

HS2

HS2 Chairman's Stocktake

August 2019

Foreword

On my appointment to HS2 Ltd at the end of December 2018, I informed the Department for Transport that, after consultation with Mark Thurston, it was my intention to carry out a stocktake of the current status of the programme. I set out to answer a number of underlying questions based on three principles which I have applied to this stocktake: transparency, honesty and sensitivity to the public's concerns.

HS2 is the most innovative and ambitious regeneration programme to be undertaken in the UK for over 150 years. The investments we have made in the past decade – and will continue to make in the next two decades – will provide social, economic and financial benefit to the people of the UK for the next century and more. It is a strategic investment in the future of the UK and should be assessed against that perspective.

HS2 is more than a high speed railway system. From its concept more than 10 years ago, the vision and purpose have been enhanced by the development of the Government's forward-looking Industrial Strategy and the creation of the Northern Powerhouse, Transport for the North and wider transport and economic strategy. HS2 is an enabler for that strategy and a reflection of it.

By its nature, it is also large, complex and technically very demanding. So, while I have considered the lessons to be learnt from infrastructure programmes such as Crossrail, HS1 and Thames Tideway, I have also been acutely aware that HS2 is of an order of magnitude larger and more complex than any of these programmes. I have also taken full account of the guidelines produced in the recently published report by the Permanent Secretary of the Department for Transport on the management of large transportation programmes.

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Executive Summary

HS2 remains the right strategic answer to join up Britain more effectively to meet the transport needs of the 21st century. It is a key enabler for the national Industrial Strategy and the individual growth strategies being developed by each region and major cities in the country.

As such it is an integral part of the plans of Transport for the North, Northern Powerhouse Rail (NPR) and Midlands Connect, providing 50% of the new lines needed by NPR. However, the scale and the complexity of the task, as well as the transformational benefits it will deliver for the country and its regions were under-estimated in the original business case.

The original plans did not take sufficient account of the compound effect of building a high-speed line through a more densely populated country with more difficult topography than elsewhere – and doing so whilst complying with higher environmental standards.

Equally, the existing cost/benefit model, which was designed for smaller scale schemes, has proved inadequate in capturing the full transformational effect of HS2, particularly on changing land values. This transformation is already being demonstrated in Birmingham.

Therefore, the budget and target schedule for the programme have proved unrealistic, while at the same time the benefits have been understated.

Given the above, the budget, schedule and business model for HS2, as well as the way it interfaces with the rest of the rail network, need to be reset – reflecting the different maturity of the Phases – to ensure the programme delivers the greatest possible benefit for the country in the most cost-effective way.

Phase One from Birmingham to London is already under way and should be completed as planned. HS2 conducts its business as a cost-conscious organisation with value for money playing a huge factor in decision-making. Though much work has been done to date to drive down costs through independent reviews and pilot studies, the cost is likely to rise from £27bn¹ to a range of £36bn to £38bn; and the target delivery date of December 2026 should become a more realistic, manageable and cost effective staged opening between 2028 and 2031.

Phase 2a, from Birmingham to Crewe, is currently near the end of its legislative process in Parliament. That process should be completed and amalgamated with Phase One and delivered to the same timescale. Its cost is likely to rise from £3.5bn to a range between £3.6bn and £4.0bn.

¹ All figures are quoted at 1Q 2015 prices; and all 'from' costs and 'target' dates are as set at the 2015 Spending Review

The hybrid Bill for Phase 2b running from Crewe to Manchester and Birmingham to Leeds is currently being prepared and is, therefore, the least mature of the Phases. Given its early stage and its essential role in delivering Northern Powerhouse Rail, Transport for the North and Midlands Connect, there is an opportunity to fully integrate the plans for each region and deliver them in smaller, more manageable sections as part of a rolling programme of investment in the Midlands and the North. In line with the experience of Phase One, the cost of Phase 2b is likely to rise from £28.6bn to a range of £32bn to £36bn with target delivery moving from 2033 to between 2035 and 2040.

In completing the review of the current status of the programme, there are a number of conclusions and recommendations that are set out in more detail in section 5. In summary, the areas for further work are as follows:

- With Phase One well advanced, take the opportunity for a strategic review of the coordination between HS2 Ltd, DfT, TfN, NPR and Network Rail of the scope, timing, funding and efficacy of the plans for investment in both conventional and high speed rail in the Midlands and the North.
- Consider more effective ways to capture the wider strategic and long term benefits HS2 will bring to the country's transport system, particularly in the Midlands and the North, as well as the wider industrial, regenerative and economic impacts.
- Continue to develop opportunities for further cost efficiencies on Phase One, including challenges to standards and specifications; plus explore the potential for third party or alternative sources of funding. This is especially relevant on Phase 2b where the scheme is less mature and more choices exist for the sponsor and stakeholders.
- Recognise the opportunity and threats presented by the approach to engaging the supply chain, developing commercial models that drive the right outcomes, and work with central government and other agencies on the challenges around resources, capacity and skills.
- To ensure that the HS2 Board and HS2 Ltd are 'match fit' to deliver the HS2 programme and its intended outcomes, we will continue to review the arrangements for oversight and governance, delegation and decision making, and enhance the capability and effectiveness of the organisation.

Introduction

The need for, and the benefits of adding, a 21st century high-speed railway to our existing Victorian rail network has been understood and supported in this country for nearly two decades.

As early as 2001, the then Strategic Rail Authority identified over-crowding on the West Coast, East Coast and Midland Main Lines as key problems on Britain's existing railways and the potential for a modern, high capacity, high speed service to help address those issues by taking long distance services off the existing lines to make room for additional local, regional and freight networks.

It is important to stress that HS2 is not just a high-speed railway, but by using 21st century rather than Victorian standards it will provide a very different level of service to conventional railways. Punctuality and safety will be an order of magnitude better with routine use of grade separated junctions and the absence of all types of surface and level crossings. HS1 for instance measures punctuality in seconds rather than minutes. Designed for ease of maintenance it will be a true seven-day railway. It has also been designed from the outset for climate change and extreme weather resilience, and to provide step free and level access for passengers at all stages of the journey.

While capacity remains a key part of the strategic case for HS2, the last decade has also seen a greater realisation of the wider role the project will play in transforming the economic geography of Britain by addressing the North / South divide and easing the pressure on London and the South East. An objective of the Government's Industrial Strategy is to improve connectivity between the towns and cities of the Midlands and the North. HS2 will help address the barriers to productivity in those regions and therefore help to address the disparity between London, the Midlands and the Northern regions.

Britain's competitive edge lies in research, the innovation that comes from it, and the ability to turn those ideas into reality. However, to maintain that edge particularly in the current political landscape, we need to make it easier for people, goods and services to move between our disparate service, distribution and manufacturing centres in the Midlands, the North and Scotland. Doing so will strengthen the supply chain's capability to maximise their efficiency and effectiveness and give people more opportunities to use their skills and experience across a wider geographic area. HS2, therefore, acts as a key enabler for the delivery of the Industrial Strategy and has already influenced key players in the services industries, such as HSBC and Channel 4, who have moved their headquarters to Birmingham and Leeds respectively.

HS2 is not a standalone railway but rather an integral part of ambitious regional growth plans, including transport. It has helped prompt the creation of Transport for the North (TfN) and Midlands Connect, key partners in helping translate the strategic purpose of HS2 into local reality with local services. That, in turn, has helped shape regional growth strategies in the North East of England, Leeds and West Yorkshire, South Yorkshire,

Cumbria, Lancashire including Manchester, Merseyside and Warrington, Staffordshire and Cheshire, the East Midlands, the West Midlands including Birmingham, London at Euston and Old Oak Common, and Scotland.

HS2 has been a catalyst in assisting the creation of these growth strategies.

In a letter to Liz Truss, Chief Secretary to the Treasury on 19 May 2019, more than 20 key figures from across the North and Midlands, including West Midlands mayor Andy Street, explained that the project was already attracting investment.

Local authorities and growth partnerships in these areas estimate that HS2 will provide the stimulus for 500,000 additional jobs and nearly 90,000 new houses. These projections fall outside the conventional cost-benefit model used to measure more incremental infrastructure projects, but they give a clear idea of the scale of the benefits HS2 could help unlock at a national, regional and local level.

The scale and complexity of the task has led to increased pressures on HS2's budget of £55.7bn – set in 2015 – and the projected delivery dates for Phase One and Phase Two. Those pressures are substantial and due to a variety of factors including: the extra demands we are making on the railway to maximise its strategic impact, the more rigorous environmental standards we apply in this country and aim to exceed with HS2, the greater density of population in Britain, and more challenging ground conditions than we expected.

This stocktake is based on existing and emerging information provided by the programme, the HS2 Ltd Executive, external advisers, my predecessors and Board Members. This leads to my conclusions about the overall financial position and the time it will take to complete the various phases of the programme, **within** the existing scope. The stocktake concludes with measures the HS2 Ltd Board and Government might consider as a result of this work.

Delivering and Valuing the Benefits

Direct Benefits

HS2 specific objectives are to:

- provide sufficient **capacity** to meet long-term rail demand and improve resilience and **reliability** on the network,
- **improve connectivity** by making journeys shorter and more frequent,
- And therefore, **boost economic growth** across the UK.

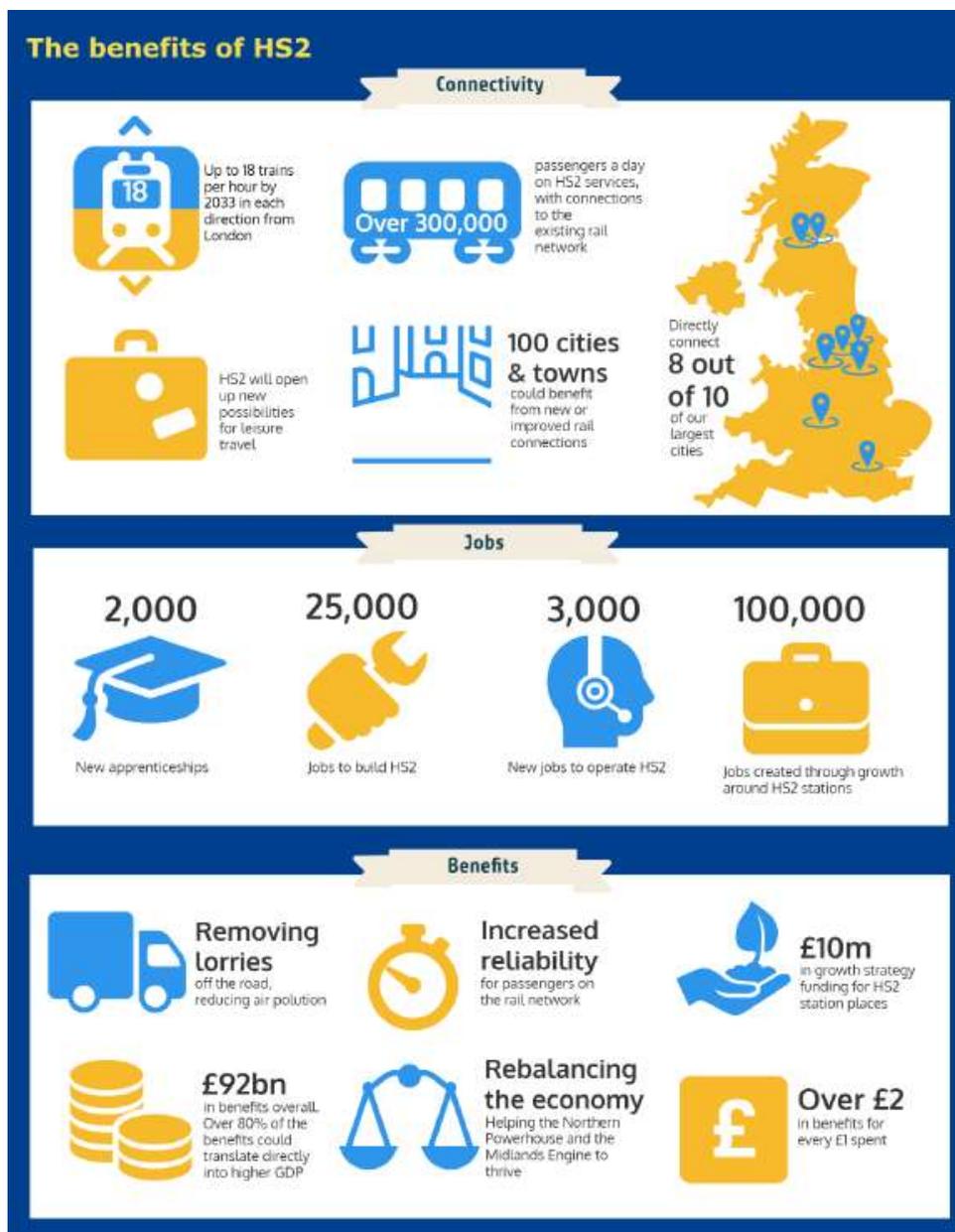


Figure 1: Benefits of HS2

HS2 was founded on the need for more rail **capacity** as demand for rail travel has been growing at an unprecedented rate since the mid-1990s with **Freight** also anticipated to grow by 90% by 2033 compared with 2011. By 2016-17, total passenger journeys on Britain’s rail network had increased by 135% since 1994-95. The growth in intercity rail travel on some of the routes that HS2 will serve has exceeded the national average growth and has almost tripled since 1994-95. Although extensive upgrades to the existing network have been made, this fragmented approach is struggling to keep pace with rising demand in the long term. This is leading to crowded, unreliable and unpleasant journeys for rail travellers.

