HS2 Phase Two

Summary of key changes to the Economic Case since October 2013

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Department for Transport

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1 Introduction

1.1 Overview

1.1.1 This report provides a summary of the key changes made to the analysis that supports the assessment of the Economic Case for HS2 since October 2013, and the effect of these on the appraisal outputs.

1.1.2 The aim of this document is to help readers understand the effect that individual changes in HS2 Ltd analysis and modelling have had on the Economic Case for HS2.

1.1.3 This document is one of a series that provides explanation and analysis of the evidence which underpins the appraisal of HS2, including the PLANET Framework Model Development Report, Assumptions Report, and Risk Analysis Technical Documentation

1.1.4 The last update to the Economic Case, which was published in October 2013[1], provided a point-estimate benefit-cost ratio (BCR) of 2.3 for the full network.

1.1.5 As with any scheme, the Economic Case for HS2 will evolve and be influenced by many factors, including:

- the design of the scheme;
- external factors such as economic or population forecasts, and changes in rail services in the future;
- forecasts of HS2 passenger demand, benefits and revenue; and
- the guidance on forecasting and appraisal of transport schemes.

1.1.6 Since October 2013 HS2 Ltd has continued to develop and improve the modelling and economic appraisal tools. The design of the scheme has been further developed, particularly with the phasing of delivery of the full network. The estimates of costs continue to be refined, with greater detail and clarity on these for all elements of the scheme. There have also been developments in modelling and appraisal practice that have been incorporated into the Department for Transport's WebTAG[2] appraisal guidance.

1.1.7 All of these changes have been incorporated into the analysis supporting the Economic Case, and this document provides an analysis of the impact that they have had on the point-estimate BCRs of HS2.

1.1.8 Care needs to be taken when interpreting the results of this analysis in two respects:

- There is a high degree of interaction between the effect of the changes, and each step in itself needs to be viewed in the context of the changes that have

[1] https://www.gov.uk/government/publications/hs2-economic-case-october-2013
[2] WebTAG is the Department for Transport's guidance on appraising all transport schemes - https://www.gov.uk/transport-analysis-guidance-webtag

been made earlier in the sequence of the analysis.

- The size of the change also depends on a number of other inputs and assumptions in the modelling and appraisal process. Alternative assumptions, such as those used in the risk analysis presented in the Economic Case, would of course lead to different results for this step-through analysis.

1.2 Summary of the changes to the Economic Case for HS2

1.2.1 Since the last estimates of the Economic Case for HS2 were published, HS2 Ltd has continued to improve the methodologies, underlying assumptions and evidence base used by the economic models to assess the scheme. Additionally, HS2 Ltd has responded to changing external factors, such as economic growth forecasts, and internal factors, such as more detailed development of the design of HS2.

1.2.2 The current Economic Case has been assessed using a newly developed version of the PLANET Framework Model (PFM) known as version 5.2,[3] which has updated and refined many elements of the demand forecasting process.

1.2.3 The key changes that have been made to the appraisal of HS2 since the BCR was last reported in October 2013 can be summarised as:

- corrections for some minor issues identified with the previous model, PFMv4.3 (Chapter 2);
- refinements to the PFM to address questions raised in the audit, improve known issues and increase automation of processes to aid quality control and reduce costs of model use (Chapter 3);
- updates to the appraisal methodology, drawing on the latest guidance and valuation of benefits contained in WebTAG. This has also changed our estimates of operating costs over time (Chapter 4);
- updated forecasts of the growth in travel to take account of changes to official forecasts for the growth of the UK economy and other drivers of transport demand, and to take account of the new government's policy on national rail fares (Chapter 5);
- improvements in estimates of the reliability impacts of HS2 (Chapter 6);
- updates to the 'without scheme' or 'Do Minimum' network assumptions relating to committed transport investment that will happen regardless of HS2, and against which the HS2 scheme is compared (Chapter 7);
- adjustments to the scheme design, phasing and timetable assumptions for the operation of HS2. These assumptions remain as modelling assumptions and are not a future service specification (Chapter 8); and
- changes in the cost of building, maintaining and operating the scheme as a

[3] The methodology and assumptions used by PFMv5.2 are separately reported.

result of increasingly detailed scheme design and up-to-date evidence on the costs of operating both HS2 and classic line trains (Chapter 9).

