Secretary of the Cabinet and Head of the Civil Service

CHANCELLOR

cc. Prime Minister
Transport Secretary
John Manzoni
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HS2 – PHASE 1 REPORT

1. A recent international benchmarking study commissioned by HMT on HS2 Phase 2 showed that the project is expected to cost significantly more per kilometre than high speed rail projects in comparable countries – almost 50% higher at the time when the study was done. In light of this, you asked me to look at ways to bring down costs. This note sets out my conclusions on HS2 Phase 1. I will write again with my conclusions on Phase 2 at the end of May.

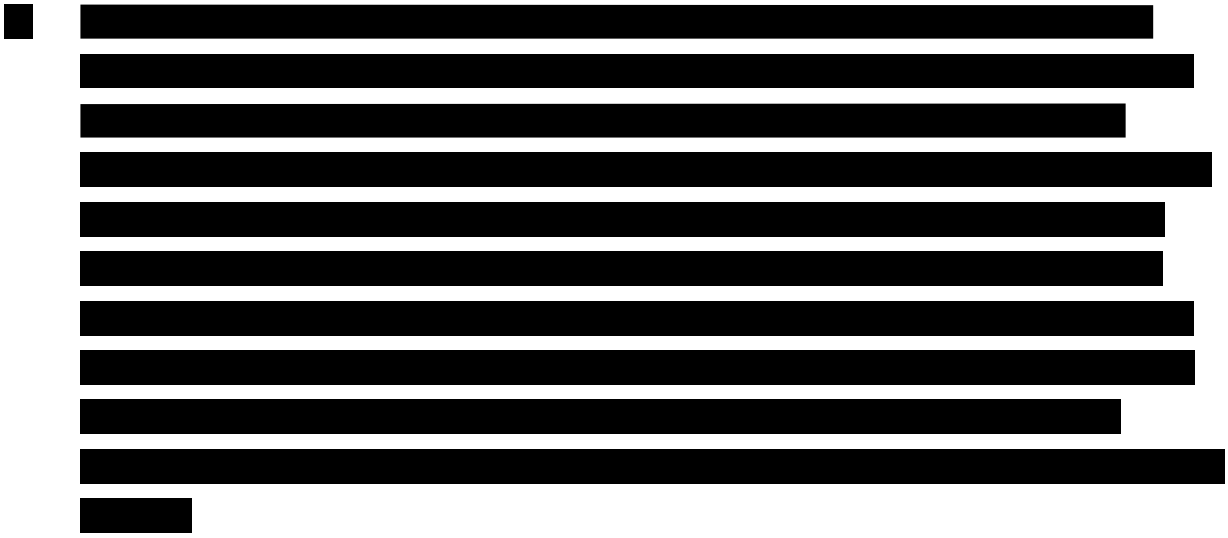
Summary

2. The established cost of HS2 Phase 1 now stands at £25.7bn (as against the SR15 budget of £24.7bn). While Phase 1 was not included in the benchmarking work, this cost looks significantly higher than international benchmarks. Much of it stems from the high cost of land, the sheer number of tunnels and stations on the route and the depth to which track is sunk into the landscape (for largely aesthetic rather than noise-reducing reasons). Much of this has now been locked in by the process of gaining public buy-in through the hybrid bill. However, there are clear areas where I believe we can still reduce cost.

3. Working closely with DfT and HS2 Ltd my review team (superbly led by Will Cavendish) has identified a series of savings on Phase 1 – in the region

of £700m-1.25bn – which if taken forward would bring the project cost back into line with the Phase 1 target price of £24.7bn (albeit still higher than international benchmarks). More detailed work is needed to pin down exact figures, and at the moment DfT have only endorsed the bottom end of the savings range. However, my view is that you could take forward all of the options set out in this advice without significant detriment to the project in economic or political terms. But there are of course counter arguments to each that you may want to discuss with the Prime Minister and Patrick McLoughlin.

4. **The most straightforward options focus on rental income and supply chain finance**. It may also be possible to reduce somewhat the cost of station design and civil engineering works – but this requires further analysis to establish better estimates.



6. The other sensitive option involves **aligning the completion dates of Phase 1 and Phase 2a** by delaying the former by a year to 2027. This would directly help to deliver at least £75-120m of savings by substituting a flyover with a flat junction at Handsacre. But my suspicion is that giving ourselves an extra year to complete and de-snag Phase 1 would also help to de-risk the project considerably. DfT have already asked HS2 Ltd to look at the pros and cons in more detail. You do not need to make a decision now. But it would be worth understanding how significant the potential savings might be.