Intercity trains removed from the West Coast Main Line (WCML) release capacity for upto 11 new fast commuter or freight trains per hour, by reducing the disparity in speed between different services. The most efficient use of capacity is where all trains operate at the same speed – as is the case on HS1 and traffic on a managed motorway.

Over the last two decades, Britain’s railways have seen an unprecedented period of growth, with a doubling in journeys. Across the network, journeys grew from 735 million in 1994/95 to 1,501 million in 2012/13. Intercity journeys increased by 65% over the same period, with journeys increasing from 77 million to 128 million. This is a 5.2% annual year-on-year growth rate.

HS2 will represent a step change in providing a reliable, comfortable, predictable and accessible journey which will transform people’s ability to be where they need and want to be, when they need or want to. HS2 will provide a step change in reliability.

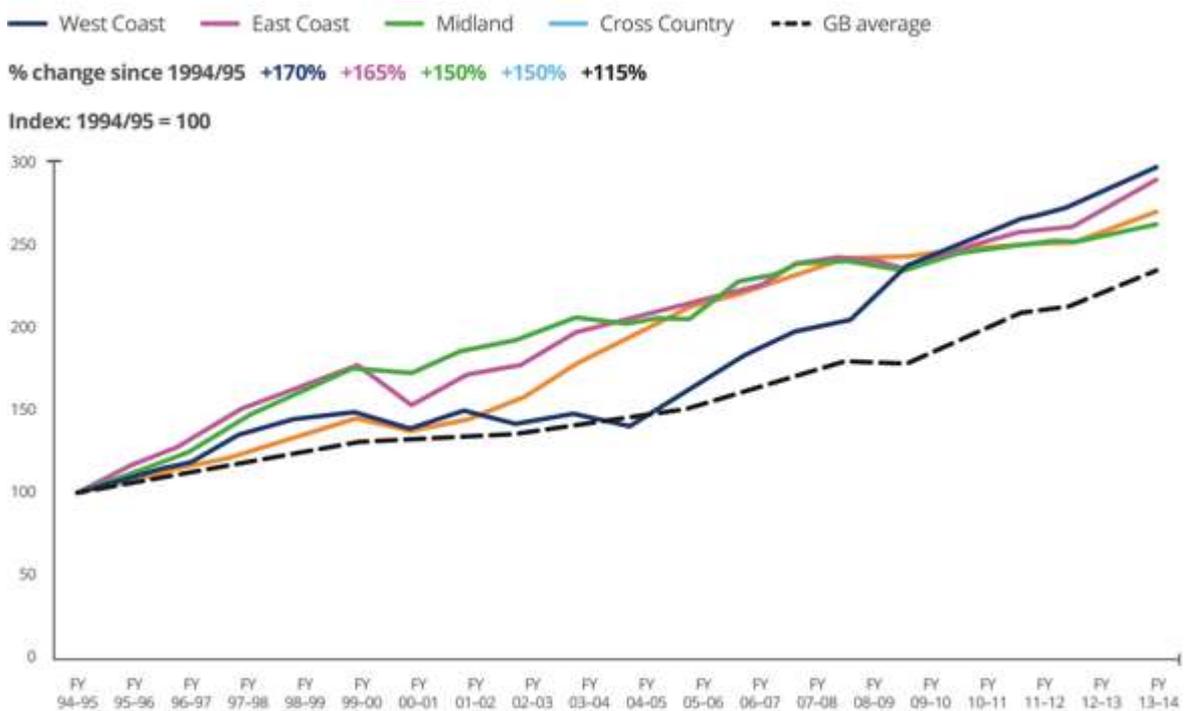


Figure 2: Growth in passenger journeys by corridor (1994/95 to (2013/14):

² Data sources: RUDD (LENNON), National Rail Travel Survey (2010, DfT), HS2 Limited

HS2 infrastructure will provide up to 18 trains per hour running in each direction to and from London and a further 6 trains per hour in each direction to and from Birmingham. Compared to today, HS2 will carry over 300,000 people every day more than doubling the number of seats available today from Euston in peak hours.

By providing direct intercity services on dedicated high-speed lines, there will be extra space for more trains on the existing heavily congested West Coast Main Line (WCML) and East Coast Main Line (ECML). This presents a once in a generation opportunity to improve services and reliability on these routes, including passenger services to locations not directly served by HS2, and freight services.

Towards an Integrated Transport Strategy

The benefits HS2 will deliver will have to be measured against the full scope of its strategic purpose and its interface with the rest of the transport network. The Government's Industrial Strategy reflects those benefits.

One of the objectives of the Government's HS2 Consultation in 2011 was to improve connectivity between Britain's regional centres by addressing the historic limitations of the existing regional rail network. Those limitations do not only apply when travelling across the North of England or across the Midlands, but between these two regions as well thereby acting as an inhibitor to businesses and supply chains which operate in both. This impacts the ability of sectors such as aerospace, automobile, pharmaceuticals, software and other advanced manufacturers to collaborate and become even more innovative.

HS2 is fully linked and an integral part of future plans for TfN (Transport for the North) and Midlands Connect. NPR cannot be built without HS2 lines coming into Leeds and Manchester. It should be noted that much of the design work for NPR has been led by HS2 as there is currently no dedicated delivery vehicle in place to deliver the NPR ambitions. Given the much later introduction into service of NPR, there are further opportunities that HS2 is reviewing and developing so both schemes are more integrated. Such interdependencies between the projects include:

HS2's Manchester spur forms part of the proposed NPR link between Liverpool and Leeds, and NPR services would serve both Manchester Airport and Piccadilly stations. Our design includes passive provision for connections for Liverpool – Manchester and Manchester – Leeds services, as well as additional station capacity. We are also including passive provisions for a potential junction to a new line to Liverpool.

HS2 is delivering parts of the Crewe Hub project, including a connection to the high-speed main line north of Crewe.

HS2 is providing a connection on the ECML (East Coast Main Line) spur, at Garforth, to enable services to reach the ECML via this route rather than the existing network.

HS2 will enable NPR services to run from Sheffield – Leeds via the Clayton junction and the HS2 main line. The HS2 scheme includes additional platform capacity at Leeds HS2 station.

HS2 is also providing a connection at East Midlands Hub to enable services to join the HS2 main line at East Midlands Hub and run north on HS2, as envisaged by Midlands Connect.

Work is ongoing to understand where else futureproofing may be required for HS2 to provide for future NPR services. For example, HS2 is currently working to understand the appropriate level of provision to be delivered as part of the Midlands Main Line (MML) electrification project.

Growth and Regeneration

As set out in the introduction, others estimate that HS2 will provide the stimulus for 500,000 additional jobs (direct and wider impacts) and nearly 90,000 new houses. The wider purpose of HS2 is to act as a catalyst for re-balancing the economy by enabling regeneration and driving regional growth. By improving connectivity, HS2 will encourage this integration between companies that are at the heart of the government's Industrial Strategy.

Once the network is completed, HS2 will directly serve over 25 stations connecting around 30 million people living in regions served by HS2 – this represents 45% of the population of the UK. Regions are using their local knowledge to identify local strengths and work out how the improved connectivity HS2 will deliver can support local regeneration and growth ambitions. It is estimated that 6 times as many jobs will be created outside of London. Regional teams are continuing to develop their plans and HS2 Growth Strategies are being developed for many of the cities the new railway will serve. This will help the country to realise the wider benefits of HS2 through economic growth and a more balanced economy. There is evidence of this already across the route:

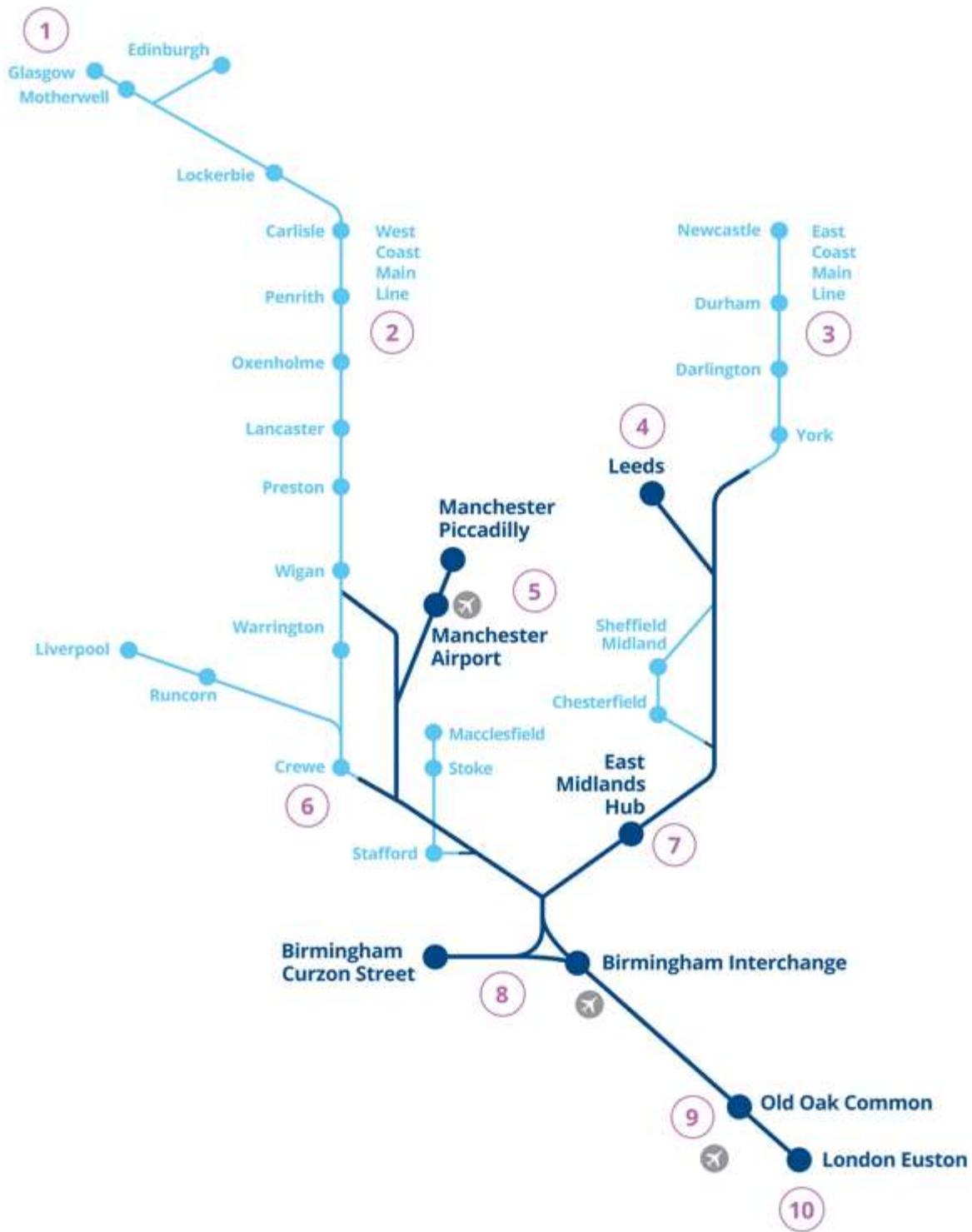


Figure 3: HS2 Network map. Based on indicative train service specification as at April 2018. Final HS2 timetable subject to consultation.