1.2.4 Each of these refinements has impacted the BCR. The overall effect of these changes is shown in Table 1. The BCR in October 2013 for the full network was 2.3, including Wider Economic Impacts (WEI). The table shows that the BCR has increased slightly, with the full network offering a BCR of 2.5 with WEI.

Table 1: Overall change in quantified costs and benefits of HS2 (£bn 2011 present value prices) as presented in October 2013 and November 2015 Economic Case

Item (£bn 2011 present value prices)			**Full network**		
			Oct-13	**Oct-15**	**Change**
1	Transport user benefits	Business	40.5	43.2	2.6
		Other	19.3	18.2	-1.1
2	Other quantifiable benefits		0.8	0.2	-0.6
3	Loss to Government of indirect taxes		-2.9	-3.0	-0.1
4	Net transport benefits = (1) + (2) + (3)		57.7	58.6	0.8
5	Wider economic impacts (WEIs)		13.3	14.2	1.0
6	Net benefits including WEIs = (4) + (5)		71.0	72.8	1.8
7	Capital costs		40.5	39.0	-1.4
8	Operating costs		22.1	22.9	0.7
9	Total costs = (7) + (8)		62.6	61.9	-0.7
10	Revenues		31.1	33.1	1.9
11	Net costs to Government = (9) – (10)		31.5	28.8	-2.7
12	**BCR without WEIs (ratio) = (4)/(11)**		**1.8**	**2.0**	**0.2**
13	**BCR with WEIs (ratio) = (6)/(11)**		**2.3**	**2.5**	**0.3**

Note that the figures may not add due to rounding

1.2.5 The following chapters of the report provide further information on these refinements and the impact they have had on the Economic Case. The implications for costs, benefits and revenues for each phase are set out, with the change in BCR being calculated for each step.

2 Correction of issues in PFMv4.3

2.1 Summary of key changes

2.1.1 In the final stages of audit and quality assurance of the PFM v4.3 model, a number of minor issues were identified with the modelling to support *The Economic Case for HS2*, October 2013. There was insufficient time to incorporate all of these changes prior to publication in October 2013, although HS2 Ltd undertook a wide range of sensitivity tests to confirm these issues were not material to the published information.

2.1.2 The changes made to the model included:

- the consistency in the unit of costs in the Heathrow Access Model compared to the rest of the PFM;
- addressing inconsistencies in passenger access to stations and catchment areas for new HS2 stations;
- the stopping patterns for some services in the 'with HS2' case;
- the transfer of passenger data between models to ensure crowding is assessed correctly on all services;
- the 'Do Minimum' highway and air networks for Phase One in 2026;
- updates to the appraisal model; and
- a software bug and data extraction process for calculating Wider Economic Impacts.

2.2 Impact of changes

2.2.1 The impact of the changes is outlined in Table 2. The most significant change is for WEIs, which increase by £1.4bn for the full network. This reflects a software bug within DfT's WITA software used by transport projects to estimate these benefits, as well as some issues with data extraction from PFM.

2.2.2 The impact on transport user benefits is more limited. Changes to the Heathrow Access Model make rail travel to Heathrow is less attractive, resulting in a loss of benefits for these trips. The impact is more significant in the full network, where HS2 would provide enhance access to Heathrow to a wider market. The full network is also affected by changes to the modelling of classic line services, which add to the reduction in benefits.

2.2.3 Other updates generally have small positive impacts, which for the seven years that include Phase One are sufficient to offset the impacts on Heathrow trips, but the greater impact of Heathrow trips, as well as changes to classic services in the full network drives a small reduction in benefits.

2.2.4 Overall, the impact of these changes on the BCR without WEIs is negligible. The BCR without WEIs changes by around 1% or less. Even the more significant changes to WEIs have a relatively limited impact, adding less than 1% for the full network.

