long time for the Crossrail programme to get the support it needed to go ahead. The first bill was defeated in Parliament in 1994 and, after a pause in the programme, the second bill took three years to be approved. Earlier hurdles were, in part, because the strategic case was unclear about the wider benefits the railway offered.

Government and transport bodies have been criticised in the past about not judging short and long-term trade-offs to leverage widest social and economic benefits from investment in transport infrastructure[x]. Short termism also hinders the ability of public sector client organisations to manage risk in major investment projects[xi]. In part, this is driven by conventions and processes that see investment decisions assessed against in-year capital budget constraints and commitments to minimise operational disruption.

Each Road Investment Strategy (RIS), Network Rail Control Period (CP), London Transport Strategy and budget for HS2 and Crossrail, are part of a longer-term transport investment strategy. However, it can be difficult to find ways to quantify and articulate the whole life costs and benefits of transport infrastructure investment beyond individual funding settlements.

Lessons from other sectors, including Scottish Power, Anglian Water and the Environment Agency show short-term decision-making can be avoided by adopting a whole life perspective of costs and benefits. Scottish Power has a funding model which supports whole life asset management and enables them to align their project delivery with these outcomes. Those sectors also appraise investments against total expenditure, enabling trade-offs between capital investment and operational costs over time to be considered along with the impact of maintenance regimes on network availability.

This approach has been achieved by investing in understanding the underpinning asset bases, incorporating this knowledge into decision-making processes and building asset management capabilities within their organisations. As transport bodies, Crossrail, Highways England, HS2 Ltd, Network Rail and TfL recognise the opportunity to embrace this approach in the way we plan our investment portfolios. We also recognise the need to grow our own organisational capabilities in order to successfully adopt a whole life perspective for transport assets.


Night resurfacing – A14

A new way of working for Highways England

The asset-led approach to maintenance and delivery will enable Highways England to:

- take direct ownership of the aspects of delivery which are core to performance, which will most directly affect customers and reputation
- take ownership of investment decisions and increase direct knowledge of the asset and the factors which generate waste and inefficiency
- increase its intelligence on local factors that influence where work is needed; and
- create new, collaborative and direct relationships with the supply chain community to identify innovations in planning, scheduling and the methods employed to improve the quality and value for money of these services.

Highways England is rolling out a new asset-led delivery model bringing key asset management capability in-house for the first time in a brand new way of working.

It will see Highways England taking more ownership of investment decisions, increasing its intelligence on local factors that influence where work is needed and taking on board many roles not previously undertaken.

These include network occupancy, scheme identification and decision-making around incidents such as severe weather.

The trade-off between more trains paths in train operator franchises and better access for efficient project delivery

Passengers and train operator franchise revenues both benefit from selling greater access rights so that operators can run more trains. Conversely, infrastructure investment can be delivered more efficiently by granting Network Rail longer possessions to undertake enhancements and renewals. It is therefore important to find an optimal balance between the selling of train paths and the efficient delivery of infrastructure. This strategic choice needs to be supported by reliable analysis and the consequences of the trade-off fully recognised.

The Opportunity

We will review whole life costs and wider social and economic benefits when making investment decisions and ensure they are considered from the very initial stages of policy design. This will provide Ministers and Boards with more insight to judge trade-offs and inform the Government's approach to planning investment programmes. For rail specifically, this will include interdependencies with franchise operators. By October 2018, transport bodies will not only provide the DfT with Business Cases that include whole life value and benefits assessments, but also assessments of the longer-term impact of decisions on economic growth and prosperity. We will also embed best practice from the Routemaps produced by the Infrastructure and Projects Authority, in particular the asset management modules.

We will invest in building our asset management capability and knowledge of our asset base. New infrastructure will routinely embed remote condition monitoring to automate the capture of asset information, but as transport bodies we have some way to go to build a more complete understanding of our older and more diverse assets. Each delivery body has already made a start. In rail, for example, in addition to the work of the regulator, Network Rail's Offering Rail Better Information Services (ORBIS) programme will more accurately anticipate when investment will be required in existing assets. For Network Rail, understanding its asset base will lead to less reactive business and investment planning and will inform discussions about how we plan for the delivery of works to minimise disruption for transport users and reduce the premiums paid for access.

High speed train visual

High Speed Two – investing in asset maintenance

Track is a key component of the rail infrastructure system and has implications for the design, construction, operation, maintenance and performance of the railway system. It is therefore essential that the specified trackform considers the wider asset management factors during the life of the railway.

HS2 Ltd had initially assumed that trackform design would include a mix of ballasted track form and slab track in bored tunnels, due to the implications of constructing and maintaining ballasted track within the confines of these types of tunnels. However, due to the very large number of trains travelling at high speed it was identified that ballasted track would require a more intensive level of maintenance effort to achieve the necessary performance expected during operations than an entirely slab-track option.

The preferred whole life cost option was more expensive upfront but will quickly achieve a positive return on the investment during operations while improving safety and operational benefits and reducing carbon in both construction and subsequent operations and maintenance.

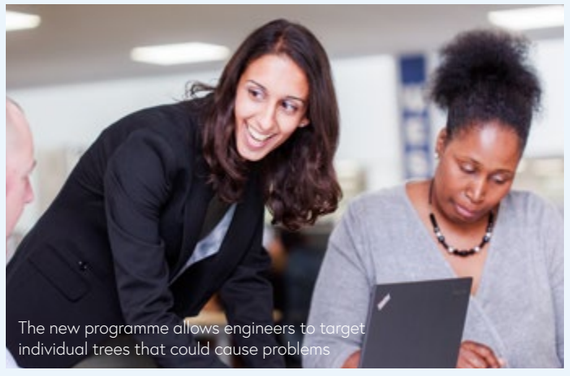
hs2

This £400m transformation programme is delivering new capabilities to the workforce designed to exploit improved asset information about rail infrastructure, enabling Network Rail to move to a predictive maintenance regime based on the usage and condition of its assets.

The ORBIS programme has been developed in collaboration with its customers. This is to ensure they are ready to use new and innovative capabilities, including mobile devices, decision support tools and applications that enable access to high quality asset information. For example, the Geo-Rail Infrastructure Network Model (RINM) has given planners and engineers greater insight on worksites via 140 data layers of railway information accessible from desktop computers.

The adoption of RINM results in more efficient surveys and will deliver £39m of benefits. ORBIS is enabling Network Rail to make quicker, more cost-effective decisions to better manage asset risk and operate a safer, more reliable railway.

NetworkRail



The new programme allows engineers to target individual trees that could cause problems

Digital Asset Management – Offering rail better information services

Improve the way we set up our projects

— to maximise value and prevent inefficiency throughout delivery.

The Challenge

Projects must have clear objectives, defined sponsor remits, defined delivery structures and the capabilities needed for clear governance if inefficiency during the later design and construction stages is to be avoided. Greater consistency and a higher degree of assurance needs to be provided to governance boards at initiation stage about how projects will be managed to cost and time, whilst securing defined outcomes. Building internal capabilities within transport bodies around sponsorship, intelligent clienting, commercial and risk management and project delivery are crucial. As is empowering sponsors and clients to challenge and be accountable for the successful delivery of projects. The Government will also continue to support a system of independent economic regulation, recognising the role this plays in driving efficiency.

Storage containers

Context

The importance of setting up projects for success has been an observation in reviews by the NAO[xii] and IPA[xiii] into project delivery. Best practice guidance is already applied by Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT when setting up transport projects. It is critical to clarify requirements and objectives at the outset of a project to ensure successful outcomes, maintain control of costs and minimise design changes has been highlighted by past experiences. As the Bowe review[xvi] into Network Rail's Control Period 5 highlighted, failure to set proper objectives and responsibilities at initiation stage can lead to poor portfolio and programme governance, low productivity and ultimately increases cost during delivery.

The NAO report on Delivering Major Projects in Government (2016) and the Infrastructure UK Cost Review (2010)[xvii] both noted that projects continued to encounter problems in their early stages – and particularly that projects often publically announced timelines and costs before plans had been properly tested.

Supported by the Infrastructure Client Group, the IPA Routemap addresses these challenges by offering support on strategic decision making during project initiation based on the latest thinking and knowledge acquired from delivery of Major Projects. Through a series of structured exercises, the Routemap enables sponsors and those responsible for project delivery to properly align complexity with the necessary capabilities and plan enhancements to ensure a more successful outcome.

Improving Project Initiation – the IPA Project Initiation Routemap[xv]

> ***Understand the delivery environment you HAVE, then CREATE the one you need***
>
> **Andy Mitchell**
> Chair of the *Infrastructure Client Group*

Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT routinely invest time and resources into creating the structures and processes to effectively govern major projects and programmes. However, we recognise that we can do more to build capability and create a culture which empowers our sponsors. There are examples where we have already tried to do this, including TfL's Sponsorship handbook and Network Rail's guidelines for collaborative working.

We have also looked at the lessons we can apply from large-scale projects like Crossrail and HS2, where there are defined project parameters, delegations and remits for Senior Responsibility Officers (SROs), a focus on benefits realisation and sustained investment in ensuring the right capabilities are in place at the right time. These lessons should be replicated within other projects in our portfolios.