1. HS2 will reduce journey times between London and Glasgow and Edinburgh to around 3 hours and 40 minutes.
2. The Lancashire Enterprise Partnership estimates HS2 services to the area could help provide an extra £600 million for the region, and 3,000 additional jobs in Preston and South Ribble alone.
3. Darlington Borough Council estimates that the HS2 Growth Hub can provide over 3,000 new jobs and a £130 million a year boost to the Tees Valley City Region.
4. The West Yorkshire Combined Authority estimates 40,000 jobs and 21,000 homes could be created.
5. The Greater Manchester Combined Authority estimates reduced travel times and increased business productivity from HS2 will support 180,000 new jobs in the region and redevelopment plans at Manchester Piccadilly include 13,000 new homes.
6. The Constellation Partnership predicts HS2 will help the creation of 100,000 new homes and 120,000 new jobs across the region, including Crewe, Stoke and Stafford.
7. The East Midlands HS2 Growth Strategy estimates that HS2 could bring 74,000 new jobs.
8. The West Midlands Combined Authority estimates HS2 could boost the economy by £14 billion and support over 100,000 jobs. Around Curzon Street Station, Birmingham Council has regeneration plans with the potential to create 36,000 jobs and 4,000 new city centre homes. At Birmingham Interchange, UK Central are designing a new business and leisure district to deliver 16,000 jobs and 1,900 homes.
9. The Old Oak Common and Park Royal Development Corporation has set out plans for 25,500 new homes, together with up to 65,000 new jobs around the station.
10. Euston Station Master Development Partner is working with Network Rail and Camden Council to deliver a unified masterplan to unlock the full potential of the area, aiming to create 19,000 jobs and 1,700 homes.

Benefit-Cost Ratio (BCR): Important but not the whole story

The use of cost-benefit analysis to assess the value-for-money of transport schemes is well established in the UK and plays an important role in ensuring that public investments deliver value to taxpayers.

The sheer scope and scale of HS2's strategic purpose, and the objectives associated with it, go beyond what the model is intended to measure. HS2 is more than a railway and therefore the benefits it will deliver go well beyond the actual railway system. By better connecting the Midlands and the North, HS2 – in conjunction with other schemes – will unlock economic potential in towns and cities and, therefore, raise overall national prosperity in a way more conventional, incremental projects cannot. Any assessment of

the true value of HS2 and the benefits it will deliver has to take these wider dividends into account.

HS2 is a low carbon mode of transport. It is part of the solution to decarbonising the UK transport system and protecting the UK economy, and environment, from the worst impacts of climate change.

Significant progress has already been made in embedding and advancing carbon management best practice across the HS2 programme. The approach is forecast to:

- realise a significant (c.45%) reduction in Phase One whole-life carbon emissions;
- deliver low carbon journeys (8gCO₂e per passenger kilometre by 2030 and 2gCO₂e per passenger kilometre by 2050);
- limit Phase One whole-life carbon emissions – through to 2030 – to less than 0.15% of the UK's 'allowable' carbon budget for limiting global warming to 1.5°C; and,
- enable up to 2,240,000 tCO₂e benefit, by 2050, from passenger and freight modal shift.

As the Government set out when first consulting on HS2 in 2011, "The BCR is important but it is not, by any means, the whole story. The Government believes high speed rail would deliver significant non-monetised benefits, such as its contribution to job creation and regeneration and its potential to promote sustained and balanced economic growth. It is these non-monetised benefits which underpin the Strategic Case for high speed rail"³.

The conventional BCR includes transport benefits (reductions in travel time and overcrowding, more frequent and reliable journeys etc.), some aspects of the wider economic impacts directly arising from HS2 (such as agglomeration – benefits arising from reducing the effective distance between businesses) and some other benefits where these can be monetised (accessibility, safety and environmental).

However, the existing approach to the appraisal of transport investment schemes does not fully capture the potential of HS2 to transform the economic geography of Britain. That is because these methods – used across Government to create consistency in the appraisal of 'business as usual' projects – do not reflect HS2's role as a catalyst for other investments and do not account for changes in spatial patterns of economic activity as businesses and people cluster in areas with improved transport connectivity. These issues are recognised in academic research⁴ which indicates the need for a revised approach to appraisal of major transport schemes. As an example, the Jubilee Line Extension set out in its original Business Case a BCR of 0.95, but has become London's top

³ High Speed Rail: Investing in Britain's Future Consultation February 2011, <https://webarchive.nationalarchives.gov.uk/20110405154200/http://highspeedrail.dft.gov.uk/sites/highspeedrail.dft.gov.uk/files/hsr-consultation.pdf>

⁴ 'Transport Investment and Economic Performance – Implications for Project Appraisal', : <https://www.gov.uk/government/publications/transport-investment-and-economic-performance-tiep-report>

3 busiest tube line and has contributed as a critical enabler of growth in London's docklands.

The BCR excludes any economic value from changes in the level and location of investment in the economy, including investment being delivered through HS2 local growth strategies, and its impacts on productivity and employment. While these depend on subsequent investment by others and so cannot be fully claimed by HS2, they will not happen without the transformative benefits of HS2 in providing additional capacity and improving connectivity between our cities and regions.

| Benefits to the economy included in the Benefit-Cost Ratio | Benefits to the economy excluded from the Benefit-Cost Ratio |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ▪ Faster, more frequent, more reliable, less crowded journeys for business travellers ▪ Agglomeration: Better transport reduces the effective distance between firms and between firms and workers, increasing productivity ▪ Increased labour supply due to improved transport ▪ Firms operating in markets dominated by a few suppliers cut prices / increase output | <ul style="list-style-type: none"> ▪ Benefits during the construction period such as jobs and skills ▪ Transformational benefits to the economy including changes to the location and investment decisions of firms and productivity benefits from better connecting city/regional economies ▪ Regeneration around HS2 stations and local growth strategies and plans (noting that these depend on HS2's catalysing effect to underpin their further investment and release the benefits) |

Put simply, applying traditional BCR modelling techniques – including restricting analysis to a 60 year timescale – does not reflect the full impact and benefit of a transformative programme such as HS2 that will change the way the economy works for generations to come.

Programme Challenges

OVERVIEW

While it is important to have a full understanding of the benefits of HS2, we must also have a realistic view of the challenges we face in relation to schedule, cost and ensuring that both HS2 Ltd and the supply chain are fully capable of delivering the programme.

Updated baselines for Phases One and Two are currently in preparation ahead of starting railway construction for Phase One and to support the parliamentary stages for Phases 2a and 2b. We need to be clear about the challenges and about the level of certainty that we can, and should, have at this stage of the programme. Phase One has enabling works under way and has main works civils contractors on board. However, stations, railway systems and integration plans are all less well developed as would be expected at this stage. Phase 2a is progressing through Parliament; and Phase 2b is even less mature.

Lessons learnt from other major programmes indicate that, at this early stage, it is appropriate to identify ranges of expected delivery dates and costs rather than specific targets.

This section sets out

- The schedule and costs challenges facing each Phase.
- The programme-wide challenges of ensuring that HS2 Ltd and the supply chain are fit for purpose.
- The ongoing work with DfT to consider potential options for scope and phasing that may offer a more affordable path to achieving the strategic goals of HS2 in conjunction with NPR and other programmes.

The programme is facing substantial schedule and cost pressures for a number of reasons. In part, that is a reflection of the scale and complexity of the programme [REDACTED]. Next, the work we have carried out has revealed that ground conditions are significantly more challenging than predicted. Finally, and in part, early estimates based on comparisons with other international high-speed railways, have for a variety of reasons proven to be overly optimistic.

While comparisons with other high-speed lines have highlighted techniques we can adopt, they have also revealed important differences – differences that reflect the extra demands we are placing on the railway in this country to deliver the strategic purpose and transformation it is designed to achieve.

For instance, HS2 has more new routes into the heart of city centres, compared to other European countries, in order to maximise the connectivity with existing regional and local

services and spark urban regeneration around stations. HS2 will also operate at higher frequency and tonnage in order to serve more destinations which, in turn, requires the use of slab track with its associated tighter geotechnical tolerances. The construction and operation of the railway will also reflect the more stringent environmental standards we apply to leave an environmental legacy that we can be proud of and mitigate the impact on communities. While all of these factors were known when setting the funding envelope in 2015, the full impact of these differences was not and could not have been fully understood at that time.

In the Spending Review of 2015 (SR15), Government set the budget for HS2 at £55.7bn. This was made up of separate Funding Envelopes for Phase One (£27.1bn) and Phase Two (£28.6bn) and with more stringent Budget Envelopes as the targets within which HS2 Ltd was expected to deliver.

These Funding and Budget Envelopes were based on the best available estimates at the time and reflect the maturity of the programme prior to Royal Assent for Phase One and in advance of finalising the route or carrying out even preliminary design for Phase Two.

This is the normal process for setting budgets and the early immaturity is addressed by the addition of contingency to reflect the risks (“known unknowns”) and wider uncertainties (“unknown unknowns”) inherent in this process. The contingency required for the different Phases will change as confidence in the cost estimates increase. However, the scale and complexity of HS2 make this process even more challenging than for other large-scale projects.

This Stocktake is based on the emerging, but as yet unassured, cost and schedule estimates that will form Baseline 7 for Phase One and Baseline 2 for Phase Two in due course.

Based on information available at that time, the SR15 funding envelopes for Phases One, 2a and 2b were set on the basis of delivery into service in December 2026, 2027 and 2033 respectively.

Lessons from other infrastructure programmes make it clear that services should be introduced in a staged manner and that, as with costs, a range and not a fixed target should be given for delivery schedules, especially at very early stages of development.

Phase One

Progress to date

There is already significant progress on enabling works with over 62 sites active on utilities preparatory work alone, property acquisitions, extensive archaeological excavations and demolitions. Our main works civils contractors are carrying out detailed design work and we have appointed our construction partners for Euston station and have a preferred

bidder for Old Oak Common. Since 2012, HS2 has spent £3.2bn on enabling works, design and other project costs and £1.9bn on acquiring land and property (of which a proportion will be recouped later).

Schedule

The target date for Phase One services is set at December 2026 in the Development Agreement, with Baseline 6.1 (described on page 17 below) introducing the concept of staged opening (3 trains per hour (tph) between Old Oak Common and Birmingham Curzon Street in December 2026 and 10tph between Euston and the North West in December 2027).

The staged opening approach, with an initial captive service with no interaction with the existing rail network, follows good practice of introducing services gradually and minimising integration risks while operational experience and reliability are built up. As a captive service, this can be introduced when the systems are ready and proven (a “soft start”) and does not require a change to national timetables.

The current schedule shows a “soft start” for the first stage of Phase One during 2029, for which setting a specific date at this stage is both unnecessary (a captive service, as explained above) and unhelpful (learning lessons from other programmes). The change from the BL6.1 date of December 2026 is driven by a later Royal Assent date, longer time spent in the main works civils Stage 1 design, and an extended construction schedule developed by the civils contractors. The longer construction period is driven by the same factors that are driving cost pressures (described below) including, inter alia, allowing additional time for ground settlement in preference to costly ground stabilisation prior to installation of high-precision concrete slab track.

The second stage of Phase One serving Euston, Birmingham and destinations on the existing West Coast Main Line (WCML) will be fully integrated with Phase 2a (announced in November 2015 as being accelerated ahead of the remainder of Phase Two) in order to maximise the benefits of the additional capacity to Crewe. This stage does require a national timetable change and so a specific date will be set around two years prior to introduction of these services

The second stage continues to be scheduled for around one year after the initial captive service. This stage will be ready during 2030, leading to a potential opening date at the end of that year or at a suitable timetable change date thereafter. (It would be unusual but not impossible for the industry to agree a special timetable change not aligned to the usual May and December dates).