7. Finally, one overaching issue that has really struck me during the review to date is the need to make more top down use of benchmark data to drive cost efficiencies throughout the project. Rather than simply building costings from the bottom up, we should be establishing top down what each particular element of the project should cost – whether constructing the line, building stations, buying rolling stock, buying and selling land and so on - and then using benchmarked estimates to try to drive down the bids received. HS2 Ltd have undoubtedly taken a rigorous approach to efficiency and seem to me to be a professional and well-led organisation. But as I say they have largely adopted a bottom-up approach, not paying much attention to cost comparisons with equivalent projects. Embedding a top-down understanding of reasonable cost, combined with a stronger 'design to cost' approach to procurement, must surely help. This is likely to be a significant part of my Phase 2 recommendations.

8. For all of the options you wish to keep in play, I recommend commissioning HS2 Ltd and DfT to produce much narrower ranges, which should be agreed with my team and your officials, by the end of May in time for my final advice to you. These should then be considered by the Major Projects Review Group (MPRG) in the autumn, with final agreement early next year before Review Point 2. In the meantime, DfT should progress with issuing the Main Works Civils Contract ITTs, subject to final MPRG/HMT approval. This report therefore forms part of on-going work, which will conclude next year as part of wider action to continuously increase the efficiency of the HS2 programme.

9. I will report back again at the end of May on Phase 2. I expect there to be greater scope to make savings on this phase of the project, as there is still the opportunity to look again at the big ticket items, which have potential to move HS2 closer to international benchmarks – route alignment, tunnels, station design and location and the like. Equally, more savings will actually be needed as the current gap between the project cost and the SR envelope is bigger too, at £7bn.

Detailed analysis

10. HS2 Ltd have just completed a detailed bottom-up assessment of the cost and schedule for delivering Phase 1. In advance of this, HS2 Ltd identified

£1.47bn of potential efficiencies, many of which were drawn from the International Benchmarking Study commissioned by the Treasury. Despite these additional efficiency assumptions, the most likely cost[1] for Phase 1 is now projected at £25.75bn (including Euston station and associated regeneration costs), £1bn above the target of £24.7bn. Since the development of their baseline HS2 Ltd have now included an additional £300m 'stretch target' in the Main Works Civils ITTs. If delivered this would reduce the £1bn gap between the expected cost and SR target to £700m.

11. There are a number of reasons why Phase 1 costs are high: for example, the high cost of land, the sheer number of stations and tunnels, and the depth to which we sink track into the landscape.

12. Some of this is unavoidable – HS2 comes direct through densely-populated urban sprawl into London and other cities, to support explicit objectives on capacity and growth, pushing up both the cost of land and the need for tunnels. The total cost of Euston station and the civil engineering work for the Euston to Old Oak Common stretch alone is £2.8bn (£960m for the line and £1.84bn for Euston on the most likely cost). Many of the international comparator rail systems have both fewer stations and more in suburban out of town locations.

13. DfT have also been forced to add in features that increase cost, in response to local pressure to minimise the visual impact of the line. Plans for Phase 1 started out with 20km of tunnels; there are now 48km. And when in open countryside, HS2 will typically sit 8m below the ground, compared with a typical 3m depth in Europe – to make sure that those working in the fields or living in nearby villages cannot see overhead lines. If reducing cost could be given more weight relative to local aesthetics, there might be opportunities to do things differently on Phase 2, though you will obviously want to weigh the politics here.

14. There is much less flexibility to make savings on Phase 1 given that much of the detail has now been locked in through the hybrid bill. Nevertheless, there are still a few design options to reduce cost – and this report has

[1] Technically the most likely outturn including risk based assumptions about contingency (the p50).

identified c.£700m–1.25bn of potential savings. These are presented below – moving from straightforward options, through to more politically-sensitive options, and finally covering options on [redacted] and 24/7 working. (See Annex A for a summary of the options).

Straightforward savings options

15. The first option targets a £25-50m **increase in rental income from property** that HS2 Ltd are acquiring to deliver Phase 1, but which will not be needed indefinitely. This portfolio is projected to be worth £700m by 2027-28. HS2 Ltd are currently assuming a net **zero** rental income from all of this property. However, advice from external property advisors suggests that we should be able to achieve at least £50m in rental income from a portfolio of this size. More might be possible if we were to look at using innovative management arrangements (e.g. a private sector joint venture).

16. The second option is to set HS2 Ltd **a specific target to secure funding from the transport element of the European Union's Connecting Europe Facility**, and £75-100m looks feasible. It is our stated policy to maximise EU funding support for HS2 and the programme has already won €39m for Phase 1. However, there is an opportunity to go further (HS1 received a total of €256m across a range of bids).

17. Third, HS2 Ltd are budgeting to spend £1.5bn on third-party works across utilities, highways and rail. They are taking all of the highway works and those utility works that are contestable into their own contracts. The budget includes specific efficiency targets of up to 10% for these works. DfT have also tasked HS2 Ltd with strengthening its processes to minimise the cost of work done by the utilities and Network Rail themselves. It is too early to say whether this will yield further tangible saving. But we should press hard.