Table 2: Change in quantified costs and benefits following corrections to PFMv4.3

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	-0.5	-1%
		Other	-0.6	-3%
2	Other quantifiable benefits		-0.1	-16%
3	Loss to Government of indirect taxes		0.1	-2%
4	Net transport benefits = (1) + (2) + (3)		-1.2	-2%
5	Wider economic impacts (WEIs)		1.4	11%
6	Net benefits including WEIs = (4) + (5)		0.3	0%
7	Capital costs		0.0	0%
8	Operating costs		0.0	0%
9	Total costs = (7) + (8)		0.0	0%
10	Revenues		-0.5	-1%
11	Net costs to Government = (9) – (10)		0.5	1%
12	BCR without WEIs (ratio) = (4)/(11)		0.0	-1%
13	BCR with WEIs (ratio) = (6)/(11)		0.0	1%

Note that the figures may not add due to rounding

3 Model development and enhancement

3.1 Summary of key changes

3.1.1 HS2 Ltd has continued to refine and improve PFM to address issues identified and improve the model's capabilities. Many of the updates since October 2013 have been presentational or have reduced risk of user errors and increase efficiency of model runs through:

- automation of a number of model checks, outputs and processes – this includes additional outputs to check model performance;
- removal of redundant or unnecessary software code and model attributes; and
- updating of model labels to ensure consistency across the model and correct issues with output data.

3.1.2 The audit and internal review process also identified a number of minor enhancements that could further improve the robustness of the model. A full list of these enhancements can be found in the Model Development Report, but can be broadly summarised as:

- improvements in the coding of network assumptions and service patterns identified as part of an in-depth review;
- improvements in the interface between models, and the way passenger data and crowding impacts are transferred between models;
- changes to the appraisal of indirect tax and impact of car mode shift; and
- improvements to assignment of passengers to rail services in PLANET South.

3.2 Impact on BCR

3.2.1 While the model development process has implemented over 60 enhancements to the model, the impact on the overall Economic Case for HS2 is small. The most significant impacts have been in PLANET South, leading to a slight reduction in the estimated benefits from the capacity released on commuter lines into London. These are more than offset by increases in the estimated benefits on long-distance trips as a result of changes in network assumptions and the way crowding impacts transfer between models.

3.2.2 The overall impacts of these changes are shown in Table 3. The impact on total benefits and revenues is less than 1%, with similarly small changes in the BCR.

Table 3: Change in quantified costs and benefits following model development

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	0.3	1%
		Other	0.1	1%
2	Other quantifiable benefits		0.0	-6%
3	Loss to Government of indirect taxes		0.0	0%
4	Net Transport Benefits = (1) + (2) + (3)		0.3	1%
5	Wider economic impacts (WEIs)		-0.1	0%
6	Net benefits including WEIs = (4) + (5)		0.3	0%
7	Capital costs		0.0	0%
8	Operating costs		0.0	0%
9	Total costs = (7) + (8)		0.0	0%
10	Revenues		-0.3	-1%
11	Net costs to Government = (9) – (10)		0.3	1%
12	**BCR without WEIs (ratio) = (4)/(11)**		**0.0**	**-2%**
13	**BCR with WEIs (ratio) = (6)/(11)**		**0.0**	**-2%**

Note that the figures may not add due to rounding

4 Updated appraisal methodology and values

4.1 Summary of key changes

4.1.1 HS2 Ltd has updated the values and methodologies used in the appraisal of HS2 to reflect the latest evidence and best practice set out in WebTAG. These changes have involved:

- updated forecasts for the UK economy, including the impact of economic growth and inflation forecasts on the value of benefits and revenues;
- changes to parameters for car fuel consumption and emissions, and estimates of the benefit of reducing car travel incorporated into WebTAG;
- updates to the timing of changes in discount rates to reflect a 2015 year of appraisal;
- incorporation of new WebTAG guidance on the treatment of cost inflation on operating costs; and
- conversion of the appraisal from calendar to financial year.

4.2 Impact of changes

4.2.1 Table 4 shows the impacts of the updates to the appraisal methodology and WebTAG guidance. The most significant changes are to revenues, increasing by £1.9bn in the full network, and to operating costs, which also increase.