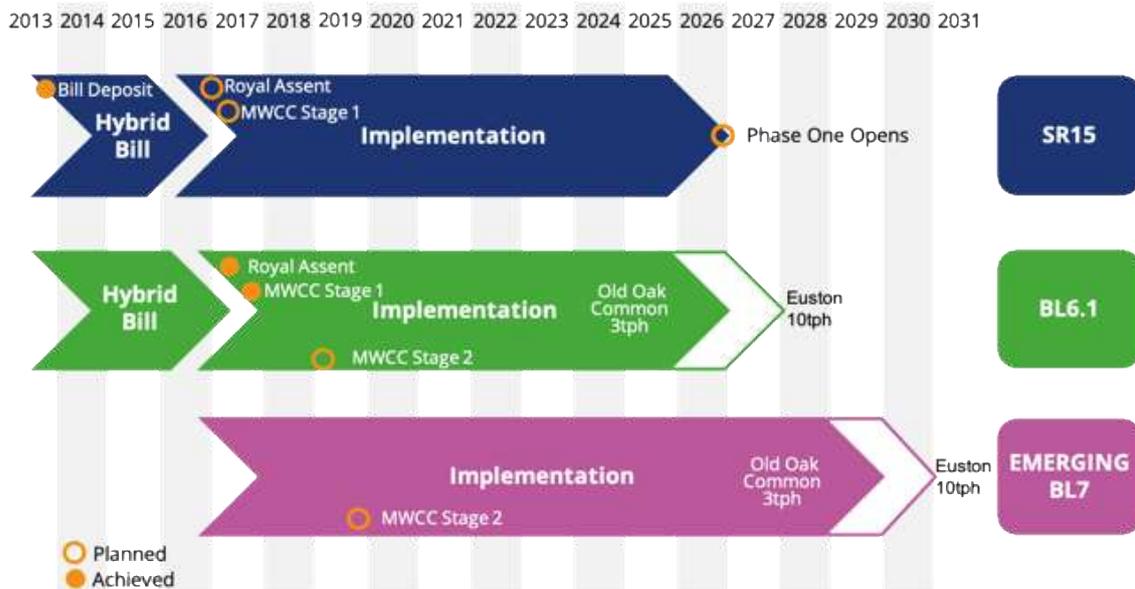


Figure 4: Evolution of Phase One schedule

Schedules for stations, railway systems (track, power, signalling etc.) and Phase 2a works will all continue to mature as these progress through their development and procurement cycles.

Cost

A Funding Envelope for Phase One of £27.6bn⁵ was set in the 2015 Spending Review.

The funding at SR15 took into account estimates (Baseline 5 in April 2015) based on initial client estimates derived from desktop drawings for the hybrid Bill and without the benefit of any investigation of ground conditions or similar levels of detail across all areas of scope.

Baseline 6 (April 2016) was created, primarily, to establish a robust and consistent HS2 client cost plan which would support the Main Works Civils Contractors (MWCC) Invitation to Tender (ITT) process. This was still overwhelmingly a client estimate with only 3.4% derived from professional services consultants. It was derived from the hybrid Bill, Environmental Statement, work banks and standardised asset models that together captured the scope at the appropriate level of detail. It also sought to drive efficiencies into the programme to remain within the allocated funding. A 'Periodic Update' review by the Cabinet Secretary later in 2016 highlighted further potential efficiencies through benchmarking HS2 against international high-speed railway projects and suggesting potential cost-saving opportunities. These efficiencies depended on innovation by the supply chain in methods of construction, off-site manufacturing, investment in technical skills and new types of plant and equipment, and European approaches to site

⁵ Including [REDACTED]

management. However, these savings have largely not been realised in practice, particularly on the non-tunnelled sections of the Phase One route.

These were considered and used as inputs to an updated Baseline 6.1 in April 2017 together with consolidated changes arising from the hybrid Bill, an updated property cost estimate and an updated rolling stock and depots estimate.

Baseline 7 is the first baseline which has significant input from the construction industry (rather than professional services contracts) following the appointment of enabling works contractors (EWCs, November 2016), main works civils contractors (MWCCs July 2017), use of the Network Rail framework rates (from December 2016) and station design services contractors (SDSCs, February 2018). Baseline 7 is derived from contractor input (50% by value), professional services / design consultant input (23%) and client-led estimates (27%).

The delivery model for Phase One MWCCs envisaged a two-stage contracting process, with early contractor engagement an important part of the model. This followed learning from other major infrastructure projects to contract on a scheme design where scope and change had been agreed prior to detailed design and construction.

Incorporating MWCC Gateway 5 submissions led to an interim emerging estimate for Baseline 7 in May 2019 of £30.4bn (point estimate, 1Q 2015 prices).

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

This represents an increase of £8.3bn over Baseline 6.1. To re-establish an appropriate contingency provision would require Phase One funding in the range £36.1bn to £38.4bn.

| Funding ⁶ | | Baseline 6.1 ⁷ | | Emerging Estimate ⁸ | | Estimate at Completion ⁹ | |
|---------------------------------|----------------------------------|--------------------------------|----------------------------------------|--------------------------------|----------------------------------------|--------------------------------------|-------------------------------------|
| Funding Envelope at SR15 (£/bn) | Adjusted Funding Envelope (£/bn) | Point Estimate (£/bn) | Contingency to Funding Envelope (£/bn) | Point Estimate (£/bn) (A) | Contingency to Funding Envelope (£/bn) | Appropriate Contingency (£/bn) (B) | Estimate at Completion (£/bn) (A+B) |
| 27.2 | 27.6 | 20.6 | 7.0 (37% of costs to go) | 28.9 ¹⁰ | -1.3 (-6% of cost to go) | 7.2 to 9.5 (30-40% of cost to go) | 36.1 to 38.4 |
| Funding for all costs and risk | | Point estimates excluding risk | | | | Including contingency to manage risk | |

Table 1: Evolution of Phase One cost estimates from SR15 to emerging position

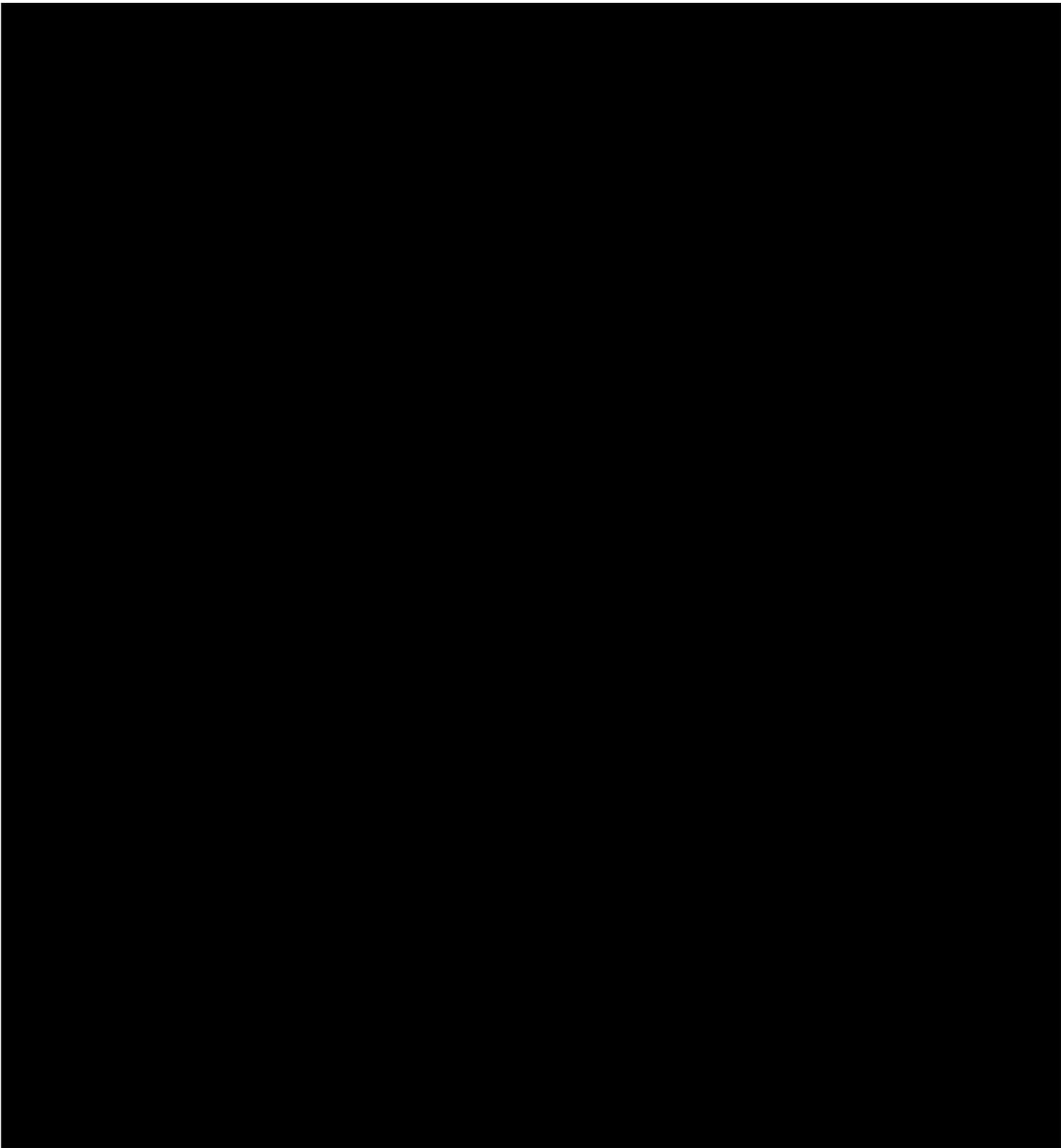
⁶ Adjusted Funding Envelope includes [REDACTED]

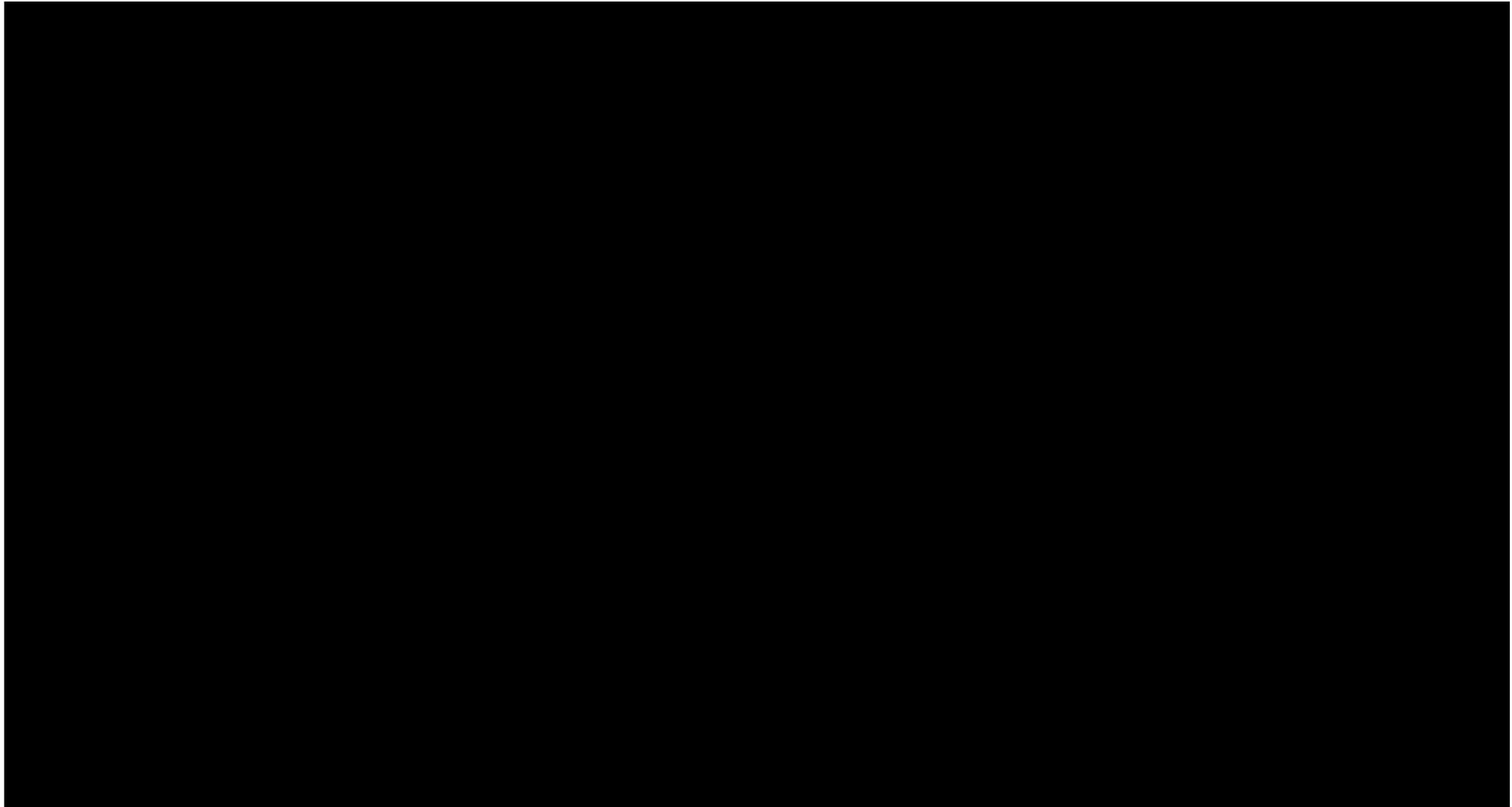
⁷ Baselines include assumed efficiencies