18. The next major opportunity is on **supply chain payments, with forecast savings of £325m (although HS2 are only comfortable with a target of an additional £140m).** £325m would represent a 2.5% saving on the £13bn Phase 1 construction contracts – the level of saving that the Office of Government Commerce estimated in 2007 that construction projects could take out of supply chain costs in return for prompt and certain payment. Data from the US suggests similar savings. Delivering these savings would

require some changes to the current procurement approach. Rather than the usual 30-day terms (or often longer) HS2 Ltd and all of its suppliers would need to commit to a payment system that guarantees immediate payment to suppliers. HS2 Ltd would also need to make sure that all sub-contractors are aware of and have confidence in these payment terms ahead of their tender returns – to make sure the savings are passed through. This should be clearly specified in the ITTs – starting with the Main Works Civils Contracts.

Savings from Decisions on the Scope of HS2 and the Interaction with the Existing Railway

19. There are further decisions that could be made about the scope of the HS2 line and its interaction with the current rail system. While most of these decisions have been locked in through the hybrid bill, I believe there are three options that have the potential to bring down costs – by £310-410m in total, two of them relating to Heathrow connectivity.

[redacted]

[redacted]

[redacted]

25. Third, there is an option to replace the currently proposed HS2 flyover junction at Handsacre junction (north of Birmingham) with a flat junction, delivering direct savings of £75-120m. A flyover was originally included to ensure that seven trains an hour could come on and off the HS2 line and onto the WCML at speed for the seven years while Phase 2 was being built. The decision to introduce a Phase 2a undermines the argument. Once Phase 2a is operational, a flat junction should be perfectly sufficient to support the one or two high speed trains per hour travelling to Stafford and potentially Stoke (although HS2 need to confirm this). Since the plan is now to

complete Phase 2a to Crewe in 2027, the flyover at Handsacre has a useful life of only one year.

26. The argument for dropping the expensive flyover junction would become even more compelling were you to decide to go one step further and align the completion dates of Phase 1 and Phase 2a in 2027, effectively deferring the completion of Phase 1 by 12 months.

27. This is obviously not a decision to be taken lightly and it is not necessary to take a view until early 2017. However, my own view is that this increasingly looks like a sensible thing to do, for several reasons:

- Providing an extra year for HS2 Phase 1 would de-risk delivery of an ambitious schedule of works – something that the MPRG has already recommended;
- There may be further cost savings that could be made by aligning the two delivery dates, over and above those associated with the option on Handsacre Junction. For instance, extending the design Phase 1 work on viaducts, tunnels and bridges could allow contractors to identify further cost savings; and
- It is very disruptive and costly to re-timetable the West Coast Mainline and HS2 schedules twice within 2 years.

28. I recommend you get a fuller note from DfT on the pros and cons of this decision, which could then be considered by the MPRG in the autumn

Station design savings

29. The next two options look at the savings that might be brought about by reconsidering the **design and funding model for stations.**

30. Phase 1 involves building three new stations (Euston aside) at a combined cost, excluding contingency, of £1.4bn. HS2 Ltd have been working steadily on reducing the costs of stations, most recently offering a further £48m worth of savings on the Birmingham Interchange and Old Oak Common stations, specifically in response to this review.

31. However, it may be possible to go further. The £5000/m^2 cost for above-ground HS2 stations looks cheaper than recent Network Rail station projects. But these are not good comparators, as the HS2 stations are built from scratch on new railway, whereas the Network Rail stations are rebuilds on existing railway. Moreover, the costs of the new HS2 stations appear high compared to international benchmarks. For example, a number of new Spanish high speed stations appear to come in at between £2,000 to £3,000 m^2. HS2 Ltd have agreed to undertake more detailed benchmarking against international comparators to quantify possible savings more precisely.

32. If further savings are achievable, they could be delivered through a **'design to benchmark cost' approach**. This would challenge local authorities to secure contributions from the Airport, NEC and other private sector organisations to build attractive and functional stations within a budget capped at the cost of relevant international comparators.

33. There is also a more specific opportunity to **seek third party contributions to the costs of Birmingham Interchange station**. Birmingham Airport and the NEC stand to benefit greatly from this new station and Solihull are also planning major developments around the site. But to date it has been assumed that the full costs of the station (£168m excluding contingency) and associated People Mover – which transports people to the NEC and the airport (£118m excluding contingency) – are met from the HS2 project budget. While HS2 Ltd's negotiating position is weakened by the commitments that we have already given to Birmingham, the Birmingham Interchange is a very significant and exciting development opportunity for the West Midlands. So, there should be scope to revisit these discussions. I therefore recommend that we set HS2 a target of realising an additional £50m of income from third parties in the Birmingham area.