Improving Sponsorship – the TfL Sponsor Capability Improvement Programme (SCIP)

TfL's Sponsor Capability Improvement Programme (SCIP) clarifies a definition of success for sponsors and develops mechanisms to incentivise and measure success. It clarifies the organisation of sponsorship for all TfL activity, with a pan-TfL sponsor community which will ensure best practice and share learning across the organisation. Management systems and processes were developed that reflect the common principles of sponsorship and the organisation and application of those principles in each operating business.

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Another lesson that can be adopted from larger projects is to improve the ability of governing boards to assure successful project delivery. Developing a well understood risk and assurance framework[xvii] will support decision making. HS2 Ltd has adopted the three Lines of Defence (LoD) model of assurance which provides a structured way of controlling a project by having defined procedures (LoD 1) and management oversight, which are subject to internal peer review (LoD 2) and independent review (LoD 3). This allows investment boards to understand the risks faced by a project in a consistent and transparent way.

The Opportunity

We will provide greater assurance that projects are being developed and delivered in ways that achieve intended outcomes and objectives. Within each transport body we will introduce a gateway at project initiation stage to review and agree the outcomes and objectives of specific schemes or portfolios. We aren't trying to harmonise processes or adopt a one size fits all approach to all project and portfolio governance, but we do want to strengthen our ability to advise Ministers and Chief Executives at the start of projects to better judge strategic choices and trade-offs.

We will apply the IPA's project initiation routemap and ensure that all sponsors of major projects, including those in the DfT, have the skills and capability needed to build a culture to effectively challenge performance.

We will do this by:

- issuing remit letters to Senior Responsible Officers (SRO) clarifying their roles and responsibilities
- requiring SROs to embed assurance, such as the 3 Lines of Defence model into projects
- requiring Boards to review and approve the outcomes and objectives of projects at the initiation stage
- requiring Boards to scrutinise project requirements and standards and the skills and capabilities needed by sponsor teams
- ensuring our SROs have the skills and capability they need, we will ensure that they all complete suitable training

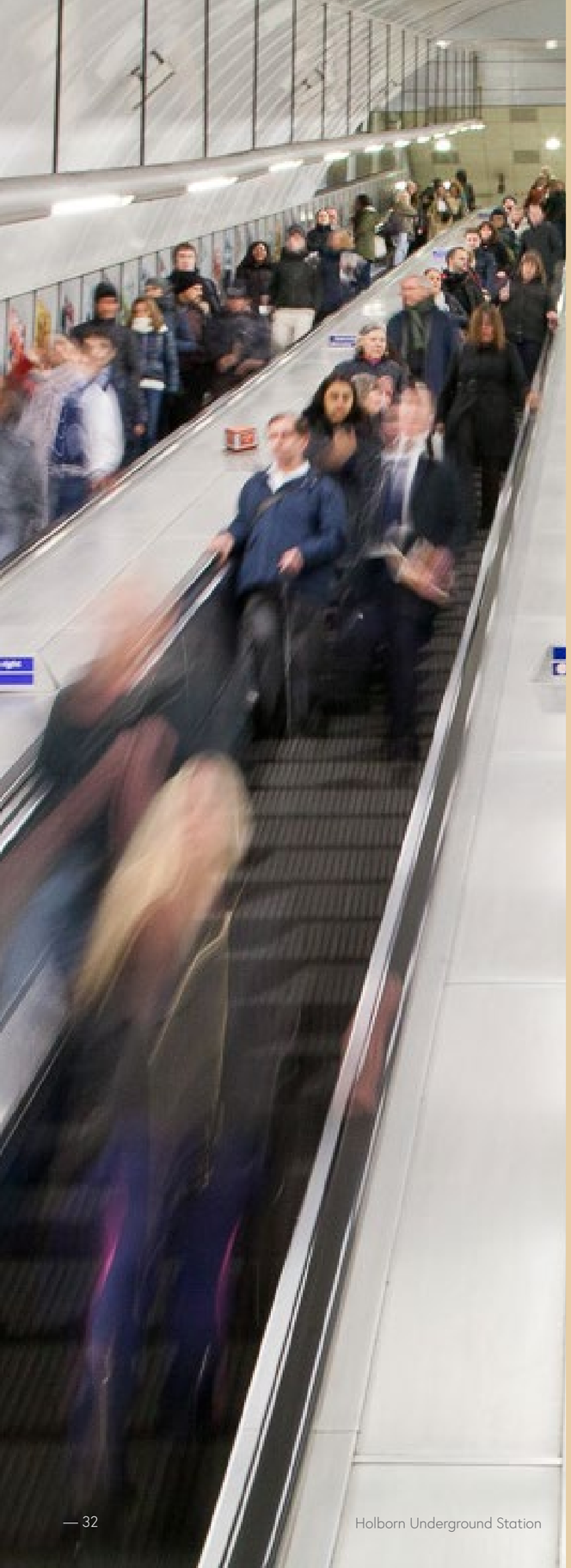
MAJOR PROJECTS KNOWLEDGE HUB
Created by the Major Projects Association

Setting up projects for success – shared learning at Crossrail and HS2 Ltd

When HS2 Ltd was established it looked to Crossrail Ltd and other construction projects like the Thames Tideway Tunnel to inform its programme and approach. Building on the London 2012 (Olympic) Learning Legacy, Crossrail has made the task of setting up major construction projects easier by sharing its learning with others. Opened in February 2016, the Learning Legacy makes accessible a library of information about how the project was established, how construction was planned and how it has been delivered. This has recently been scaled up to support all major projects under the Major Project Association's Knowledge Hub[xix]. HS2 Ltd has benefited from the lessons Crossrail can teach on how to set up a special purpose vehicle to deliver major infrastructure.

Crossrail hs2

Cardinal Place exit – London Underground



Holborn Underground Station

Create a transport infrastructure performance benchmarking forum

— to share best practice and innovation.

The Challenge

Investment decisions need to be informed by high-quality performance data from similar, comparable domestic and global projects. Accurate and complete project performance information provides better assurance of what projects are likely to cost and helps identify drivers of cost in individual projects, which in turn can highlight best practice and drive innovation.

Context

Transport bodies have not fully exploited the insight provided by comparing the performance of previous projects. This process of sharing and comparing is commonly referred to as benchmarking. Other sectors have used benchmarking to drive efficiency targets, but our current approaches to capturing cost and performance data is not systematic and lacks the consistency required to support decision making. More importantly, in transport it is not common to share performance data and there are a lack of systems and consistent processes to facilitate such comparisons between data and information.

A benchmarking tool that supports the comparison of cost, design and delivery approaches, asset performance and captures accurate data can improve transport infrastructure investment decisions. Used effectively, benchmarking will streamline decision making and procurement, help set realistic efficiency targets and track delivery against outcomes. The supply chain routinely benchmarks costs, but the ability of transport bodies to use a similar approach to gather intelligence is less developed. By understanding our historical performance, benchmarking will help decision-makers and sponsors to identify and maximise opportunities for efficiency during the investment planning and project initiation stages. More broadly, benchmarking will also underpin the actions to tackle the other challenges described in this strategy.

Oil rig in the North Sea

The Oil and Gas Performance Forum – driving improved project delivery through collaboration

The Performance Forum was set up in 1994 by companies in the oil and gas industry to provide an independent assessment of cost and performance information. Over 20 years later, the Performance Forum facilitates a standardised way of collecting and analysing data to support companies in making informed decisions that can drive greater value from oil and gas projects.

The Performance Forum does this by providing members with metrics that enable them to:

- produce estimates at the appraisal stage based on technical parameters;
- provide confidence in estimates prior to gate review;
- accurately measure project performance at the end of execution;
- demonstrate competitiveness of project costs and schedule against the industry benchmark;
- present consistent and unbiased comparison between a peer group of companies; and
- identify change in scope, cost and schedule between final investment decisions and start-up

London underground driver

Using Benchmarking to drive operational performance – CoMET and Nova at TfL

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TfL is part of the CoMET and Nova metro benchmarking groups which pool information from 32 cities around the world. In the last five years, TfL has made significant progress in using this information to help target efficiency initiatives in the London Underground. For example, in areas like operating cost recovery ratios (25% improvement), cost per km (12% improvement) and carbon emissions per million passenger km (22% improvement).

Performance benchmarking, used consistently to inform investment decisions and business cases will make the setting of budgets more stable, providing the evidence needed to drive efficiency. This needs the supporting processes, skilled people and an information sharing framework to enable:

- objective assurance of project costs and benefits
- understanding about how different attributes can affect the 'should cost' of projects
- make informed comparisons between projects
- inform project initiation, design, delivery and evaluation processes
- identify opportunities to drive increased efficiency; and
- set and track performance metrics

The Opportunity

We will share data and performance metrics to establish a benchmarking forum between Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT. Benchmarking will provide better 'should cost' and performance information to inform investment decisions. The forum will also enable international comparisons, applying learning from HS2's use of high-level comparisons with international schemes to establish 'should costs' for the phase two of the railway. We will design the forum to support the automation of data capture.