⁸ Emerging Estimates exclude assumed efficiencies

⁹ Assessed based on emerging Point Estimate with contingency appropriate to level of maturity

¹⁰ Phase One point estimate includes [REDACTED]





Indirect Costs

Indirect costs, also known as 'preliminaries', cover the cost of administering a project including provision of staff for management and design; site-based costs such as accommodation and security; and contractors' fees.

[REDACTED]

At Baseline 6.1, Indirects were based on assured¹¹ typical industry benchmark rates. However, Baseline 7.0 incorporates the MWCCs' latest assessment ('Gateway 5') based on up-to-date market information and actual site constraints and logistics. This shows that:

- The MWCCs' construction schedules, each around 2 years longer than estimated at B6.1, has a significant impact on time related preliminaries such as management, design, accommodation, site wide services and security.
- The MWCCs have all cited the scale and complexity and sheer geographical length, and associated site access, security, logistics and health and safety requirements as requiring them to employ large management teams. For example, all the contractors have stated that they need much higher volumes of security and temporary / permanent fencing than was allowed for in the client's BL6.1 estimate.

- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

¹¹ Assurance following the standard three lines of defence (LOD) model

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]

Phase 2a

Progress to date

The Phase 2a (West Midlands to Crewe) hybrid Bill is progressing on schedule. Final hearings in the House of Commons Select Committee for Phase 2a took place on 15th May 2019 which represents a significant milestone in the Bill's passage through Parliament. The Bill passed its Second Reading in the House of Commons on 30 January 2018 with a majority of 25:1. The Third Reading of the Bill is expected in the House of Commons before the Summer Recess (July 2019).

Schedule

As described above, Phase 2a was announced in November 2015 as being accelerated ahead of the rest of Phase Two in order to bring forward the benefits of additional

capacity and improved journey times for services joining the West Coast Main Line at Crewe.

Royal Assent for Phase 2a is expected at the end of 2019 and, as described above, Baseline 6.1 introduced the concept of incorporating Phase 2a into the staged opening plans for Phase One, as shown in Figure 7.



Figure 7: Evolution of Phase 2a schedule

The emerging schedule for Phase 2a supports that alignment with Phase One, acknowledging the importance of allowing sufficient time for all stages of procurement, enabling works, civils works (including high volumes of earthworks), railway systems and integration with the existing rail network.

Cost

A Funding Envelope for Phase 2a of £3.5bn¹⁴ was set in the 2015 Spending Review.

For Phase 2a, the estimate at SR15 represented the first initial view of accelerating implementation of the route to Crewe from the overall Phase Two budget. The SR15 figure shown above includes an adjustment for the later transfer of some scope at Crewe from Phase 2a to 2b.

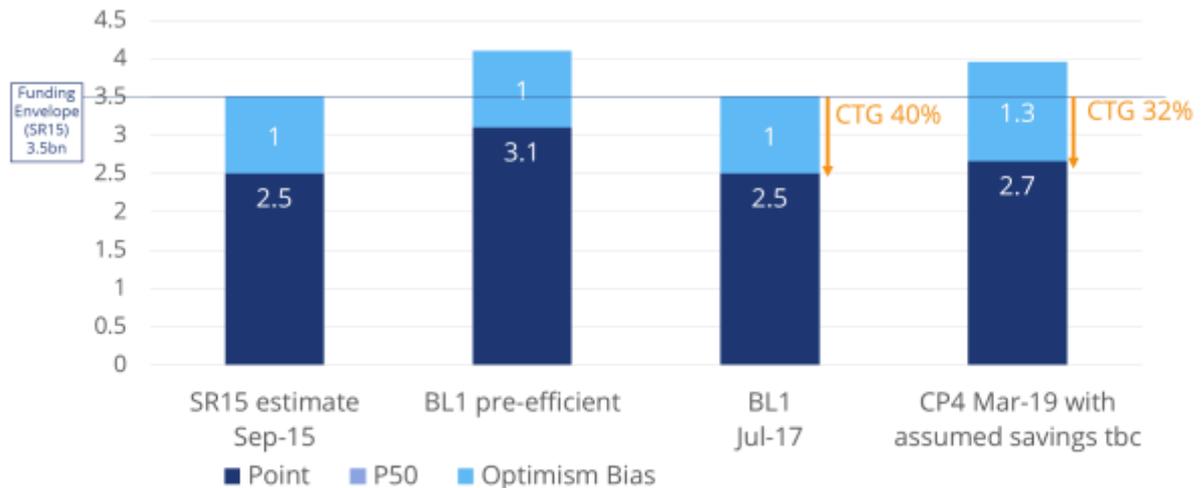
As Phase 2a matured from SR15 (September 2015) to Baseline 1 (July 2017 for Phase 2a), the estimate took account of environmental mitigations and standards to align with the hybrid Bill design, re-location of the Infrastructure Maintenance Base-rail from Crewe to Stone, removal of maintenance loops and the adoption of slab track. Baseline 1 also assumed that [REDACTED]. The overall estimate at BL1 matched that at SR15.

¹⁴ [REDACTED]

The emerging Phase 2a estimate (March 2019) shows [REDACTED] from further maturity and design development, including [REDACTED].

| Funding ¹⁵ | | Baseline 1 ¹⁶ | | Emerging Estimate ¹⁷ | | Estimate at Completion ¹⁸ | |
|---------------------------------|----------------------------------|--------------------------------|----------------------------------------|---------------------------------|----------------------------------------|------------------------------------------|-------------------------------------|
| Funding Envelope at SR15 (£/bn) | Adjusted Funding Envelope (£/bn) | Point Estimate (£/bn) | Contingency to Funding Envelope (£/bn) | Point Estimate (£/bn) (A) | Contingency to Funding Envelope (£/bn) | Appropriate Contingency (£/bn) (B) | Estimate at Completion (£/bn) (A+B) |
| 3.7 | 3.5 | 2.5 | 1.0 (40% of Point Estimate) | 2.7 ¹⁹ | 0.8 (31% of Point Estimate) | 0.9 to 1.3 (35-50% of Point Estimate) | 3.6 to 4.0 |
| Funding for all costs and risk | | Point estimates excluding risk | | | | Including contingency to manage risk | |

Table 2: Evolution of Phase 2a cost estimates from SR15 to emerging position



Notes: All at 1Q 2015 prices
Funding Envelopes and cost estimates shown net of transfer from 2a to 2b for contribution to extended Crewe tunnel

Figure 8: Evolution of Phase 2a cost estimates

All of these are point estimates to which an appropriate contingency should be added in order to understand the likely funding need. Given the current level of maturity, this

¹⁵ Adjusted Funding Envelope includes transfer of [REDACTED] from Ph2a to 2b of a contribution to extended Crewe tunnel

¹⁶ Baselines include assumed efficiencies

¹⁷ Emerging Estimates exclude assumed efficiencies

¹⁸ Assessed based on emerging Point Estimate with contingency appropriate to level of maturity

¹⁹ Phase 2a point estimate includes [REDACTED] to be confirmed through Baseline development

stocktake has assumed a range of 35-50% contingency might be required, leading to an overall emerging estimate for Phase 2a of £3.6bn to £4.0bn.

Phase 2b

Progress to date

At the same time as building Phase One and seeking Royal Assent for Phase 2a, HS2 Ltd continues to develop and refine the scheme for Phase 2b, which will see HS2 extended to the Midlands and the North on a new network. Infrastructure and junctions on the Phase 2b route include passive provision for the delivery of NPR and will be the backbone on which their ambitions can be realised. This has seen continued close working with TfN to ensure the hybrid Bill for Phase 2b reflects these ambitions. Public consultations on the Working Draft Environmental Statement and Equalities Impact Assessment for the 2b route closed in December 2018 and further consultation will take place this year on our route refinement proposals. The programme team expects to submit the hybrid Bill for this final phase of HS2 in 2020.

TfN's final Strategic Transport Plan identified the most important corridors for investment on road and rail in February 2019 and has placed NPR at the heart of its broader transport strategy. TfN and the DfT have developed a Strategic Outline Business Case (SOBC) for NPR. However, route decisions and funding options are still to be determined.

Many Local Authorities have not waited for HS2 to get underway but have initiated their growth strategies and plans on the basis of the planned arrival of HS2. Birmingham city centre is already experiencing an economic dividend from HS2, evident in the extensive redevelopment in the city centre.

Schedule

The opening of the full HS2 "Y" network was considered, in 2014, achievable in around 2033. As well as being a long-term forecast, this was based on Royal Assent by 2020 for a Phase Two hybrid Bill.

In Baseline 1, Royal Assent was to be in October 2022 (with Bill deposit in September 2019). And in the emerging schedule, Royal Assent is set at Dec 2023 (based on a Bill deposit in June 2020).

Baseline 1 was developed on the basis that construction activities could be fitted within the reduced time between Royal Assent and 2033 which would have required the hybrid Bill not to place any significant demands on environmental mitigations or constraints on lorry movements during construction.



Figure 9: Evolution of Phase 2b schedule

The emerging schedule for Phase 2b (an as-yet-unassured post-CP2 development activity) allows for the currently assumed Bill deposit date of June 2020, parliamentary timescales informed by experience from Phase One, and a schedule that takes into account a view of likely construction constraints and resources. This gives an earliest delivery into service date – without any float or allowance for additional scope expected to be instructed by DfT – in the mid 2030s. It is therefore more appropriate at this stage of development to indicate that Phase 2b could be opened between 2035 and 2040.

Cost

A Funding Envelope for Phase 2b of £25.1bn²⁰ was set in the 2015 Spending Review.

The SR15 funding was based on client estimates that pre-dated the existence of any formal baseline (Baseline 1 was developed in 2018 and Baseline 2 is currently in preparation). The estimates at SR15 - for Phases 2a and 2b separately - were based on advice, but not design, from engineering consultants, with route options defined but with ground conditions and the extent of tunnelling and demolitions unknown.