4.2.2 These increases are both driven by the treatment and forecasts of inflation used in the appraisal. Government policy means fares – and so revenues – are linked to the Retail Prices Index (RPI). Similarly, WebTAG now advises (in the absence of better information) that costs would be expected to rise in line with RPI, Average Weekly Earnings, or fuel price forecasts from the Department of Energy & Climate Change, depending on the cost item.

4.2.3 The Economic Case converts these estimates of future costs and revenues into 'real prices' (the value of costs and benefits in the future, measured in today's prices) using the GDP deflator. Changes in forecasts of RPI and the GDP deflator by the Office for Budget Responsibility (OBR) mean that, while there has been no change in the assumptions about costs or fares growth, these are now forecast to be higher in real terms in the future.

4.2.4 The other changes have a smaller impact on the overall business case. In the seven years that include Phase One, transport user benefits fall as lower economic growth reduces the value of time during earlier years of the project. However, stronger economic growth in the longer term means that this result is reversed for the full network, as a larger proportion of benefits occur in later years when values of time are now higher. Changes in estimates of the external costs of car travel also have a small positive effect on the business case.

4.2.5 Overall, the WebTAG changes drive a small increase in the BCR. Increases in the forecast value of revenue lead to a reduction in net costs to government over the appraisal period. This more than offsets the slight reduction in benefits.

Table 4: Change in quantified costs and benefits following changes to the appraisal approach and values

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	0.3	1%
		Other	0.1	1%
2	Other quantifiable benefits		0.0	2%
3	Loss to Government of indirect taxes		-0.2	6%
4	Net Transport Benefits = (1) + (2) + (3)		0.2	0%
5	Wider economic impacts (WEIs)		-0.3	-2%
6	Net benefits including WEIs = (4) + (5)		-0.1	0%
7	Capital costs		0.0	0%
8	Operating costs		0.5	2%
9	Total costs = (7) + (8)		0.5	1%
10	Revenues		1.9	6%
11	Net costs to Government = (9) – (10)		-1.4	-4%
12	**BCR without WEIs (ratio) = (4)/(11)**		**0.1**	**5%**
13	**BCR with WEIs (ratio) = (6)/(11)**		**0.1**	**4%**

Note that the figures may not add due to rounding

5 Updated forecasts of demand and economic growth

5.1 Summary of key changes

5.1.1 HS2 Ltd has updated the forecasts of the growth in travel on rail, air and highway in accordance with the updated WebTAG and taking into account the latest evidence on the growth of the UK economy and other drivers of transport demand. Some minor updates to the methodology and processing of data have also been implemented to reflect the latest best practice. Changes include the following:

- The methodology used to forecast rail demand has been updated to reflect the latest changes to WebTAG guidance. In particular, Passenger Demand Forecasting Handbook (PDFH) version 5.1 relationships are now used to forecast the impact of External Environment and Inter-modal factors. PDFH 5.1 is also now used in the Regional PLANET models for the relationship between changes in demand and the cost of rail travel.
- Forecasts of drivers of demand for all modes have been updated. Economic growth and employment forecasts have been updated in line with data published by the OBR in March and July 2014. National rail fares growth now takes account of the new Government's manifesto commitment for regulated fares to increase in line with inflation to the end of this Parliament. Other drivers of demand have been updated in line with DfT guidance.
- Air forecasts have been updated using data from DfT's National Air Passenger Allocation Model, while highway forecasts have used TEMPro v6.2, with adjustments made to ensure consistency of economic growth assumptions.
- A number of improvements to processes and automation of tasks has been implemented.

5.2 Impact on demand

5.2.1 Growth in rail passenger demand is assumed to continue until a 'cap' is reached[4]. As with previous analyses of the Economic Case, the cap is applied at a given level of demand for rail trips over 100 miles. This same level has been adopted here for the sake of consistency.

5.2.2 Overall rail demand growth is forecast to be slightly slower than in our previous forecasts. Lower economic growth outside London, along with reductions in forecasts of car and bus costs, lead to lower forecasts of rail demand growth, particularly for shorter-distance trips. The impact of lower growth in rail fares during this Parliament boosts growth, but is insufficient to offset the other drivers of demand. As a result, the cap is reached one year later than in the October 2013 forecasts, in the financial year 2037/38.