Tunnel contruction

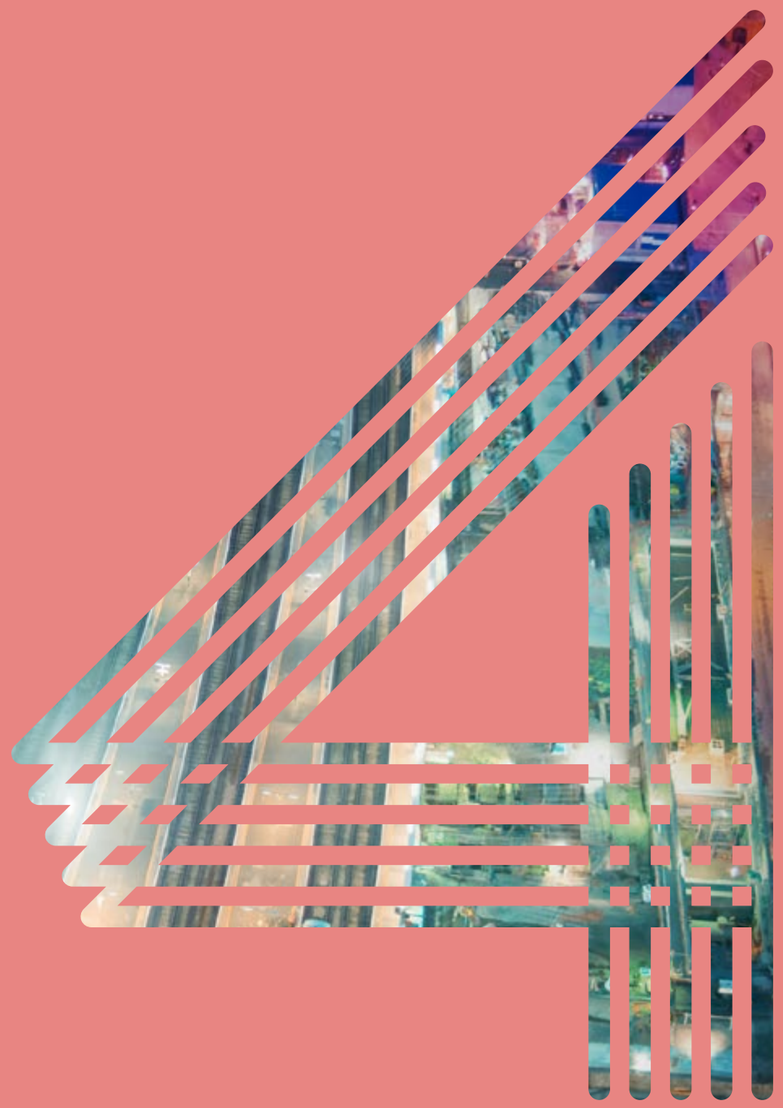
Collaborative Benchmarking – The UK Transport Infrastructure Performance Forum

Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT are exploring how to share data and information to identify opportunities for efficiency, innovation and collaboration. Jointly, the organisations have sponsored a project to establish a way of recording specific high-level metrics which will allow transport bodies to share performance data and deliver greater efficiencies. This has already brought together technical leads to share learning around tunnel construction costs, health and safety and carbon performance. We assume that the proof of concept pilot will improve how we collaborate to improve performance.

We will support our teams to use benchmarking information to drive better quality decision making.

To drive change, each delivery body and DfT will require all assurance and business case templates to include benchmarked information by October 2018.

Gantry installation in Sheffield



Establish a common approach

— to estimating and cost management to improve cost confidence and assurance.

The Challenge

Cost estimates are a critical input into effective decision making. Sponsors need an approach to estimating that enables them to make value-driven decisions, balance trade-offs and risk and enable them to manage projects to cost. Robust and consistent estimates will better facilitate this. Equally, estimators need to be able to draw on a range of benchmarking techniques to produce robust estimated 'should costs'. To drive change and create a culture of cost-led design, capability in estimating and cost planning services need to be priority.

London Bridge Station

Context

Sponsors are required to make decisions at stage gates based on estimates that can be incomplete, not fully understood and insufficiently detailed to provide the basis for constructive challenge. The status quo often results in budgets being set too early in the investment life cycle with unrealistic efficiency targets being retrospectively applied in an effort to bring costs back under control. Better decision making will be driven by a more consistent and better approach to communicating estimates at different stages in an investment's life cycle and improved clarity in how risk is accounted for.

The NAO[xx] has observed that project complexity and the absence of data and effective challenge are key sources of over-optimistic estimates in government projects. As noted by the Institute for Government[xxi] , sponsors need to challenge and understand estimates, especially how risks are being accounted for. This includes understanding the provenance and coverage of the base data used to compile the estimate. Additionally, the approach used to quantify risk, using techniques such as optimism bias, reference class forecasting or quantitative analysis, should be explained to aid transparency.

Project estimates are typically based on the anticipated volumes of work, which may not be fully scoped during early planning of an investment. Each transport body and teams in each body, deal with these assumptions inconsistently. This can lead to misunderstanding, delays in decision making or treating early, single point estimates with a high and unwarranted degree of confidence. Improving the accuracy of our cost forecasts will improve confidence and enable a culture of cost-led design.

Recognising the likely increase in transport investment over the next seven years and the levels of complexity expected in Network Rail's CP6 and Highways England's RIS2, our existing estimating capability is likely to become stretched. The Ministry of Defence (MoD) has recognised the importance of capable project cost assurance, resulting in the establishment of the Cost Advisory and Assurance Service (CAAS) team, which reviews all Equipment and Support investments.

British Frigate Ship

MOD Defence Equipment and Support Cost Assurance and Analysis Service – becoming an expert client

The Cost Assurance and Analysis Service (CAAS), part of Defence Equipment and Support (DE&S) organisation, provides cost management support to all key MOD projects. Many of these skills are used in non-competitive supplier procurement where both estimating and negotiation skills are key to achieving value for money. Their approach relies heavily on documented processes and the Association of Cost Engineers (ACE).

DE&S have identified CAAS as being a key enabler to providing reliable cost estimates for major projects.

Crossrail and Highways England both place estimates at the centre of control frameworks, which enables robust assurance of costs. Network Rail, with the introduction of Rail Method of Measurement (RMM) and TfL, with its estimating books, have provided a consistent basis of estimating their schemes. By scaling up these examples and enhancing client-side estimating capability, transport bodies will be better able to engender a 'right first time' culture.

Improving estimating, by enabling better scenario planning, optioneering, a risk estimation and allocation, can be supported by benchmarking and cost data. This will, therefore, reduce the likelihood of having to replan budgets. A more robust approach to estimating will lead to greater certainty in the investment pipeline which benefits the supply chain.

Aerial photograph of TfL's infrastructure

Consistent approaches – TfL's cost estimating books

TfL has developed a suite of 'cost estimating books' which form an essential component of TfL's estimating maturity, benchmarking and cost intelligence. It is mandatory to capture costs at contract award and again at financial close out for repeatable work items. Analysis of projects follows a consistent breakdown structure known as the 'Cost Feedback Structure' and unit costs are reported against defined work items and presented with a full analysis of currently held data, cost elements such as design, preliminaries, etc and the impact of cost drivers (any "factor" that could have an impact on the base cost). An example of a cost factor would be, working in a highly confined site as opposed to a non-confined site, which adds on average 7.5% to the base cost.

Cost data is continuously improving, as further cost analysis becomes available and increased granularity is possible for cost drivers. The cost drivers allow development of cost improvement waterfalls and supporting action plans. A good example of this is the unit cost improvement achieved for ballasted track renewal which shows a 39% improvement against estimate.

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The Opportunity

We will be more consistent across Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT in the way our estimates are constructed, assured and challenged. Within transport bodies, we will apply learning from CAAS and standardise terminology and definitions, provide clear guidance on the expectations at each stage of design development (i.e. when to switch from top-down estimating to detailed bottom-up estimates) and how to make provision for uncertainty in projects. As transport delivery bodies we will consistently apply these guidelines. By October 2018 we will begin embedding common approaches and reinforcing this through the Benchmarking Forum. This will enable easier comparisons between projects, cognisant of design and project maturity, to support sponsors to challenge costs more effectively.

We will use improved estimates and benchmarking information to create a culture of design to cost.

This means producing estimates in a way which is consistent with our cost capture processes and being able to compare forecasts with outturn costs. It also requires us to have the tools and resources to intelligently interpret what these estimates and comparisons tell us, be it differences in complexity or inaccuracies in estimating. This will improve confidence that design is completed within a cost envelope, helping to set targets and improve the control we have around projects.

We will build our estimating and cost planning capability. This includes having skilled estimators and cost planners who can construct consistent estimates. We will work closely with the industry and professional institutions, such as the Royal Institute of Chartered Surveyors and the Institution of Civil Engineering. We will promote the estimating profession and to ensure that the transport bodies can access the right people. This will include reviewing estimating skills requirements and ensuring that transport bodies are able to provide high quality, stable and transparent baseline estimates as well as being able to effectively assure estimates and drive value for money.

Hackney Wick Station – subway installation

Network Rail is due to formally launch the Rail Method of Measurement (RMM) in late 2017. RMM has been written to provide a basis for the elemental cost analysis, measurement and valuation of all costs of a project. These include costs incurred whether they are incurred by the infrastructure owner or the contractor, allowing a Total Cost Management of Projects to be provided.