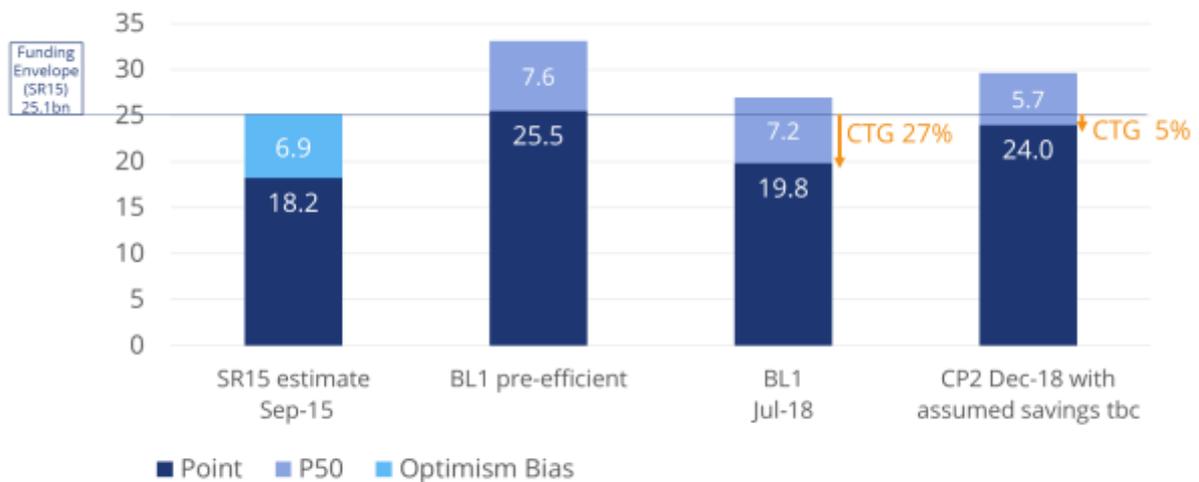
Baseline 2 will be based on the defined Phase Two route supported by preliminary designs from our engineering consultants, but still at a level of maturity commensurate with the early stages of development - Phase 2b remains literally on the drawing board.

The differences between the SR15 estimates and the emerging but as-yet-unassured inputs to Baseline 2 are as follows (all in 1Q 2015 prices):

²⁰

| Funding ²¹ | | Baseline 1 ²² | | Emerging Estimate ²³ | | Estimate at Completion ²⁴ | |
|---------------------------------|----------------------------------|--------------------------------|----------------------------------------|---------------------------------|----------------------------------------|-------------------------------------------|-------------------------------------|
| Funding Envelope at SR15 (£/bn) | Adjusted Funding Envelope (£/bn) | Point Estimate (£/bn) | Contingency to Funding Envelope (£/bn) | Point Estimate (£/bn) (A) | Contingency to Funding Envelope (£/bn) | Appropriate Contingency (£/bn) (B) | Estimate at Completion (£/bn) (A+B) |
| 24.8 | 25.1 | 19.8 | 5.3 (27% of Point Estimate) | 24.0 ²⁵ | 1.1 (5% of Point Estimate) | 8.4 to 12.0 (35-50% of Point Estimate) | 32.4 to 36.0 |
| Funding for all costs and risk | | Point estimates excluding risk | | | | Including contingency to manage risk | |

Table 3: Evolution of Phase 2b cost estimates from SR15 to emerging position



Notes: All at 1Q 2015 prices
Funding Envelopes and cost estimates shown net of transfer from 2a to 2b for contribution to extended Crewe tunnel

Figure 10: Evolution of Phase 2b cost estimates

Phase 2b is at a significantly earlier stage of development than either Phase One or 2a. The changes between SR15 (September 2015), Baseline 1 (July 2018 for Phase 2b) and the emerging estimate (CP2 at December 2018) represent increasing maturity of design as progress is made towards a hybrid Bill for Phase 2b.

From SR15 to Baseline 1, design development led to an increase [REDACTED] as follows, all at 1Q 2015 prices:

- Land and Property [REDACTED]
- Infrastructure Capital costs [REDACTED]
- Infrastructure Indirect costs [REDACTED]
- Rolling Stock Depots (Inc. indirect costs) [REDACTED]
- Rolling Stock, operations and maintenance and wider network works [REDACTED]

²¹ Adjusted Funding Envelope includes transfer of [REDACTED] from Ph2a to 2b of a contribution to extended Crewe tunnel

²² Baselines include assumed efficiencies

²³ Emerging Estimates exclude assumed efficiencies

²⁴ Assessed based on emerging Point Estimate with contingency appropriate to level of maturity

²⁵ Phase 2b point estimate includes [REDACTED] to be confirmed through Baseline development

The key drivers of these increased estimates are ongoing design development including development of the rolling stock and depot strategy, further assessment of the cost of alterations to the existing rail network to achieve fully integrated services, and further work on land and property costs. As would be expected at this stage of maturity, the scheme is taking into account developing operational assessments (depot locations and maintenance plans) and stakeholder input (driving costs in stations and elsewhere).

Baseline 1 for Phase 2b included [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED].

As discussed with MPRG on 30 June 2019, realistic value engineering savings could be expected to reduce the point estimate by [REDACTED], giving a net point estimate of c£24.0bn in this stocktake.

The emerging estimate (CP2.1 is planned for July 2019) will be further developed towards Baseline 2 (due in early 2020) and will reflect additional scope expected to be instructed by the DfT including touchpoints with NPR and electrification of sections of the Midland Main Line, for which commensurate funding will be required.

All of these are point estimates to which should be added an appropriate contingency in order to understand the likely funding need. For Phase 2b, [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED].

PROGRAMME-WIDE

Schedule and Cost Summary

Taking the programme in its entirety, and noting the differences in maturity between Phases One, 2a and 2b, the emerging overall schedule and funding requirement are estimated to be:

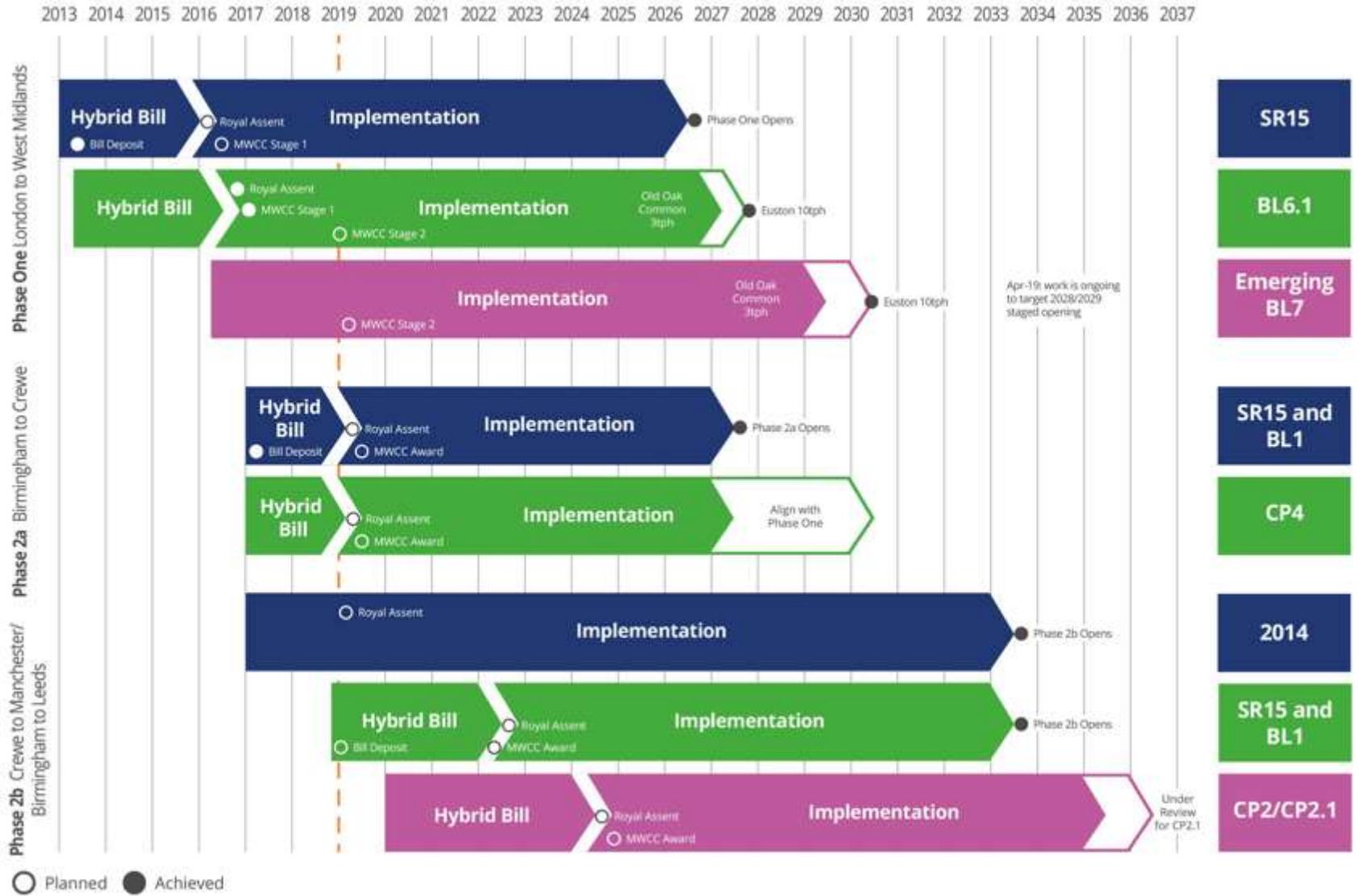


Figure 11: Evolution of HS2 schedules

| Funding ²⁶ | | | Baseline ²⁷ | | Emerging Estimates ²⁸ | | Estimate at Completion ²⁹ | |
|--------------------------------|---------------------------------|----------------------------------|--------------------------------|----------------------------------------|----------------------------------|----------------------------------------|-------------------------------------------|-------------------------------------|
| | Funding Envelope at SR15 (£/bn) | Funding Envelope adjusted (£/bn) | Point Estimate (£/bn) | Contingency to Funding Envelope (£/bn) | Point Estimate (£/bn) (A) | Contingency to Funding Envelope (£/bn) | Appropriate Contingency (£/bn) (B) | Estimate at Completion (£/bn) (A+B) |
| Phase One | 27.2 | 27.6 | 20.6 | 7.0 (37% of costs to go) | 28.9 | -1.3 (-6% of costs to go) | 7.2 to 9.5 (30-40% of cost to go) | 36.1 to 38.4 |
| Phase 2a | 3.7 | 3.5 | 2.5 | 1.0 (40% of Point Estimate) | 2.7 | 0.8 (31% of Point Estimate) | 0.9 to 1.3 (35-50% of Point estimate) | 3.6 to 4.0 |
| Phase 2b | 24.8 | 25.1 | 19.8 | 5.3 (27% of Point Estimate) | 24.0 | 1.1 (5% of Point Estimate) | 8.4 to 12.0 (35-50% of Point Estimate) | 32.4 to 36.0 |
| | 55.7 | 56.2 | 42.9 | 13.3 (31%) | 55.6 | 0.6 (1%) | 16.5 to 22.8 | 72.1 to 78.4 |
| Funding for all costs and risk | | | Point estimates excluding risk | | | | Funding for all costs and risk | |

Table 4: Evolution of HS2 costs

This indicates an incremental delivery across the Phases from 2029 onwards for Phases One and 2a, followed by Phase 2b between 2035 and 2040, and with an overall funding requirement in the range £72.1bn to £78.4bn.

SCOPE

While continuing to seek to address the schedule and cost pressures, HS2 Ltd is assessing options which could lead to a more affordable scope for HS2 Ltd to deliver in conjunction with greater integration with NPR and Midlands Connect. This will not only help ensure maximum synergies between HS2 and regional services, but also help strengthen the approach to manage and break the programme into manageable proportions, delivered effectively and sustainably over a longer timescale.

In addition to assessing scope options, HS2 Ltd has examined the Sponsor's Requirements set by the DfT to challenge any aspirations for excellence that may be driving cost for little benefit. The initial assessment is that the primary drivers of cost are the required service pattern (addressed through the scope options above) rather than requirements to build a railway that follows best practice in safety, operations and maintenance, and environmental sustainability.

²⁶ Adjusted Funding Envelope includes [REDACTED]

²⁷ Baselines include assumed efficiencies

²⁸ Emerging Estimates exclude assumed efficiencies

²⁹ Assessed need based on emerging Point Estimate with contingency appropriate to level of maturity

It must be recognised that HS2 is providing some scope that would be needed anyway, e.g. improvements at Euston to the London Underground station and a new Network Rail concourse, to meet rising demands, a pedestrian link to Euston Square, and upgraded assets for the existing railway such as replacement of life-expired Pendolino trains. Further assessment is required to establish these contributions so that HS2 is recognised for building assets (those listed above and others such as Birmingham International Station) from which non-HS2 passengers will also benefit.