[4] The definition of the demand cap is reported in the accompanying Assumptions Report

5.2.3 However, the changes to the forecast's inputs have also changed the distribution of demand, which can have important impacts on the benefits of HS2. The reduction in growth is particularly noticeable for shorter-distance rail trips as a result of changes in forecasts of car and bus travel costs (see Table 5, below). In the cap year, while the number of trips over 100 miles remains broadly constant (due to the definition of the cap), the number of trips under 100 miles falls[5]. As a result, the total number of rail trips in the cap year falls by 3%.

Table 5: Change in the number of rail trips forecast by PLANET Long Distance (PLD) in the cap year (without HS2) as a result of updating forecasts

Distance, miles	% Change in trips in the cap year
0-50	-10%
50-100	-2%
100-150	2%
150-200	4%
200-250	3%
250+	0%

5.2.4 These reductions are primarily for non-London trips. Rail trips to and from London increase by 5% as a result of increases in forecast economic growth in London, as well as the adoption of PDFH 5.1 elasticities. Since the travel market to and from London accounts for a significant proportion of HS2 demand, this will tend to mitigate the impact of slower growth.

5.2.5 Finally, the adoption of PDFH 5.1 elasticities drives a reduction in the growth in commuting trips. Table 6 shows how the proportion of leisure and business trips by rail has increased in the cap year for trips within PLANET Long Distance (PLD).

Table 6: Journey purpose proportions in PLANET Long Distance, versions 4.3 & 5.2

Purpose	PFMv4.3	PFMv5.2
Commuting	25%	22%
Business	29%	30%
Other	46%	48%

5.2.6 The change in the distribution of trips is important. An overall reduction in demand growth, with an associated later cap year, will tend to reduce the benefits of HS2. However, for HS2, the London market and leisure and business passengers are

[5] Small variations in demand occur due to two reasons. The first is that the cap is defined as the 'year in which a given level of demand for trips over 100 miles would be reached', and not a fixed level of demand - hence small variations occur depending on whether this level of demand is reached at the start or end of the cap year. The second is due to the technical process (control matrix) involved in apportioning demand between the models that make up PFM, leading to the differences in the cap year percentage changes shown in the table. The control matrix process is described in section 7 of the accompanying model description report (*PLANET Framework Model (PFM V5.2) – model description).*

particularly important. In these markets there is a slight increase in demand, which will offset the overall reduction in demand growth.

5.2.7 Lower economic growth forecasts and other revisions to the air forecasting approach adopted by DfT's latest air model means that air demand growth is slightly slower than in the previous forecasts, resulting in lower demand in the cap year. Highway demand also grows more slowly, although the later cap year helps to offsets this reduction.

5.3 Impact of changes

5.3.1 The changes in demand result in positive and negative effects. Overall, these drive a slight increase in benefits for the seven years that include Phase One and a 1% increase in benefits for the full network (see Table 8).

5.3.2 In line with the changes in distribution of demand, benefits increase by around 7% on trips to and from London (see Table 7). However, non-London trips see reductions in benefits as demand is lower for these flows.

Table 7: Change in benefits by origin/destination (PLD, 2037/38 forecast)

	Phase One	**Full network**
London	7%	7%
Non-London	-4%	-4%

5.3.3 The growth in business trips is also clear. Table 8 shows that benefits for business passengers increase, while benefits for 'other' passengers are lower, driven by the reduction in commuting demand.

5.3.4 The increases in business and leisure demand, as well as the higher demand on HS2's core London market, mean that HS2 demand overall increases in the cap year, despite the reduction in rail demand. However, this increase in demand is not converted into an increase in revenues. The new government's policy on regulated rail fares means that fares are some 6% lower by the cap year. The reduction in fares means revenues fall by 4% for the full network, despite the slight increase in demand. This also means that the BCR is reduced.