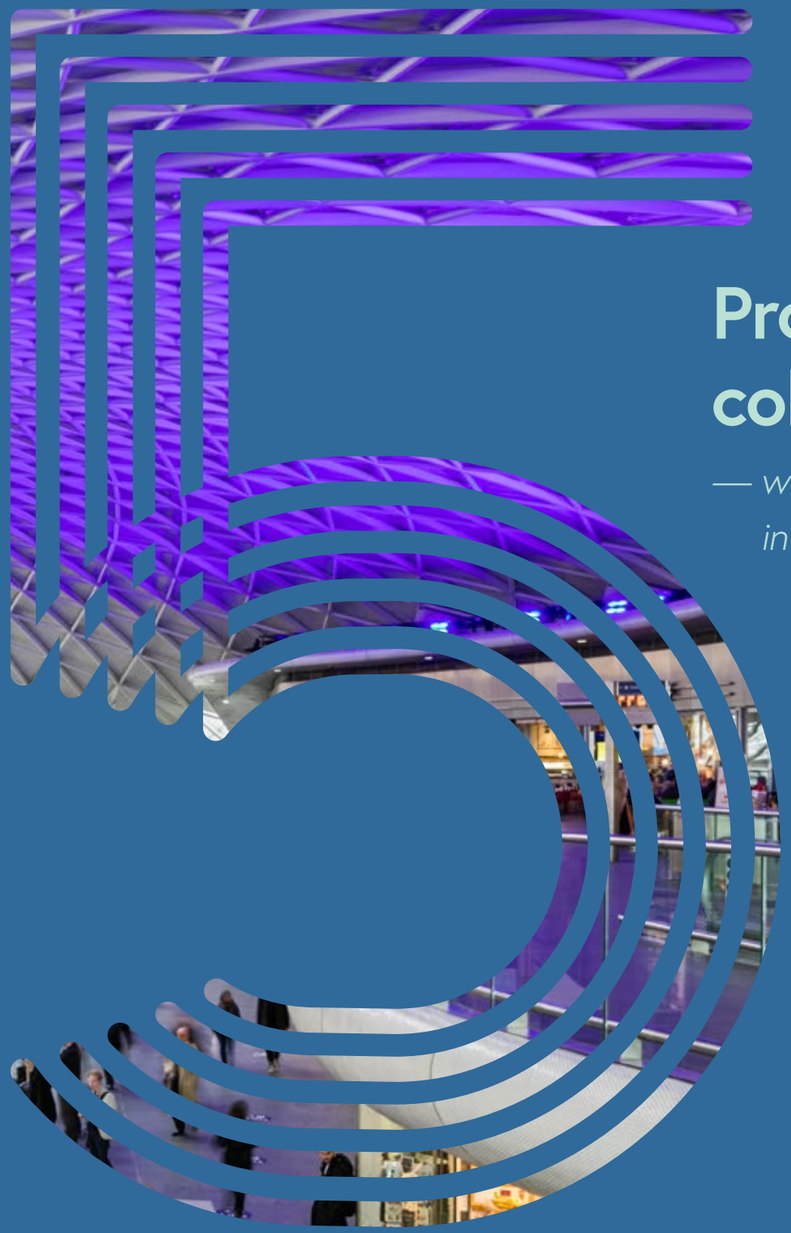
The RMM provides a structure for the consistent preparation of budgets for capital and maintenance works to a railway asset such that there is understanding between all involved as to where cost items are covered, how they should be measured, what they include and if relevant what cost items are not included. This approach builds confidence in the base cost of the estimate.

Rail Method of Measurement (RMM)

NetworkRail

Birmingham New Street Station

King's Cross Station



Promote long-term, collaborative relationships

— with industry to reduce transaction costs in procurement and maximise innovation.

The Challenge

The way that transport bodies are set up to engage with the supply chain defines how suppliers subsequently structure themselves for delivery. Shifting practices away from asset-focused transactional contracts towards collaborative approaches, such as alliancing, will require effort and commitment. Transport bodies can support the supply chain to maximise innovation opportunities and greater productivity through delivery models that promote early collaboration, align incentives, offers strong leadership and are characterised by more effective management of risk. The structure of the supply chain will also impact on aspects of delivery like bid, transaction and overhead costs, which occur at each level of the supply chain and are ultimately paid for by the client.

Context

Traditionally transport bodies have used competitive tendering of contracts as the main and sometimes only, commercial lever to drive efficiency. Typically, contracts will be placed with a first-tier supplier who will directly execute little or none of the work, instead sub-contracting to a selection of specialist second-tier organisations who may engage third-tier suppliers and so on. This practice results in overheads and bid costs being duplicated at each stage of the sub-contracting chain. Joint delivery models that span all tiers of the supply chain can reduce costs and remove duplication, which benefits the client and supply chain.

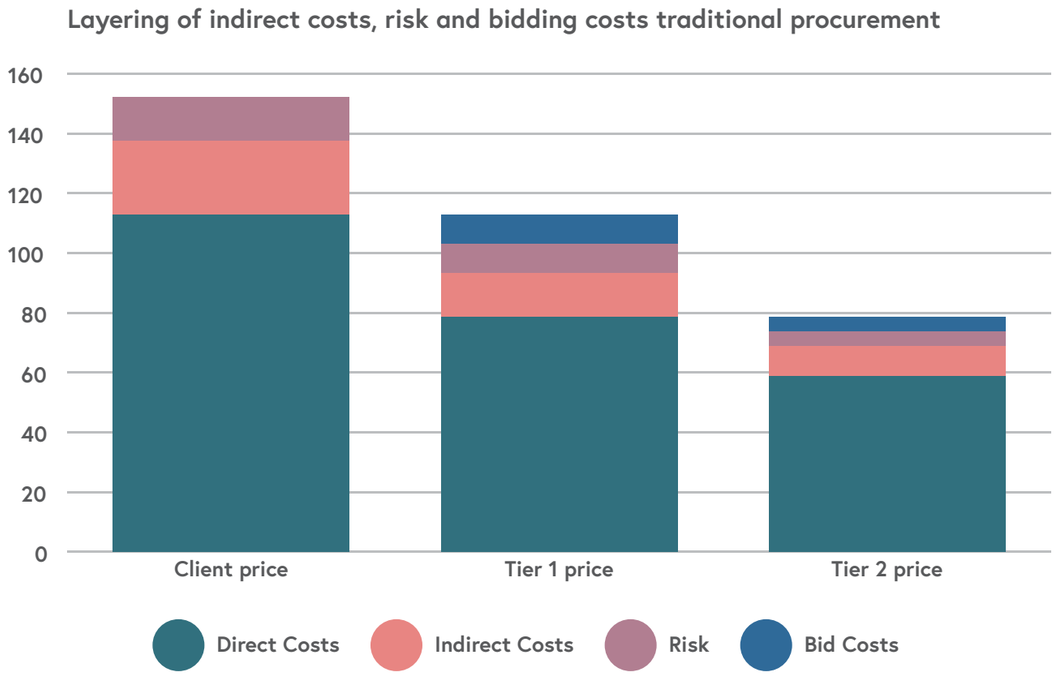


Figure 3: Example of Layered Overheads and Transaction Costs

Industry recognises the opportunity to remove this duplication too. When working with Transport for London, Mace group were able to deliver 18% savings against budget for the Stations Works Improvement Programme on London Underground works through a joint delivery partnership model. In addition to cost savings, this resulted in faster procurement and a more flexible construction scheduling.

Bank Station Upgrade – innovative contractor involvement

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London Underground's Stations and Crossrail Directorate recognise that supply chain innovation has to occur early on in the procurement process in order to derive maximum benefits from such innovation. The principle has led to a new procurement process known as Innovative Contractor Engagement (ICE). ICE is an 'Infrastructure UK' model approach that seeks to maximise the value of supply chain innovations.

The Bank Station Capacity Upgrade Project team led the development of the ICE and pioneered its use to procure the design and build contractor for the project. The current performance indicates a more "effective product" and an efficient delivery method – delivering both faster and cheaper when compared to the original business case.

Benefits include:

- 10% reduction in the estimated final cost
- 23% reduction in closure duration of the Northern Line; and
- more effective step-free access solution direct from street to platform on the Northern and DLR lines.

Suppliers consistently call for greater collaboration in the delivery of projects. Features like early engagement and aligned incentives and objections to drive commercial opportunities are often referenced. Collaborative models like alliancing can address this. Anglian Water's experience has demonstrated how alliancing with a group of suppliers provided greater certainty and resulted in increased confidence amongst industry members to invest in innovation and skills.