The benefits of HS2's investment – current and proposed - are shared across other networks. For example, many of the activities undertaken by NR on the HS2 programme are, in turn, reducing the need for other NR spending on enhancements or maintenance.

It is also the case that, as the Northern elements of HS2 are increasingly developed more closely and as part of NPR, aspects of this might better be funded by NPR directly.

[REDACTED]

[REDACTED]

CAPABILITY

Under the leadership of the Executive team, the company has been tackling the cost and schedule challenges under a number of dedicated work streams. It is recognised that we can do even more in relation to improving cost and schedule, reviewing potential scope options and seeking alternative sources of finance and funding.

As the programme develops, HS2 Ltd is continually assessing and improving how the company operates. Project Evolve is tasked with exploring possible options to make sure that we have the best possible delivery model to support the Phase One programme. The introduction of Integrated Project Teams working jointly across the client-contractor divide is a clear example of that approach. However, while this will allow the team to continue to challenge the costs, my assessment is that this will not, in itself, move the needle far enough to bring the project within the funding envelope with appropriate contingency. So, while I along with the Board will continue to challenge the organisation to provide and then improve on robust estimates for delivering a railway that meets the

strategic goals and offers real value for money, we also need to be realistic about the full cost – and the schedule in which it can be built.

At the same time, the experience of Crossrail, and other major projects as addressed in the recent report *Lessons From Transport For The Sponsorship Of Major Projects* (April 2019) by the DfT and Infrastructure and Projects Authority (IPA) underlines the importance of rigorous governance, an open culture and organisational capability in the successful delivery of major projects. I will continue to challenge the team to create an organisation with the right role and capabilities while driving down internal overhead costs. Transparency and integrity of reporting is at the heart of delivering public value for money.

So too, however, is ensuring a stable and maturing supply chain. The European infrastructure managers' report that working with the supply chain on a stable long-term pipeline of work creates confidence and leads to reductions in unit rates of up to 20%³⁰.

[REDACTED]

³⁰ European Infrastructure Managers Report, 2019

<http://www.eimrail.org/publications/press-release/the-european-rail-infrastructure-ceos-discuss-about-the-rail-sector-s-future>

Conclusions & Recommendations

Strategy & Coordination

HS2 is the right strategic approach for Britain; a once in a generation opportunity to join up the country in a way that reflects the aspirations and demands of this century rather than those of the nineteenth. No other scheme delivers similar capacity, connectivity or transformational economic rebalancing.

In terms of meeting our growing transport needs there is no realistic alternative to relieve overcrowding and congestion on the roads and rail links between London, Birmingham, Manchester and Leeds and more generally within and between the Midlands and the North.

HS2 will also provide the basis for driving improved productivity, economic growth and regeneration in regions across the country by better joining up our key Supply Chains. It is at the core of the UK's Industrial Strategy. HS2 should be the backbone of this country's approach to planning its future, not just in terms of transport and the wider economy, but also how we meet the demand for more affordable housing and a sustainable environment.

HS2 was set up, in effect, as a stand-alone programme. Over time it has become more integrated into overall transport policy at a regional and central government level, but that process needs to go much further and embrace the full implications and ramifications of the programme across the full spectrum of social and economic policy. HS2 is a national endeavour and it needs to be thought of, organised and resourced in a way which recognises not just the scale of that ambition but also the size and complexity of the task - as well as the huge opportunity it represents to deliver a more prosperous, balanced and fairer Britain.

Integration of HS2 with the conventional railway and with Network Rail (NR) will be vital. NR is the operator of the existing network, HS2's partner in the redevelopment of Euston Station and elsewhere, and a supplier to HS2 Ltd for works on the operational railway. Mark Thurston and Andrew Haines (NR's Chief Executive) are aligned in their desire to build a strong coordinated approach to HS2. That co-ordination needs to be intensified and include our regional partners.

Transport for the North, Northern Powerhouse Rail and Midlands Connect have all come into existence since HS2 was originally conceived. They too must be fully integrated in how, collectively, we plan and deliver a future rail network. Not surprisingly given their relatively recent birth, strategic planning and developing proposals for other new railway enhancements and systems remains at an early stage. There remains a gap in the strategic development and planning of future railway systems that needs to be addressed in order to create a coherent delivery model that maximises the benefit both to individual

regions and the country as a whole and delivers that model in the most cost-effective way. That gap needs to be closed as a matter of some urgency.

[REDACTED]

The transport network, however, is not an end in itself. Rather it is an enabler to help deliver a range of economic and social objectives. As such HS2, in particular, and transport in general needs to be better integrated into thinking about how to deliver those objectives, whether it is the Industrial Strategy, housing policy or the creation of a sustainable environment.

Recommendation 1

Recommendation 1: Think strategically; deliver in more manageable pieces

The HS2 programme needs to be reset and restructured to reflect the maturity of the different phases: Phase One is under way and should be delivered as planned, albeit to a more realistic timescale; Phase 2a should complete its passage through Parliament and then be amalgamated with Phase One for delivery; and the strategy for Phase 2b should be reviewed with a view to greater integration with other schemes, and then delivered in manageable steps to suit that strategy.

HS2 is working with business leaders in the North and Midlands who are already investing in anticipation of HS2 and there is a real opportunity to re-plan Phase 2b more closely with proposals for NPR, TfN, Midlands Connect and NR enhancements. Consideration is and should continue to be given to how these HS2 Phases, NPR works, and NR enhancements might be planned and / or built in a more seamless, integrated manner. Within such an integrated strategic plan, we should consider whether delivery could be organised in smaller, more manageable sections. It is possible to anticipate a 'rolling programme' of major rail works in the North of England and the Midlands, blending these improvements with the existing and proposed rail network.

The following steps and measures are proposed in response to this recommendation:

- The Phase One target delivery date of December 2026 should become a more realistic, manageable and cost effective staged opening between 2028 and 2031.
- The delivery of Phase 2a to be configured and timed to more closely to align with the Phase One schedule such that we can achieve London to Crewe rather than

just Birmingham. This should be agreed with DfT and HS2 and communicated by **November 2019**.

- Much work has been done to date to ensure NPR and HS2 work cohesively together. Elements of the HS2 design incorporate several NPR touchpoints. NPR could use c.80km of HS2 lines into Manchester and Leeds as part of its current designs. This represents more than 50% of the total new lines needed for NPR. HS2 stands ready to lead on a **3-month strategic study** outlining these types of interfaces and opportunities between HS2 and NPR, as well as TfN, Midlands Connect and NR. The study will also assess the potential to approach Phase Two into smaller delivery areas and set out the priority in which elements of the scheme can be assessed without impacting the hybrid Bill deposit date. By closer alignment of HS2 with NPR, we can consider how the Northern cities can be connected to achieve the best balance of cost between the two. The study outputs will include a proposal for a strategic rolling programme of works.
- The above activity to be reinforced with stakeholder engagement activity led by the HS2 Chairman with leaders in the North and Midlands. A plan of activities will be set out with the objective of joint consensus of HS2's proposed approach within the study. The project aims to achieve this by **November 2019**.

Capturing further benefits

The current economic case for HS2 is robust despite higher costs and the current conservative approach to benefits. This approach does not reflect either the strategic ambition of the project or the transformational effect it will have economically and socially. Those wider benefits from HS2 are being understated.

The approach to estimating benefits that is being applied to HS2 was designed for conventional, standalone transport projects. The benefits from transformational programmes such as HS2 are significantly more difficult to capture. The method currently used to estimate benefits explicitly excludes the benefits arising from changing land use patterns over time. Yet we have seen how projects such as the Jubilee Line Extension have radically re-shaped economic geography. There is already qualitative evidence from Birmingham that land use patterns are being reshaped. The benefits assessment period of 60 years from scheme opening is too short given the UK's track record of maintaining core rail routes over 150 years.

The HS2 business case demands a broader, more strategic assessment of benefits to fully reflect the breadth, depth and duration of its impact.

Recommendation 2

Recommendation 2: Develop a methodology that better reflects the long term and transformational changes that will be brought about by programmes such as HS2.

The existing cost / benefit model was not designed with transformational programmes such as HS2 in mind. A new assessment method is required that captures the true scale of the benefit and extent of the timescale over which that benefit will be delivered. HS2 is more environmentally sustainable than road or air transport and will dramatically change land values over the next century at least. The current model, which does not fully reflect that change in value and is capped at 60 years, is not adequate. HS2 has already started to take the lead in helping to develop a new approach that better reflects the wider and longer term benefits of HS2 and consider how that could be reflected in its Full Business Case for Phase One. The following describe the steps to deliver this recommendation:

- Develop a methodology proposal (**August 2019**) that considers factors currently discounted by the standard 'WebTAG' approach, including the long term value that the HS2 railway will deliver, the regeneration benefits around stations and benefits during the construction period such as jobs and skills. This is also an opportunity to reaffirm the responsibilities and accountabilities for delivery of benefits set out in the HS2 Benefits Strategy.
- Understand the provisional implications for the benefit-cost ratio (BCR) (**September 2019**) and test the approach with the DfT, HMT and independent reviewers.
- Provide a revised BCR as part of HS2's Full Business Case for Phase One (anticipated in **December 2019**).
- Identify and develop further improvements to the method for estimating the benefits of HS2 to support future business cases for Phase Two of HS2 (**March 2020**).

Phase One

Work on a revised baseline for Phase One is not yet complete. The budget of £27bn was set (in practice in 2013, before the scheme was designed and then uprated for inflation in 2015) at a level intended to provide a 95% confidence level of success. There is no prospect of being able to deliver Phase One on the current basis within this budget. The latest evidence – from the supply chain, HS2 Ltd and independent benchmarking – suggests that a funding envelope of £36bn to £38bn would be required to achieve an acceptable level of confidence, with the current scope and commercial and operational models. Greater precision on this will require further assurance.

It is also clear that opening any part of Phase One in December 2026 is not viable and that a focus on an aggressive schedule would prevent the adoption of the most economic and efficient approach to the programme. While we need to maintain momentum and realise the benefits as soon as realistic, it would be more prudent to plan for an opening between 2028 and 2031. Based on recent experience from major rail projects, it is proposed that any opening of services should be introduced in a staged manner. Greater precision will require further assurance and depends, critically, on progress with the current civil works contractors.

Phase Two

Work on the schedule and costs for Phases 2a and 2b is still relatively immature. Phase 2a is currently making good progress through Parliament. It is working to a provisional budget of £3.5bn. The latest estimated cost to complete is in the range of £3.6bn to £4.0bn and in a timeframe to align with Phase One.

Phase 2b is a major undertaking and is already facing cost and schedule pressures. It is larger than Phases One and 2a combined but has a smaller budget. It tackles more challenging geology as well as entering two major new city centres – Manchester and Leeds – on entirely new lines. Additional scope has also been introduced into Phase 2b which needs to be reviewed against affordability and funding arrangements. The status of the estimating work on Phase 2b is incomplete and therefore an opportune time for HS2 and DfT to undertake a review of the full Phase 2b scope in line with potential re-phasing as outlined in Recommendation 1 – specifically looking at HS2 core route areas and interdependencies that could be delivered in conjunction with other schemes.

Lessons learned from Phase One in terms of contract design need to be applied to Phase Two. The current cost forecast for Phase 2b is in the range of £32 to £36bn. The critical path will be determined by the timetable for completing Phase 2b works at Euston Station in the South, and Manchester Piccadilly in the North. Current schedules would suggest that it would be prudent to plan on opening Phase 2b within a range of 2035 to 2040.

Recommendation 3

Recommendation 3: Continue to challenge costs and derive further efficiencies within the proposed scope of the railway.

Value-engineering has helped to reduce cost estimates already on Phase One and there are indications that opportunities for reducing costs remain through reviewing the engineering assumptions that underlie Phases 2a and 2b. I will continue to use Professor Andrew McNaughton, Lord Mair and Professor William Powrie to work with the HS2 Ltd Chief Engineer to examine the engineering assumptions behind existing designs. The value engineering on MWCC to date has been far reaching and it is not anticipated that there is significant additional cost reduction available in this area. As other areas develop in maturity, so the focus of value engineering and cost scrutiny will shift accordingly to drive best value for money throughout the programme.