Table 8: Change in quantified costs and benefits following updated forecasts of demand and economic growth

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	1.0	2%
		Other	-0.4	-2%
2	Other quantifiable benefits		0.0	2%
3	Loss to Government of indirect taxes		0.1	-4%
4	Net transport benefits = (1) + (2) + (3)		0.7	1%
5	Wider economic impacts (WEIs)		0.1	1%
6	Net benefits including WEIs = (4) + (5)		0.8	1%
7	Capital costs		0.0	0%
8	Operating costs		0.2	1%
9	Total costs = (7) + (8)		0.2	0%
10	Revenues		-1.2	-4%
11	Net costs to Government = (9) – (10)		1.4	5%
12	**BCR without WEIs (ratio) = (4)/(11)**		**-0.1**	**-3%**
13	**BCR with WEIs (ratio) = (6)/(11)**		**-0.1**	**-3%**

Note that the figures may not add due to rounding

6 Improved estimates of rail reliability

6.1 Summary of key changes

6.1.1 One of the key benefits offered by High Speed Rail is an improvement in the performance and reliability of services. HS2 Ltd's modelling has always included this benefit, drawing on modelling by the DfT on the reliability of the classic rail network. However, this analysis has become increasingly out of date, and the methodology used, whilst reasonable at a strategic level, had the potential to cause inconsistencies when comparing individual routes.

6.1.2 HS2 Ltd has updated the approach to assessing reliability benefits, drawing on the latest evidence of both the reliability of a dedicated high speed rail network, and the performance of the classic rail network.

6.2 Impact of changes

6.2.1 The new methodology and data have had a significant impact on the relative benefits of the improved reliability offered by HS2. The improvement in reliability is somewhat smaller over shorter distances. Most notably, the expected benefit between London and the West Midlands is less than in previous forecasts. However, over longer distances HS2 is now expected to offer a larger improvement in reliability. This relative change is reflected in the results in Table 9. The greater importance of long-distance trips in the full network means that, overall, the expected improvement in reliability is greater than previously forecast – driving an increase in benefits, attracting more passengers onto HS2 and adding to the benefits and avenues of the scheme.

Table 9: Change in quantified costs and benefits following improved estimates of rail reliability

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	1.4	3%
		Other	0.4	2%
2	Other quantifiable benefits		0.0	1%
3	Loss to Government of indirect taxes		-0.1	3%
4	Net transport benefits = (1) + (2) + (3)		1.7	3%
5	Wider economic impacts (WEIs)		0.4	3%
6	Net benefits including WEIs = (4) + (5)		2.1	3%
7	Capital costs		0.0	0%
8	Operating costs		0.0	0%
9	Total costs = (7) + (8)		0.0	0%
10	Revenues		1.1	4%
11	Net costs to Government = (9) – (10)		-1.1	-3%
12	**BCR without WEIs (ratio) = (4)/(11)**		**0.1**	**7%**
13	**BCR with WEIs (ratio) = (6)/(11)**		**0.1**	**7%**

Note that the figures may not add due to rounding

7 Updated 'Do Minimum' networks

7.1 Summary of key changes

7.1.1 HS2 Ltd has undertaken a full review of the representation of future rail services in the 'Do Minimum' (or 'without scheme' case). The update has drawn on advice from the DfT on their latest view of future investments in rail that are expected to be in place by the opening of HS2, and the implications for rail journey times and capacity.

7.1.2 The main changes to the 'Do Minimum' scenario can be summarised as:

- incorporation of the latest timetables for the West Coast Mainline (WCML), extending some services and reducing journey times to the North West and Scotland, and increasing capacity to some locations;
- adjustments to reflect the latest view of Midland Mainline services after electrification is completed;
- changes to TransPennine Express services to Scotland and some minor re-routing of services and enhanced capacity to Manchester Airport;
- extension of Crossrail services to Reading;
- adoption of an updated view of future services in the East Coast Mainline following the recent franchise award. This timetable expands the number of locations served, but reduces frequency and capacity to some existing locations; and
- incorporation of the latest timetables for East Midlands, London Midland and Chiltern services, generally improving journey times and capacity.

7.1.3 These changes have been implemented without any significant re-optimisation of service patterns with the introduction of HS2. It is likely that future work may identify opportunities to improve the value for money of classic line services with HS2 in the future.