Learning about collaboration from Project 13

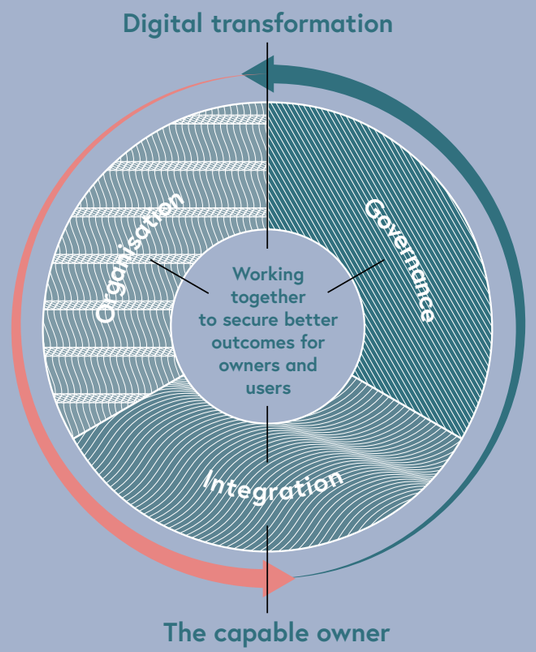
	Simple Collaboration	Integrated functions and relationships	High performing enterprise
Governance	Definition of value agreed by the owner. Long-term relationships with suppliers accepted. Performance targets and reporting agreed.	Value shapes investment programme. Regular reports on supplier performance. Performance reporting integrated with production.	Value at the centre of asset management. Suppliers influencing investment decisions. Performance reporting integrated with asset management.
Organisation	Supply chain strategy in place. Traditional contracts with financial incentives. Core team co-located with common systems.	Key suppliers procured through frameworks. Cost reimbursable contracts with incentives. Single integrated project organisation.	Suppliers working together in clusters. Suppliers' rewards depend on performance. Best candidates for key roles in the integrated organisation.
Integration	Integration defined and integrator in place. Integrated planning and management. Good practice in Health,Safety and Wellbeing (HSW).	Integrated business processes and systems. Production system in place. HSW defines good practice for the construction industry.	Fully integrated programme team with key suppliers contributing. Real-time digitally enabled production systems. HSW defines good practice for UK industry.
Capable Owner	Owner's champion appointed. Owner's functions aligned with delivery team. Plan in place to develop Owner capabilities.	Owner functions integrated with delivery team. Key capabilities in place. Development and succession plans in place.	Owner and suppliers working together to develop investment strategy and next generation improvement plans.
Digital Transformation	Digital Strategy in place Level 2 BIM in use across the programme. Plan for digital delivery in place. Plan for smart infrastructure in place. Value of information recognised.	Suppliers of digital services/ technologies appointed. Consultants' and contractors' business models adapted to the digital environment. Plan for adoption of Level 3 BIM. Information being managed as a resource across the whole 'data estate'.	Suppliers of digital services/ technologies at the core of the programme team. Digital production platform in place. Asset management integrated with delivery. Integrated through-life approach to information in place.

Infrastructure Client Group's Project 13 offers a blue print for successful alliancing

From Transactions to Enterprises, known as Project 13, sets out practical advice for companies to help them "...take ownership of the complexity of their projects and their relationships with their supply chains". Project 13 aims to help project owners use competition in the supply chain more creatively, by creating arrangements that enable the parties to work together to deliver the best possible arrangements for all, instead of chasing lowest initial costs.

The concept revolves around building capability around five key pillars which secure better out comes for owners and users, as shown.

The pioneering work in Anglian Water and the @One Alliance shows what can be achieved when regulator driven targets in shared objectives are used to innovate.



As the IPA has observed, traditional commercial models typically seek to transfer risk from the client to the supplier, irrespective of who is best placed to manage it and focus on delivering a narrowly defined output to cost. Moving towards commercial models which build collaboration and align objectives will make it possible to manage delivery risk more effectively. Collaborative models ensure a shared understanding of a client's requirements and innovation potential is released. In particular, building deeper relationships with small to medium-sized enterprises provides clients with a better understanding of how innovation can drive the right outcomes more efficiently.

The benefits of being more collaborative with the supply chain will benefit the efficiency of transport bodies but it will also support the supply chain to accelerate its own restructuring and boost productivity. Encouraging collaboration between different levels of the supply chain and the structured sharing of best practice and innovation is an area that the Construction Leadership Council have also identified as critical to driving change.

> ***The client may therefore pay for risk twice – once to pay the supply chain for holding or managing the risk and then to bear the actual costs of the risk when its transfer ultimately proves impossible***[xxii]
>
> **Experience from Major Capital Project – IPA**

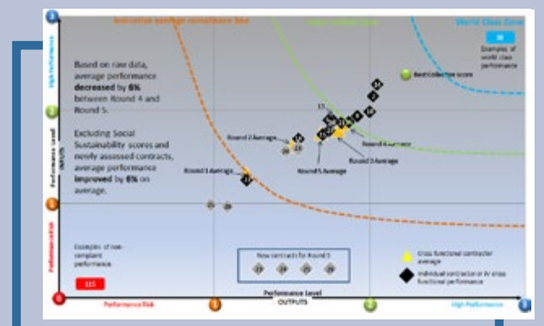
Tunnel construction

Crossrail Performance Assurance – collaborating to drive performance improvement

A key challenge for Crossrail and its stakeholders was to create a mechanism for assuring that main contractors were collectively performing at a level that would enable the programme's strategic objectives to be met, despite the backdrop of changing economic conditions or industry issues such as labour shortages. These include safely delivering a world-class railway on time and on budget, setting a new standard for major project delivery and leaving a legacy of improved supply chain performance within the infrastructure sector.

In response, Crossrail developed a performance assurance framework which spanned six core delivery areas (health & safety, commercial performance, quality, environmental performance, community relations and social sustainability) and used a detailed suite of lead and lag indicators to produce a highly accurate, objective picture of supply chain performance.

The model created additional incentives for the supply chain to outperform the base requirements of the contract by creating a platform to demonstrate performance improvement and world class performance levels. It also allowed the client to intelligently manage the programme using a risk-based approach, stimulated and rewarded innovation, improved collaboration and enabled the sharing of best practice across the programme.



The process underpinned a 48% improvement across programme-critical contracts since its inception in 2012 and has been celebrated by the Crossrail Board and wider industry as the exemplar supply chain performance management model, providing mutual benefits to both the supply chain and Crossrail. This improvement in performance directly correlated to cost and schedule efficiency, with the top performing contracts being approximately 10% more efficient.

Crossrail

St. Pancras International Station

The Opportunity

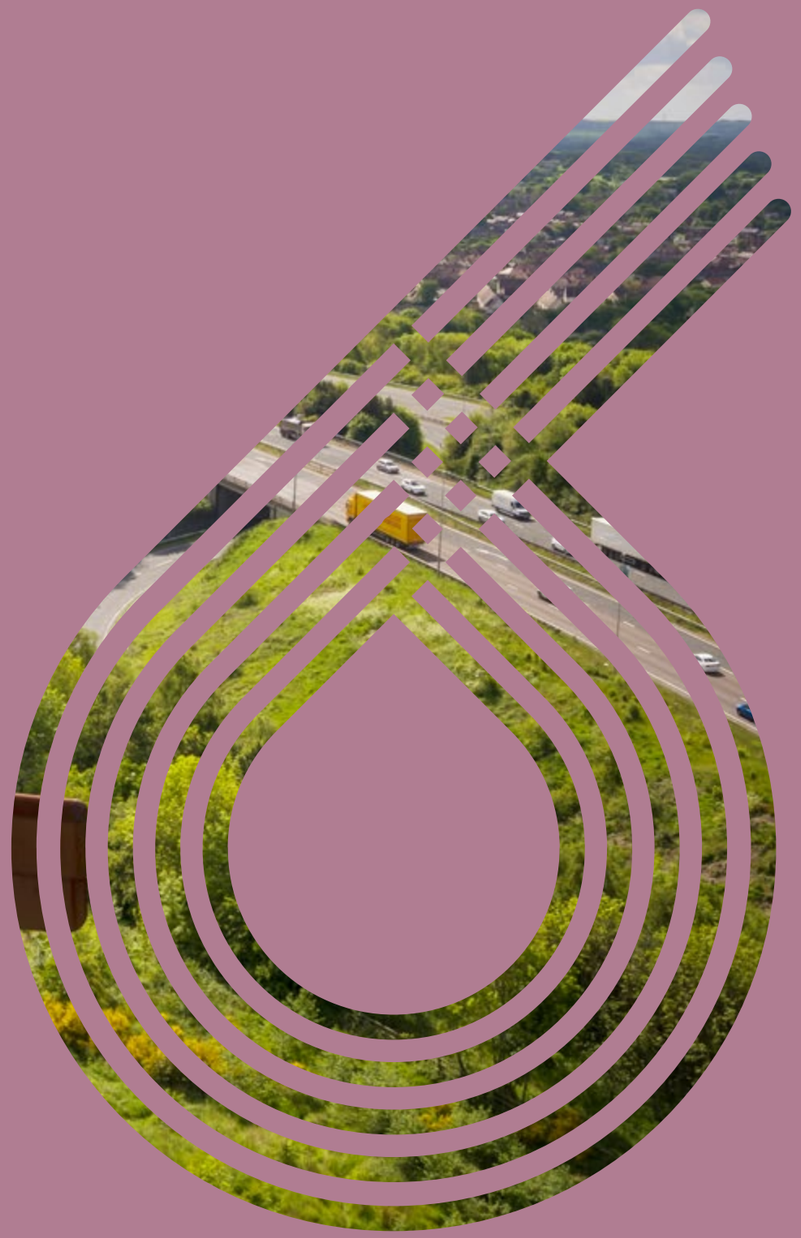
We will choose alliancing, or an approach based on collaboration, as a first resort. This means committing to and improving collaboration between supplier and clients and building capability around the core themes of alliancing. It means engaging design and construction suppliers early and as partners in delivery, maximising the opportunity for clients to articulate their objectives clearly, for the supply chain to advise on technical viability and to innovate and invest in skills, innovation and capital equipment.