The value engineering to date has been far reaching and it is not anticipated that there is significant additional cost reduction available.

On Phase One, main works civils opportunities need to be captured by the end of **August 2019** with recommendations put forward for consideration to the Chief Engineer. A particular study of the requirements related to derailment risk mitigation is already underway. With detailed design submissions coming in from the joint venture design companies, HS2 Ltd should continue to strongly challenge for and seek out value engineering savings at each design stage gate.

The project teams are also considering whether reducing the project's physical footprint in certain locations is feasible, for example at Euston. An assessment of this is to continue with the respective design teams by **December 2019**.

In addition to the Tunnelling Technical Challenge group, Terms of Reference are to be developed by **mid-August 2019** for a Geotechnical and Civils Technical Challenge Group. Similar challenge groups proved successful in reducing cost and risk on previous projects such as HS1 and Thames Tideway, and would be likely to have a positive impact for HS2.

The Government's Transport Infrastructure Efficiency Strategy has identified a lack of benchmarking across the sector. While HS2 Ltd has used benchmarking to support its revised baseline for Phase One, benchmarking needs to be deployed more uniformly to help keep pressure on costs through the programme's life cycle.

The Board will continue to demand evidence from management that it is driving out the most cost-effective delivery of the scheme on behalf of the taxpayer.

Recommendation 4

Recommendation 4: Re-set the funding arrangements for HS2.

The current proposed funding arrangements for the programme has proved unrealistic for the scale and complexity of HS2. Given the cost and time pressures, HS2 will need to work with DfT and HMT to update the funding arrangements and agree the funding envelope for the programme. This should be done for Phase One and Phase 2a in conjunction with seeking authority for Notice to Proceed (NTP) for Stage 2 of the main works civils contracts.

It is acknowledged that an upward revision of the funding envelope will have an impact on the economic case for the scheme. However, learning from past projects, it is imperative to place this programme on a sustainable footing at this stage – rather than enter construction with an over optimistic view on budget and contingency.

I recommend that a similar process for the Phase 2b budget takes place following the strategic review work (see Recommendation 1) and the development of Baseline 2.

As part of this work, it is important to acknowledge that HS2 is creating large value uplifts in the places it serves and in the assets it creates. Alternative funding and finance opportunities must be considered in addition to the ongoing activities on cost and schedule. We should continue to explore opportunities with the private sector, local authorities, development agencies and other local stakeholders to assist with funding in return for future revenues. In parallel with maintaining pressure on costs, HS2 Ltd, with Government, should take further steps to realise value from its assets, especially around land and property in city centres.

HS2 has identified development opportunities with an outturn value across the full line of route in the order of [REDACTED]. The commercial development portfolio comprises: Over-Site Development (OSD) opportunities at stations and depots (including Euston); in-station retail; advertising and car parks. In addition, opportunities to privately finance [REDACTED]

Prior to NTP, HS2 Ltd will seek to gain authority and delegation from HMT and DfT to be able to maximise and capture commercial development value to fund the programme. To achieve this, HS2 will identify the optimum corporate structure (related to Recommendation 7) that will best align motivations and optimise value-creating opportunities especially around its stations.

In addition, HS2 will continue to explore Private Finance opportunities both pre and post construction for [REDACTED]. This workstream has already had input and advice from IPA and HMT and will conclude its findings by **December 2019**.

Supply chain

The supply chain faces its own specific challenges in meeting the demands of a programme of the size and complexity of HS2. The programme has also developed alongside some fundamental changes in the supply chain within the UK. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

This demands a flexibility and creativity in future contracting arrangements supported by different sources of financing that allows an appropriate distribution of risk for the different types of work within the programme (e.g. stations have different risk profiles from railway systems). Collectively, we need to learn from Crossrail's and HS2's experience to date, both for the programme itself and as we plan other mega projects in this country. Increased contracting flexibility will need to consider the size of the contracting market available and how best to manage the interface and integration risk. In addition, the procurement process' need to be robust enough to ensure HS2 is future proofed against any potential litigation and challenge.

The UK Government recognises systemic issues that still limit the performance of UK infrastructure projects as set out in its' report *Transforming Infrastructure Performance*³¹. The scale of HS2 presents an opportunity to make a significant contribution to enhancing collaboration and contracting arrangements with businesses within the UK. The relationship and collaboration between the UK supply chain and HS2 is already strong and provides a solid platform for further thinking in this area.

Recommendation 5

Recommendation 5: Promote greater and continued collaboration with the supply chain.

A number of lessons have been learned from the contracting strategy on Phase One. HS2 Ltd is in advanced discussions with DfT and the IPA on the procurement and delivery approach for Phases 2a and 2b and should continue these until an overall strategy is agreed upon on by **October 2019**.

As part of a flexible contracting approach, improvements need to be found in the use of existing government frameworks and how they could help programmes and projects like HS2 get to market more quickly and reduce the associated costs of going to market for both HS2 and the supply chain.

³¹ Transforming Infrastructure Performance, 2017

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664920/transforming_infrastructure_performance_web.pdf

HS2's approach to collaboration and integrated project team delivery aligns closely with Project 13 (which has been developed by the Infrastructure Client Group - ICG). As such the scale of HS2 is already taking a leading industry position and government should work closely with HS2 to ensure maximum learning is extracted for other projects. HS2 is a huge opportunity for the UK to rebuild its construction capability. HS2 should continue working with the other ICG members on the future pipeline of supply and demand and ways in which the UK can create more opportunities for overseas contractors to participate, particularly for Phases 2a and 2b.

Major programmes undertaken by Highways England (HE) and Heathrow expansion projects could provide opportunities to create efficiency through the use of shared national logistics hubs. HS2 will continue seeking these opportunities where practical for Phase One and Phase 2a and become an integral part of the approach for Phase 2b **prior to the deposit of the hybrid Bill**. These opportunities could be reviewed in line with the work of the National Infrastructure Commission.

Skills and Resources

Major infrastructure programmes are hugely important to the development of our skill base. Currently, HS2 supports 9,000 people working on the programme through our supply chain. The work force is expected to peak at around 30,000. HS2 will be competing with other major infrastructure programmes such as Crossrail, Hinkley Point and Heathrow.

Although we have opened two colleges – in Birmingham and Doncaster – to help develop the skills we require in the future, there is a more immediate need to be more innovative during the competing pressure points amongst all the UK major programmes. Again, this needs to be much more coordinated across both government and this sector. With this in mind, the National College for High Speed Rail plans to rename itself as NCATI (National College for Advanced Transport and Infrastructure) to include a broader transport remit, attract a wider pool of new entrants and be seen as a centre to develop talent for other bodies like TfL, NR, DfT and HE.

Recommendation 6

Recommendation 6: Contribute to development of UK skills and resources.

HS2 needs to continue working with external and professional bodies such as the Institution of Civil Engineers (ICE), Major Projects Association (MPA), IPA, the Construction Leadership Council and The National Skills Academy for Rail (NSAR) in developing a better equipped and trained workforce. In addition to the STEM (Science, Technology, Engineering and Maths) activities HS2 already contributes towards, the company should ensure collaboration continues with universities and the further education sector.

Building on this collaboration, by **December 2019**, HS2 must establish with its current and future supply chain any capacity issues as well as any potential skills shortages that need to be addressed in a joined up fashion.

Scale, Complexity and HS2 Ltd

The scale and complexity of HS2 is unique in the UK. It is the biggest programme in the Government's portfolio that has ever been undertaken. The redevelopment of Euston Station, Curzon Street or Manchester Piccadilly are projects which, if standing alone, would qualify on the Government's formal list of Major Projects. There are choices to be made about the appropriate client models and, in turn, the resourcing requirements for HS2 Ltd.

In addition, international benchmarking work has shown that comparable projects in other European countries have not had to engage with the challenges of opening up new city centre to city centre high speed railways in such densely populated places. The interfaces – not just between trains, systems and stations but also with local development proposals, highways and the wider rail network – represent real challenges for the future and add to the complexity of the relationships being handled within the programme.

The scale and complexity of HS2 means the company has to be structured appropriately to be able to deliver effectively.

HS2 is undergoing a programme of restructuring how it operates. The aim is to work differently with the supply chain to create Integrated Programme Teams (IPTs) which will reduce duplication and complexity whilst driving collaborative working. Creating IPTs will in turn enable HS2 to better deploy its people within a more robust delivery structure. HS2 will also need to maintain a sensible balance between permanent and agency staff to enable adequate arrangements to be in place for succession planning and talent management. HS2's remuneration arrangements need to reflect the complexity of the programme and enable staff with the experience required to be recruited and retained.

HS2 is already working to demonstrate that the company has sufficient capability across the enterprise functions to award, manage and monitor the Main Works Civils Contracts (MWCC) for Phase One. The HS2 Improvement Programme (HIP) was started in Feb 2018 with the aim of undertaking an Organisational Capability Assessment using a Capability Model with 24 Capability Areas. This work is sponsored by the CEO and it is important that the Board fully engage in the conclusions of HIP to ensure that the company is 'match fit' and ready for Phase One construction.

Effective programme controls are essential to be able to effectively manage and have visibility of our works. HS2 is driving an improvement programme which is well underway and is due to complete in the autumn of 2019. The improvement programme will support the integration of data across the project controls applications.

The recent report – 'Lessons from Transport for the Sponsorship of Major Projects' – has underlined the importance of accountability, behaviours, control of schedule, costs and benefits, and system integration. Many of these lessons are directly or indirectly applicable to HS2 and will need to be appropriately assessed for suitability for the different phases. The HS2 Ltd Board should establish a regular oversight process to ensure it is satisfied with the company's progress against these recommendations. There should be a review of governance and oversight arrangements for Phase One and Phase Two to ensure these are fit for purpose for the current demands of the programme. In addition I am keen for the HS2 Board members, who come with a wealth and wide range of experience and expertise, to work closer with the HS2 Ltd Executive team.

As the programme progresses through its different stages, relationships with the DfT and other government departments e.g. HMT need to adjust accordingly with appropriate discharging of delegations. The sponsor's role needs to reflect the stage of the programme and the autonomy the project has earned. The DfT will be required to ensure they have the capability needed to support HS2 at different stages of the project life cycle. For example, a more arm's length sponsorship approach on Phase One may be more appropriate compared to Phase Two.

Recommendation 7

Recommendation 7: Ensure that the HS2 Board and HS2 Ltd are 'match fit' to deliver the HS2 programme and its intended outcomes.

HS2 will be built by the supply chain. HS2 Ltd needs the capability and capacity to procure and manage that endeavour and ensure the delivered assets form an operable railway that can achieve the intended outcomes and deliver the transformational benefits for Britain. And the HS2 Board – with appropriate delegation from government – provides the oversight to ensure effective decision-making and management of risk by HS2 Ltd³².

³² HS2 Ltd Board terms of reference, www.gov.uk/government/organisations/high-speed-two-limited/about/our-governance

Board effectiveness: An independent review is being conducted and overseen by the company secretariat and legal counsel to review the governance, delegation regime across the company, and effectiveness of the Board. This work – including a review by an external body – will be concluded in **October 2019** with a number of recommendations.

Delivery capability and effectiveness: The HS2 Chairman and HR director should work with the DfT on ensuring appropriate benchmarking with private and public sector pay; and work will continue on talent management and succession planning, striking the right balance between permanent employees and external resources.

One of HS2's priorities is completing an organisational restructure including the move to client / supplier integrated project teams (IPTs) to deliver a new organisation and ways of working by **December 2019** (Project Evolve). In addition and in parallel, the specific programme is completed on the implementation of an integrated programme controls system by the **December 2019** (Project Atlas).

Aligned with and complementing Project Evolve, an updated organisational capability assessment will be presented to the Board in **October 2019** to confirm that the company has progressed since its previous assessment and is match fit for the next stage of the programme, including management of Stage 2 of the main works civils contracts.

All of the above will be informed by consideration of the applicability of 'Lessons from Transport for the Sponsorship of Major Projects', initially to Phase One (**August 2019**) and then to Phase Two. Work is already in train to establish workshops for the exercise.