7.2 Impact of changes

7.2.1 The changes to the assumptions on rail services without HS2 has a range of complex impacts that vary significantly across different areas and passenger flows. For long-distance flows, the changes generally increase the benefits of HS2. For the seven years that include Phase One, changes to the WCML between London, Preston and Scotland mean that HS2 services will offer greater benefits to these areas.

7.2.2 For the full network, this increase in benefits is partly offset by the improvements offered by electrification of the Midland Mainline. This will improve capacity and reduce journey times, and so reduce the scale of the benefits offered by HS2. Despite this, the overall impact of the revised service assumptions on long-distance flows is positive for the full network.

7.2.3 However, the impact of these changes to assumptions on shorter-distance flows is significant – particularly commuters who benefit from the capacity freed up on the classic network by HS2. Improvements to frequency, capacity and journey times on Chiltern, London Midland and East Midlands services mean that the benefits fall in the full network, offsetting the benefits to longer-distance passengers.

7.2.4 Despite the changes in 'Do Minimum' network assumptions driving a reduction in benefits overall, revenues are forecast to increase. This reflects the differences over long and short distances – with increasing benefits (and so demand) on comparatively high-yield, long-distance routes exceeding the reductions in demand on shorter-distance routes.

7.2.5 The new assumptions on classic services also reduce the potential cost savings offered by the released capacity on the classic network. This results in a small reduction in the forecast BCR for the full network.

Table 10: Change in quantified costs and benefits following revised 'Do Minimum'

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	-0.3	-1%
		Other	-0.9	-5%
2	Other quantifiable benefits		0.0	-2%
3	Loss to Government of indirect taxes		0.0	1%
4	Net transport benefits = (1) + (2) + (3)		-1.3	-2%
5	Wider economic impacts (WEIs)		-0.6	-4%
6	Net benefits including WEIs = (4) + (5)		-1.8	-2%
7	Capital costs		0.0	0%
8	Operating costs		0.0	0%
9	Total costs = (7) + (8)		0.0	0%
10	Revenues		0.4	1%
11	Net costs to Government = (9) – (10)		-0.3	-1%
12	**BCR without WEIs (ratio) = (4)/(11)**		**0.0**	**-1%**
13	**BCR with WEIs (ratio) = (6)/(11)**		**0.0**	**-1%**

Note that the figures may not add due to rounding

8 Changes in scheme design

8.1 Summary of key changes

8.1.1 HS2 Ltd has continued to refine the routes and evidence base for journey times on HS2. This has led to slightly revised timings which have been modelled, including:

- improvements to journey times between London and Stafford and Crewe in Phase One, and to Manchester, Leeds, York and Newcastle in the full network;
- slight changes in journey times between London and Scotland; and
- improvements in journey times on some inter-regional services.

8.1.2 The impact of changes in the scheme design that have been announced are reflected. These include:

- accelerating the building of part of the Phase Two route from the West Midlands to Crewe so that we are able to open that stage of the HS2 network just one year after Phase One, in 2027; and
- the fact that the Government will not be considering the proposed link to High Speed 1 (HS1).

There have also been updates to the estimates of the impact of HS2 on noise and carbon emissions.

8.1.3 These changes have also affected the estimated costs of the scheme. Cost changes are dealt with in chapter 9.

8.2 Impact of changes

8.2.1 The removal of the HS1 link, in line with the benefit assumptions as at October 2013, results in a reduction in benefits of almost £0.3bn, which drives the total benefits of the scheme slightly lower overall. However, overall the changes have a positive impact on the full network. The benefits to transport users increase, as there are bigger journey time improvements to more areas, resulting in benefits of just under £0.4bn.

8.2.2 The design and delivery of the scheme is now in three stages. This means areas on the western leg around Crewe and Manchester gain some of the benefits of an extended network six years earlier than in the previous Economic Case. This adds some £0.3bn to the overall benefits of the scheme and results in an overall increase in benefits for the full network.

8.2.3 Table 11 summarises these changes. One of the largest changes is in 'other quantifiable benefits', reflecting the loss of benefits from the HS1 link. Other benefits in this category are largely unchanged.