We will build on the guidance provided in the Procurement module of Routemap by the IPA[xxiii] which emphasises the need to consider procurement and delivery models early in project initiation. We will initiate projects in a way which addresses the key risks likely to face the project and jointly find ways to mitigate them, rather than simply transferring them into contracts and we will select the right delivery model.

We will use our spending power, procurement levers and pipeline of construction work to support the construction sector in becoming more productive. This includes encouraging modern methods of construction, innovation and sharing best practice. To make it easier for suppliers to work with our organisations and reduce overhead costs, we will also develop shared and consistent procurement processes including standardised design, products, processes, documentation and procedures.

Figure: Key aspects of alliancing

M3 junction Smart Motorway



Challenge standards

— to enable innovation and drive effieciences.

The Challenge

The safety of the transport users and those who work on the infrastructure is paramount and standards help us achieve this. Standards provide a framework and the ability to manage safety and technical risks in the design, construction and operation of transport infrastructure. Standards prevent short-term imperatives from resulting in longer-term operational cost or unacceptable asset performance. However, whilst standards must address our core statutory, regulatory and performance requirements, they should not stifle innovation or efficiency. The supply chain should be supported to develop new solutions and not held back in terms of innovation by historical norms.

Angel of the North near the A1 – Gateshead

Context

Standards can be defined as an agreed, repeatable way of doing business. National and European standards address a significant proportion of infrastructure asset needs, but coverage is not comprehensive. The Industry Standards Group[xxiv] noted that companies overlay their own standards, some of which have evolved over decades and which may not always have kept pace with innovations in the market, organisational priorities or government policy. This has led to bespoke standards and different interpretations of the same standard, which is inherently inefficient.

Smart Motorway M42

Smart Motorway Programme – challenging historic standards

Highways England traditionally increased capacity on the motorway network through widening roads. That approach required the purchase of additional land, the demolition of existing bridges and building of new highway assets. Over the last two decades increased capacity has been increasingly delivered by utilising the existing assets more efficiently. Spanning projects like smoothing traffic flow using variable speed control (from 1995), to operation of the hard shoulder in peak periods (from 2006) and through to permanent all lane running without a hard shoulder (from 2014).

This evolution has changed standards and required the development of new ones based on: extensive stakeholder engagement; the piloting of projects to gather research and safety data; utilisation of new technology; and working with the supply chain to identify innovation opportunities whilst maintaining the safety and operational benefits of the existing network.

All lane running now offers far better value than conventional widening, delivering: lower collision rates; faster and smoother journeys; and the promotion of economic growth and environmental benefits at significantly less cost. This allowed Highways England to improve far more of the network than traditional widening could have achieved with the same investment.

The challenge to standards continues as Highways England identifies further opportunities to extract even more benefits from smart motorways and extend intelligent transport systems to other parts of the strategic roads network.

highways england

The complexity of some standards often makes them difficult to challenge[xxv], leading to disproportionate cost being justified in the name of compliance. This is compounded by a tendency for project teams and contractors alike not to challenge standards because the process for managing derogations may be too complex, time consuming and potentially disruptive to project delivery creating a culture where the status quo prevails.


TfL lift

Challenging lift design at London Underground

In 2017, the Mayor of London announced the biggest boost to step-free access on the Underground in the network's 153 year history by investing £197m over the next five years, requiring greater investment in lifts. London Underground uses two lift suppliers to supply bespoke lifts which meet London Underground Category 1 Standards. Each of these manufacturers has a single preferred installer. In contrast, Network Rail's single low cost lift design is used across the majority of the rail industry and can be bought, essentially off the shelf and installed by numerous organisations across the UK.

In February 2017, the Step Free Access (SFA) study compared the costs of lifts and made a number of recommendations to strengthen the case for challenging non value-add practices, processes and standards within London Underground, including:

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- consider what elements of design could be delivered more efficiently by developing standard designs (e.g. foundations, lift structures, standard material palettes)
- expand its lift supplier base, engage with lower tiered contractors when suitable and review its New Engineering Contract preference
- adopt the low-cost lift specification where feasible
- develop in-house design capabilities including an SFA design manual setting-out core design principles and requirements to ensure a consistent approach to design
- consider at the earliest stages of each project the opportunities to build off-site
- consider batching up similar schemes

Currently, there is little incentive to challenge requirements and seek agreement to derogations or the adoption of innovation that doesn't have an immediate benefit for their current project but which could deliver a legacy for adoption in future projects. Knowledge sharing across transport bodies can nurture early challenge proposals to implement them later in the project pipeline.

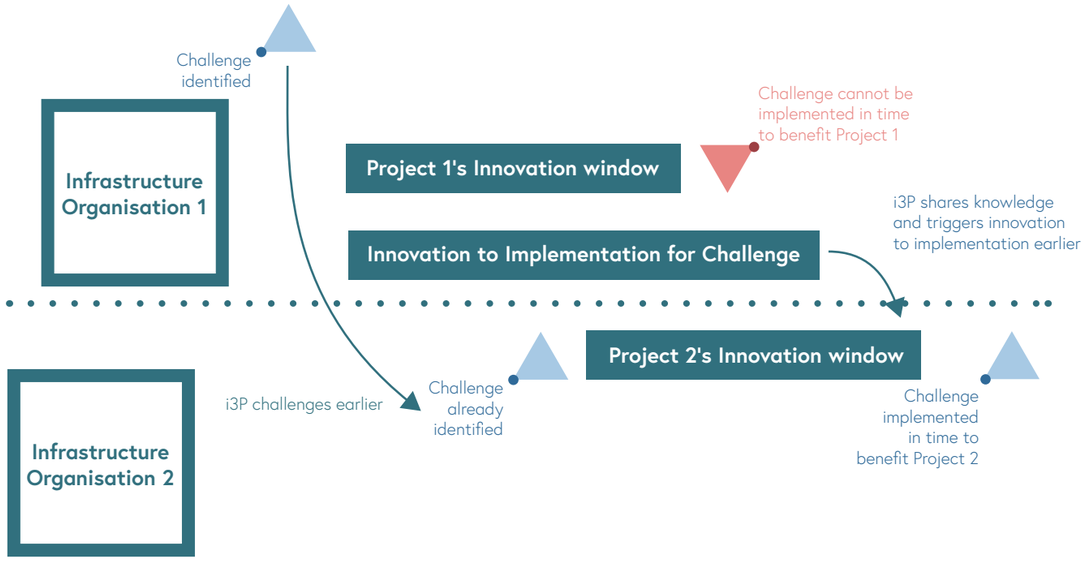


Figure 4: Accelerating challenge using i3P

Web based collaborative knowledge sharing platforms provide an effective way to support transport bodies and the supply chain in identifying and managing innovations. Innovation and new delivery approaches can create a legacy of experience for future projects to benefit from. Infrastructure Industry Innovation Platform (i3P) has been developed to provide exactly such a forum, where both clients and industry can engage and share ideas. i3P also provides a forum to engage with over 60,000 entrepreneurs, innovators and research groups to identify scalable solutions to delivery challenges.

There is precedence for this kind of collaboration and, in rail, the UK Rail Research and Innovation Network (UKRRIN)[xxvi] have started to mobilise clients, suppliers and research teams to look more closely at digitalisation and innovation in rolling stock. In infrastructure a similar coordinated structure is needed to maximise the impact of R&D investment.

Collaborative Innovation – i3P

Launched in October 2016, the Infrastructure Industry Innovation Platform (i3P) makes connections and links between organisations, entrepreneurs and industry and in doing so accelerates the adoption of new innovations in UK infrastructure. i3P achieves this by transforming ideas into practical and scalable solutions. The members of i3P also provide the mechanisms and tools to direct innovation towards addressing the major challenges facing the infrastructure industry. The forum also provides a vehicle to share challenges to standards across the infrastructure community.

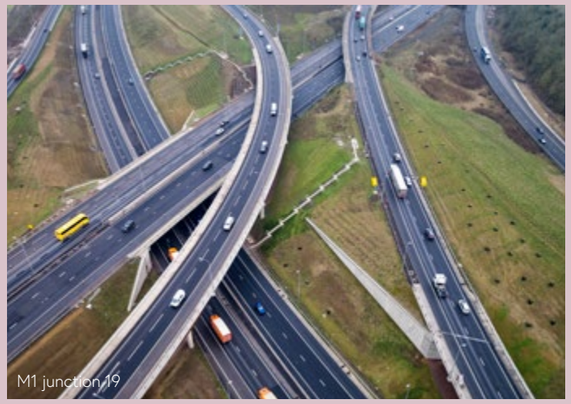
The Opportunity

We will collaborate with standards and industry bodies to identify opportunities to adopt common requirements and codify common derogations for high value assets. This will build on existing work to establish codes of practice for temporary works' design and certification requirements and in house projects such as Highways England's programme to refresh and update the Design Manual for Roads and Bridges. We aim to deliver a joint programme of work to address requirements for common high-value design elements by October 2020.