Engineering savings

34. Civil engineering comprises a significant portion of the cost on Phase 1 – £6.4bn excluding contingency. The bulk of this is for spend on tunnels (38%), bridges and viaducts (10%) and earthworks (24%).

35. A significant wedge of this cost stems from the sheer number of tunnels on the route and the depth to which we have sunk tracks into the landscape.

This is the result of the many individual concessions that were made during the passage of the hybrid bill – driven by a strong desire to hide trains, track and power lines from local communities. There are now 48km of tunnels compared to the 20km that were originally planned, and HS2 is typically sunk 8m in the ground compared to the 3m that is normal for EU counterparts. This drives cost because the deeper that the line is sunk down into cuttings, the greater the amount of spoil that needs to be shifted; and it is shifting soil that is costly. Sinking track to just 5m rather than 8m reduces the volume of earth that needs to be shifted by 45% – so this could be a major potential saving.

36. There is little that we can do about this on Phase 1 – the route has been locked in through the hybrid bill and there is very little scope to change its vertical alignment. But there is greater potential flexibility on Phase 2, as the hybrid bill has not yet been tabled. Furthermore, the track runs through more open country so there may not be such pressure to hide the line. Given this, I believe that we should look at how we could control the use of tunnels and depth of track to moderate costs.

37. The good news is that the overall **unit costs** of civil engineering works do not appear out of line with UK comparators once we have taken into account these prior design decisions. However, the issues are slightly different for tunnels, viaducts and earthworks.

38. The patchiness of good data on the costs of **tunnelling** outside the UK, coupled with the significant influence that local conditions and country-specific regulations have on cost, means that it is difficult reliably to benchmark tunnelling costs internationally. For example, differences in ground conditions, ease of spoil disposal, and twin bore versus single bore all make a difference.

39. Where UK comparisons are possible, HS2 appears to fare relatively well (e.g. the Chiltern tunnel comes in at £20,221 per single bored metre whereas the tunnels on HS1 south of Stratford come in at £20,650 per sbm). EU comparators range from £18,600sbm to £34,100sbm. HS2 Ltd are targeting further savings of £50m to £75m by designing tunnel entrances at lower cost.

40. The costs of HS2's **viaducts** also seem broadly comparable to benchmarks. 'Trace' width – the total width of land allowed for the tracks – has been reduced to 13.5m, which is the European norm, and costs are in line with international benchmarking data – £25m/km as against £25.5m/km.

41. There is no evidence to suggest that the unit cost of **earthwork** construction is higher than European norms – the data is not readily available. But, HS2 Ltd have sought to drive efficiencies where they can. As stated above, the cost of earthworks is largely driven by the depth of the route. But the slope of the cutting also makes a significant difference. HS2 Ltd has already increased the gradient of the slope of the walls from 25% to 33%, in line with European norms. And on trace width, which has a more limited impact on earthwork costs, I have concluded that HS2 Ltd's approach is proportionate. On issues such as drainage and land access, which all affect trace width, HS2 Ltd's approach is similar to that of other EU countries.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

24/7 working

46. Finally, I have also looked at the often-raised question of the savings that could be achieved through flexible and/or 24/7 working. **There are clearly benefits to allowing contractors to work flexibly where this reduces cost or risk**, and HS2 already has powers for 24 hour working on the tunnels and the wider civils work at Old Oak Common. (Note that HS2 Ltd are currently using 24/5 working, leaving 24/7 as a contingency in the event of slippage).

47. However**, in general, 24 hour working adds to total cost, as the cost of labour is 1.5 to 2 times higher at night time,** so is only considered for works on the critical path. HS2 Ltd have committed to work with any contractors proposing 24 hour working and to support any reasonable application to the local authority (who would need to authorise it). There are some constraints to this, but councils are usually sympathetic if the application helps to speed up construction work and noise is limited.

Next Steps

more fully worked up savings numbers, agreed with my team and your officials, by end of May, in time for my final report.

49. In the meantime, I believe that DfT should progress with issuing the Main Works Civils Contract ITTs, subject to final MPRG/HMT approval. The work on this review has suggested that in those areas where they can be effectively benchmarked against comparators (the tunnels and viaducts), the works are now at comparable cost.

50. I will write to you again at the end of May with a full report, setting out options to make savings on Phase 2, including proposals on rolling stock and depots, and on cost estimation and contingency, which we have not covered yet. Options for Phase 2 savings in general should be more substantial than those for Phase 1, as the route and its specifications have not yet been locked in through a hybrid bill process. Equally, there may well be opportunities to embed the approach of designing to international benchmark costs much more widely through a Phase 2 control regime.

JEREMY HEYWOOD
12 May 2016