Table 11: Change in quantified costs and benefits following revised HS2 timetables

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	0.6	1%
		Other	0.2	1%
2	Other quantifiable benefits		-0.4	-70%
3	Loss to Government of indirect taxes		0.0	1%
4	Net transport benefits = (1) + (2) + (3)		0.3	0%
5	Wider economic impacts (WEIs)		0.0	0%
6	Net benefits including WEIs = (4) + (5)		0.3	0%
7	Capital costs		0.0	0%
8	Operating costs		0.0	0%
9	Total costs = (7) + (8)		0.0	0%
10	Revenues		0.5	2%
11	Net costs to Government = (9) – (10)		-0.5	-2%
12	**BCR without WEIs (ratio) = (4)/(11)**		**0.0**	**2%**
13	**BCR with WEIs (ratio) = (6)/(11)**		**0.1**	**2%**

Note that the figures may not add due to rounding

9 Changes in costs estimates

9.1 Summary of key changes

9.1.1 HS2 Ltd has continued to refine and improve its estimates of the cost of constructing, maintaining and operating the HS2 network.

9.1.2 Costs have been updated for the full network, reflecting a number of changes in the design and scope of the scheme, and improvements to the processes used to build the cost estimates. These include:

- accelerating the building of part of the Phase Two route from the West Midlands to Crewe, so that we are able to open that stage of the HS2 network in 2027, just one year after Phase One;
- updated costs for rolling stock procurement and maintenance;
- the removal of the proposed link to HS1; and
- updated estimates for operational costs.

9.1.3 The later phases of the scheme are at different stages of the design and development process, with a difference in design maturity, and the process behind building the cost estimates reflects this.

9.2 Impact of changes

9.2.1 In present value terms, changes in the profile of costs can change the estimated costs in the appraisal because of the discounting applied to these costs. Costs that happen later are more heavily discounted, reducing the costs for the appraisal. In the case of the full network, while some costs are brought forward (through the acceleration of delivery to Crewe), Parliamentary powers required for the full network are now expected to be completed later. This means work to deliver the rest of the network starts later and is more intensive in the later stages of delivery. The reduction in costs has increased the BCR for HS2, with the BCR increase for the full network adding almost 0.1 to the overall estimate.

Table 12: Change in quantified costs and benefits following updates to cost methodology

	Item		Full network	
			Change (£bn 2011 present value prices)	**% Change**
1	Transport user benefits	Business	0.0	0%
		Other	0.0	0%
2	Other quantifiable benefits		0.0	0%
3	Loss to Government of indirect taxes		0.0	0%
4	Net transport benefits = (1) + (2) + (3)		0.0	0%
5	Wider economic impacts (WEIs)		0.0	0%
6	Net benefits including WEIs = (4) + (5)		0.0	0%
7	Capital costs		-1.4	-4%
8	Operating costs		0.0	0%
9	Total costs = (7) + (8)		-1.4	-2%
10	Revenues		0.0	0%
11	Net costs to Government = (9) – (10)		-1.4	-5%
12	**BCR without WEIs (ratio) = (4)/(11)**		0.1	5%
13	**BCR with WEIs (ratio) = (6)/(11)**		0.1	5%

Note that the figures may not add due to rounding

10 Summary

10.1 Summary of results

10.1.1 Since HS2 Ltd published the Economic Case for HS2 in October 2013, there has been continued focus on improving the robustness of the model and the representation of the proposed scheme. Changes in the scheme design have been incorporated and changing external factors, such as economic growth forecasts, have updated the estimates of future demand.

10.1.2 The full network has seen increases in transport user benefits (in addition to the changes in Wider Economic Impacts and revenues) as a result of changes in the scheme design and new estimates of the benefits of the improved reliability offered by a high speed network. Combined with a modest cost reduction, this means that the BCR (including Wider Economic Impacts) has increased from 2.3 in October 2013 to 2.5 today.

10.1.3 The analysis in this document has focused on a single-point BCR to facilitate comparison across the steps and changes that have been presented. In the Economic Case for HS2, in line with advice from the National Audit Office (NAO) and other stakeholders, we have moved away from simply presenting our results as a single-point estimate of the BCR. By presenting the risks and uncertainties around the case, we are better able to demonstrate the key factors and assumptions to which our analysis is sensitive, and more clearly address the risks that are being considered.