Temporary works are often a significant cost element in the construction of major projects. The need for a more consistent national approach to the design and approval of temporary works for major infrastructure projects, reflecting the application of European Standards, has been identified. Work led by HS2 Ltd and supported by British Standards Institute (BSI), brought together the Health & Safety Executive, Network Rail, London Underground, Crossrail, National Grid, Thames Tideway Ltd. and Highways England to develop a common approach to design and templates for temporary works technical approval forms and certificates. The resulting published documents, PAS 8811:2017 Temporary works – Major infrastructure client procedures – Code of practice and PAS 8812: 2016 Temporary works – Application of European Standards in design – Guide are good examples of collaborative working across major infrastructure clients to drive efficiency with benefits to the construction industry more widely. The construction industry more widely.

Infrastructure clients collaborate to achieve consistent temporary works requirements

Highways England – cloud based collaborative authoring approach


M1 junction 19

highways england

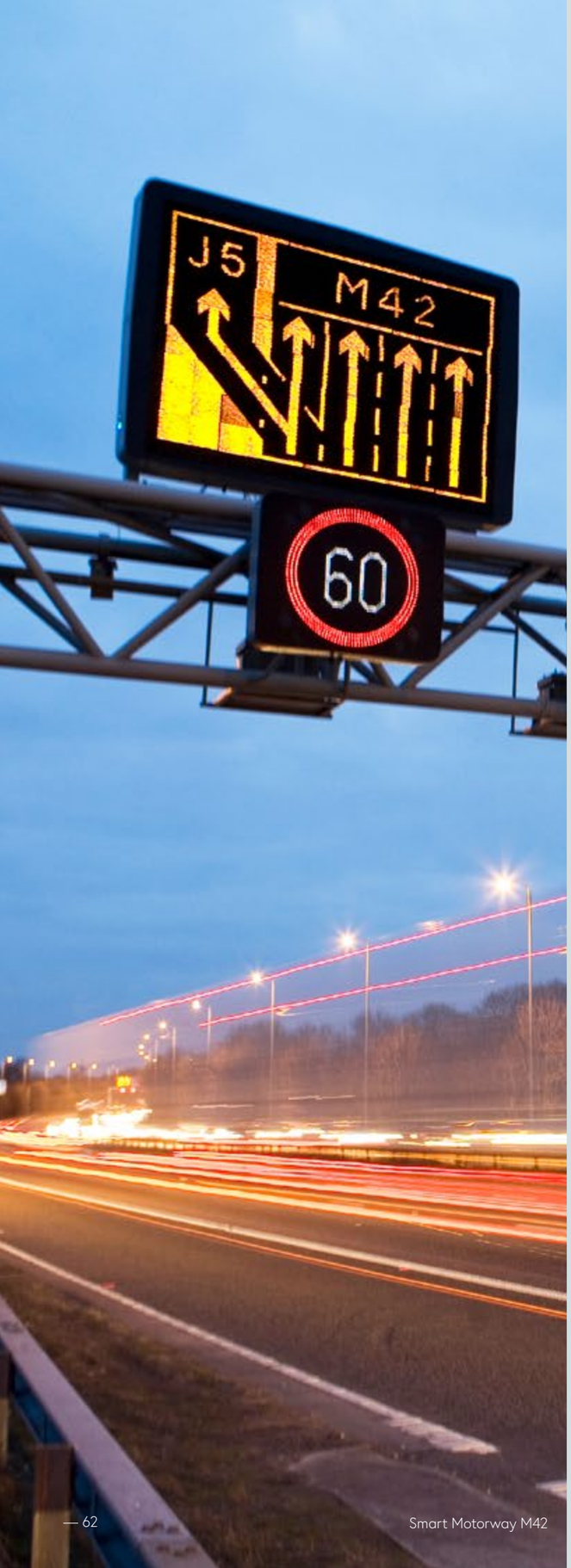
The Design Manual for Roads and Bridges (DMRB) is universally recognised by road transport professionals as the 'design bible' for highways infrastructure. It comprises a 13-volume series of more than 300 current standards, advice notes and other documents – some dating back nearly 30 years. Highways England's license requires them to formally refresh and update the DMRB. Whilst respecting the achievements of the current suite of DMRB documents, our vision for the future DMRB is to define clear and unambiguous requirements.

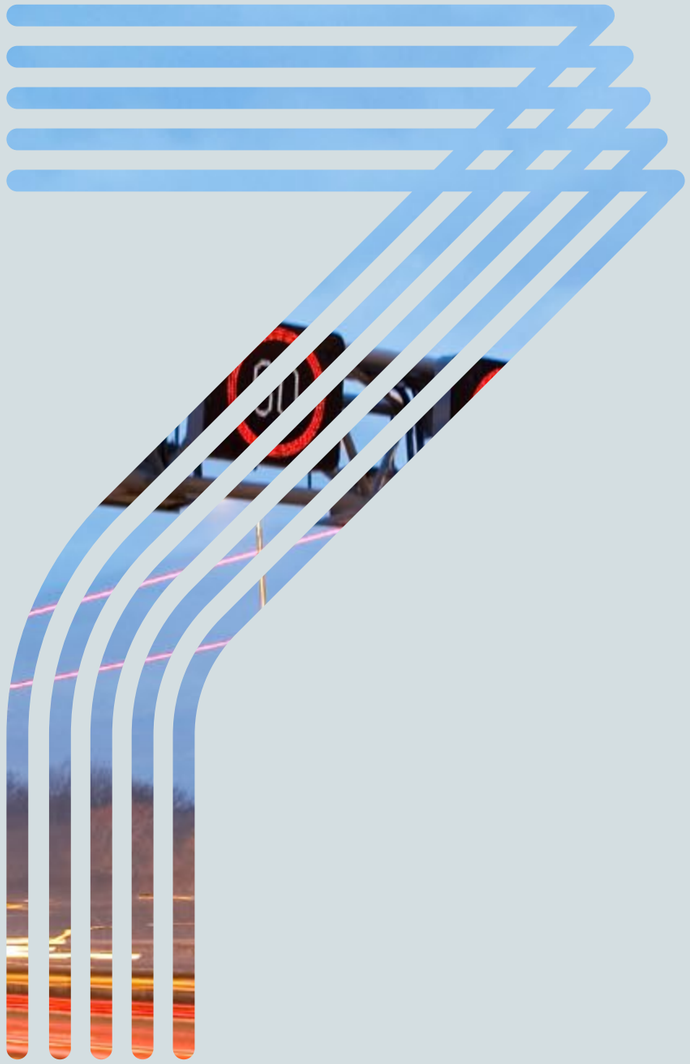
The refresh of the DMRB will:

- adopt new document development processes including Agile techniques and cloud based authoring tools
- introduce a new structure, style and format for documents to remove ambiguity and obsolete content and make a clear distinction between requirements and advice
- enable innovation by providing designers with clarity of the performance levels and outcomes sought
- reduce advice by either incorporating it into relevant documents or passing it to other organisations to be managed in other ways; and
- future-proof the documents and enable a more effective interface with digital design software

We will collaborate with industry through the Infrastructure Industry Innovation Platform to identify where innovations can help to redefine how we set standards. HS2 Ltd, TfL and the DfT will join Crossrail, Highways England and Network Rail in signing up to i3P by the end of 2017. We want to encourage research and development into new materials, technologies and ways of doing things that can help us challenge historical norms in standards. i3P will become the primary platform for collaborating with industry and each other to identify and share innovations. Our collaboration through i3P will be supported by mature innovation programmes within each delivery body.

A1 – Allerdene bridge





Exploit digital technologies and standardise our assets

— to enable the adoption of best practice from the manufacturing sector, such as off-site construction.

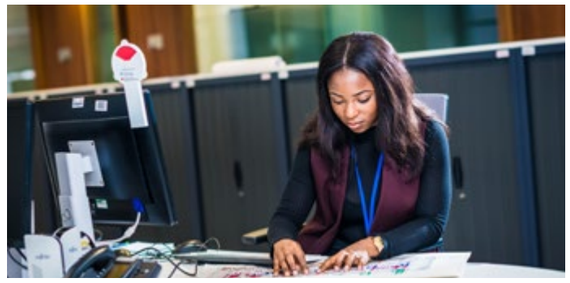
The Challenge

Digital technology and lessons from manufacturing present considerable opportunities to industry to innovate, invest and upskill in order to boost productivity. Suppliers need to be supported and incentivised to accelerate the use and application of Building Information Modelling (BIM) and digital technology in the design and project delivery of transport infrastructure. Digital tools will enable the more extensive adoption of modern construction methods, such as off-site construction and standardisation of assets, which will unlock industrial capacity across the UK.

Smart Motorway M42

Context

Transport bodies must do more to embrace innovation and invest in people and equipment. Harnessing the significant purchasing power in transport, Crossrail, Highways England, HS2 Ltd, Network Rail, TfL and the DfT can help to support the construction supply chain to increase its productivity and drive down costs by adopting digital modern methods of construction.



The Construction Leadership Council has targeted delivering better outcomes by embracing digital technologies, including BIM, increasing the proportion of assets which are manufactured and improving whole life asset performance. Transport can, as a sector, help industry to speed up its progress towards these goals to deliver better outcomes and drive efficiency.

New technologies such as BIM have been embraced, but the full application and potential of these tools has yet to realised in transport. Crossrail will be the first major UK infrastructure project to fully utilise the BIM lifecycle concept[xxvii] and HS2 Ltd has already invested significantly in BIM. By accelerating the transition to digital design and delivery methods our capacity to adopt off-site construction methodologies and manufacturing processes into the delivery of transport infrastructure will be bolstered.

Extensive evidence has existed for some time, including the Government Construction Strategy (2011), that greater standardisation and pre-assembly can drive innovation, improve productivity and reduce waste in construction. Off-site construction offers huge potential to reduce costs by enabling standardisation of products and processes. By applying lessons developed in the manufacturing sector, production methods in transport can be streamlined to increase volumes and quality and standardise product delivery.

TfL lighting – kit of parts

TfL introduced a whole life value process for lighting which allowed them to test the market for innovative new lighting technology. Following a comprehensive consultation process with over 80 lighting manufacturers and suppliers, TfL prepared technical specifications with minimum output requirements for the procurement of advanced lighting technologies. Eight year contracts were awarded to 13 manufacturers who are incentivised, though competition, to continue to innovate and reduce costs further.

London Underground will be able to rationalise its volume of lighting products by up to 90%, creating considerable economies of scale. The replacement of existing lighting with new products at Charing Cross Station ticket hall will save 25% in whole life cost, including 75% in maintenance costs.

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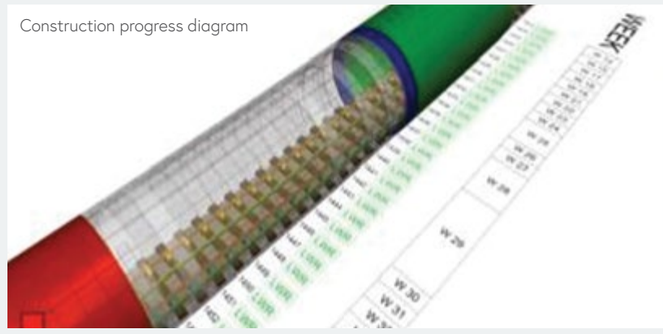
The Opportunity

We will standardise common component parts, designs and processes to maximise the efficiencies approaches such as off-site construction and BIM offer. This means increasing our catalogue of standardised products and components, scaling up the approach TfL have adopted. We will develop a common set of principles to simplify and accelerate new product acceptance. We will increase our use of 3D, modelling, accelerate our deployment of BIM and other digital engineering data systems. Like Crossrail and Anglian Water, we will integrate estimating and cost information into these digital tools to help designers and engineers design to cost and produce more accurate estimates. We will switch to a 'presumption in favour of off-site construction' by the end of 2019, replicating the approach adopted by HS2 Ltd.

Artist's impression of Birmingham International Centre (BIC) train station

Construction progress diagram



TfL Baker Street to Bond Street Tunnel Relining Project – innovative engineering with digital technology

By applying BIM Virtual Design and Construction, work on the 215-metre section of tunnel between Baker Street and Bond Street was carried out in engineering hours, with virtually no passenger disruption and allowing the line to remain open, a first for the London Underground.

The project was modelled virtually from start to finish so that key stakeholders could be convinced that the project could be done safely. This allowed the project team to test solutions and plans and leave any failures behind in the digital world. A common data environment containing a data rich information model enabled high levels of collaboration across the team. The model was used to support 3D modelling, 4D planning, coordination, clash detection, innovative solution design, training, familiarisation and safety planning.

This application of BIM and digital engineering helped to complete the project without impacting the operation or safety of the line, 4.5 months ahead of schedule and 10% under budget. The project has been recognised within the industry and won multiple awards.

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How we will deliver the TIES – implementation and next steps

The TIES has highlighted the benefits of greater collaboration and shared problem solving across all transport bodies. It encourages fostering these relationships in order to embed the recommendations into the wider transport culture. In recognition of the need for leadership in this complex area, the Secretary of State has appointed Andrew Wolstenholme as Chair of the Transport Infrastructure Efficiency Taskforce (TIET), leveraging Andrew's central role in the CLC. Respectful of DfT's arm's length bodies governance and funding, the TIET will provide the framework, oversight, challenge and coordination for all workstreams that have been identified in this Strategy. The taskforce will also provide a One Year On report which will show progress on this work, set out the next steps and review the relevance of this strategy.

The approach we have taken to adopt, implement and scale-up the recommendations and best practice that have been made is by embedding them into existing efficiency programmes across the Transport bodies. Each organisation has its own internal structures of governance to embed activities and drive efficiency. As such, each will develop its own plan for responding to these challenges. The progress of these plans will be reviewed by the TIET in order to build on best practice and provide support where needed.

Many of the recommendations that have been made can either only be made in, or will be much improved by, collaboration across the 'DfT arm's length bodies'. In some cases, such as in challenging railway standards, this collaboration may only be between particular ALBs. To retain oversight of progress on these issues, it is expected that these Coordination Groups will provide feedback to the TIET. Where collaboration involves all ALBs and the DfT, such as in benchmarking, the TIET will sponsor specific projects to develop these recommendations. This work has already started with a remit being drafted to build on the work concluded as part of the benchmarking proof of concept under Challenge 3.

TIET Delivery Board

The TIET Delivery Board will provide the oversight and leadership to all the TIES work, chaired by Andrew Wolstenholme. It will be made up of senior decision-makers from the Transport Bodies, with the secretariat provided by the DfT. As Chair he will maintain momentum and coordinate implementation in collaborative areas, such as in benchmarking.

Members will be uniquely placed to define, embed and drive change within their organisations, sharing information on best practice and drawing on expertise from outside of transport.

Key Responsibilities

- Provide assurance that TIES has been embedded into existing efficiency and transformation plans of the DfT family
- Members of TIET will be responsible for ensuring a named implementation lead(s) within their organisation
- Coordinate and, where required, lead collaborative activities across the transport bodies and with other industry groups
- Ensure that organisations are resourcing projects and activities that tackle the challenges in the TIES and supporting activities
- Steer and make links with other existing industry and cross-government initiatives (e.g. Construction Leadership Council, National Infrastructure Commission, Infrastructure & Projects Authority)
- Agree funding, scale up and manage the on-going the cost and performance benchmarking work
- Agree how implementation and outcomes will be measured. Including, establishment and governance of the Transport Benchmarking Forum

Group Coordination Teams

- Initiate collaborative projects
- Share best practice
- Not all ALBs will be involved in every team
- Report back to TIET via project lead

DfT Arm's Length Bodies

- Provide initial high-level response
- Develop detailed cross-functional implementation plans
- Report back to TIET via Sponsor

Outputs

- Report into the CEO Infrastructure Group.
- Interface with CLC, Project 13 and other supporting initiatives focussed on improving productivity in infrastructure and / or construction

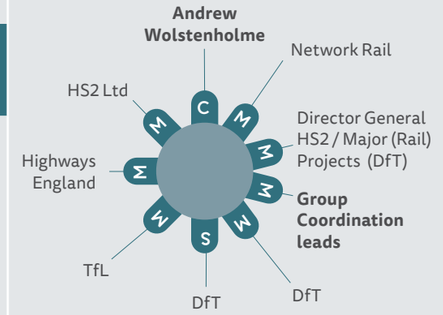
Frequency

Bi-monthly

Milestones

- DfT's Arm's Length Bodies response with their implementation plans
- Commence next stage of benchmarking
- Collaboration activity commences

Attendees



Next Steps Collaboration on targeted action

Work has already begun to build on the insight provided by the benchmarking proof of concept, with a remit being proposed for the initial TIET Delivery Board. In a similar way, remits will be provided for the recommendations under each of the seven challenges in this Strategy. These will provide the background to the projects, the objectives and intended outcomes, informed by metrics from the benchmarking workstreams, as well as level at which oversight and management will be provided.

We will review whole life costs and benefits during investment appraisals	We will provide greater assurance to projects
We will share data and performance metrics to establish a benchmarking forum	We will collaborate with industry through the Infrastructure Industry Innovation Platform
We will collaborate with standards and industry bodies	We will be more consistent in our estimates

TIET Delivery Board

We will review whole life costs and benefits during investment appraisals	We will provide greater assurance to projects
We will share data and performance metrics to establish a benchmarking forum	We will be more consistent in our estimates

We will improve our use of benchmarking information	We will build our estimating capability
We will combine our spending power to improve supply chain productivity	We will choose alliancing

One Year On Report

We are committed to keeping this strategy and its recommendations under review and aim to publish a progress update a year from now, setting out how we responded to the seven challenges and implemented change in our organisations. This report will highlight the impact on the delivery of efficiencies amongst transport bodies and in turn inform the Construction Leadership Council's ambitions to drive greater productivity in the construction sector and its supply chain.

We look forward to working with the Government, especially Ministers, the Construction Leadership Council, industry and professional bodies and our supply chain to deliver greater efficiency and productivity in transport infrastructure.

A303 near Stonehenge

Acknowledgements

This strategy has benefited from extensive and willing support from practitioners across transport bodies and other respected figures from the wider construction and projects sectors. The support was provided through a series of round-table discussions, added essential detail and context to the work. It would not have been possible to develop this Strategy and its recommendations without the input of these experts and practitioners.

TIES Project Team		
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Dale Evans (Anglian Water)	**Hannah Vickers** (ICE)	**Tim Bowen** (Costain)

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Page 46 – (Table) **Learning about collaboration from Project 13** https://www.ice.org.uk/news-and-insight/project-13

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