
High Speed Two (HS2) Phase Two

PFM v7.1 Step-through report
Summary of key changes to
modelling assumptions between
PFM v6.1c and PFM v7.1





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Department for Transport

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1 Overview

1.1 Introduction

- 1.1.1 This report provides a summary of the key changes made to the modelling suite and assumptions that support the assessment of the Economic Case for HS2 and the effect of these changes on the benefit modelling outputs. These changes occur between PFMv7.1 which underpins the Summer 2017 business case with PFMv6.1c which was used to underpin the November 2016 business case.
- 1.1.2 The aim of this document is to assist readers to understand the effect that individual changes to the modelling assumptions and economic assessment have had on the Economic Case for HS2 by isolating distinct categories of updates to the modelling suite into a series of logical steps.
- 1.1.3 As is the case with any large infrastructure project, the Economic Case for HS2 will evolve over time and be influenced by many factors including:
- The design of the scheme;
 - External factors such as socio-economic forecasts;
 - Revisions to rail service provision in the forecast years;
 - Forecasts of HS2 passenger demand, benefits and revenue; and,
 - Official guidance on the forecasting and appraisal of transport schemes.
- 1.1.4 Since the last model release version, HS2 Ltd has continued to develop and improve its modelling and economic appraisal tools. This has included employing recent evidence on current and future patterns of passenger demand as well as refinements to the route and service pattern for the high-speed rail network. There have also been developments and updates in modelling and economic appraisal practices in the Department for Transport's (DfT's) WebTAG guidance that have been incorporated into the modelling.
- 1.1.5 These changes have been incorporated into the analysis supporting the Economic Case, and this document provides a summary of the impact that they have had on the economic case for HS2.
- 1.1.6 This document is one of a series that provides explanation and analysis of the evidence which underpins the appraisal of HS2, including the Forecasting Report, the Assumptions Report, and Risk Analysis Technical Documentation. This document should be considered in the context of these other documents.

1.2 Summary of the Changes to the Modelling Suite

1.2.1 The current Economic Case has been assessed using a newly-developed version of the PLANET Framework Model (PFM) known as PFMv7.1 which has been updated with various revisions to modelling and economic appraisal methods since the release of the previous model version, PFMv6.1c.

1.2.2 The key changes that have been made to the PFM modelling suite since the previous model release version are:

- Converting the PFM for a new release of the EMME modelling software. Not only does the new release of EMME improve model run-time performance, it also allows for enhancements to the model standard outputs that were not available under the previous software version;
- Updates to the Train Service Specification (TSS) for conventional rail services to reflect revisions to the assumed pattern of rail services in the forecast years;
- Updates to the HS2 scheme design and proposed service provision including to stopping patterns, vehicle capacity, and journey times;
- Revised future year rail demand matrices following the release of new forecasts of exogenous demand drivers such as GDP and employment; and,
- Updates to the appraisal methodology drawing on the latest guidance and valuation of benefits contained within the DfT's WebTAG.

1.2.3 Each of these updates has an impact upon the benefits of the HS2 scheme which is discussed in more detail within the chapters of this report. Full details of the updates are contained within the other documents associated with the release of PFMv7.1:

- PFMv7.1 Model Description Report;
- PFMv7.1 Model Release Notes;
- PFMv7.1 Assumptions Report; and,
- PFMv7.1 Forecasting Report.

1.3 Summary of the Change in Costs and Benefits

- 1.3.1 The overall impact of the updates that have been implemented between PFMv6.1c and PFMv7.1 is presented in Table 1. This shows that all components of benefits have reduced with the updates from PFMv6.1c to PFMv7.1. The largest reductions in benefits are from user benefits, but there are also reductions in other benefits such as wider economic impacts.
- 1.3.2 The remainder of this note will go into more detail on the updates that have been incorporated into the latest version of the model, and the impact of each of these updates on the modelling. However, a significant contributor to the reduction in the benefits is the latest socio-economic forecasts which predict lower growth rates than the previous model release.
- 1.3.3 This is significant because the socio-economic forecasts are used to derive rail demand forecasts for the PFM, as well as being used in the calculation of benefits for the future modelled years.

Table 1: Overall change in the quantified costs and benefits of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network			
		PFMv6.1c	PFMv7.1	Abs. Change	% Change
		2015/16 present value prices			
1	Transport User Benefits				
	Business	62.0	56.5	-5.5	-8.8%
	Other	21.4	15.8	-5.6	-26.1%
2	Other quantifiable benefits	0.4	0.3	-0.0	-10.2%
3	Loss to Government of Indirect Taxes	-4.1	-3.8	0.3	-7.7%
4	Net Transport Benefits (PVB)	79.6	68.8	-10.8	-13.5%
5	Wider economic impacts (WEIs)	21.1	17.2	-4.0	-18.8%
6	Net benefits including WEIs = (4) + (5)	100.8	86.0	-14.7	-14.6%
7	Capital Cost	57.1	55.8	-1.3	-2.3%
8	Operating Costs	25.3	27.6	2.3	9.1%
9	Total costs = (7) + (8)	82.3	83.4	1.1	1.2%
10	Revenues	43.4	41.0	-2.4	-5.4%
11	Net costs to Government = (9) – (10)	38.9	42.4	3.5	9.0%
12	BCR without WEIs (ratio) = (4)/(11)	2.0	1.6	-0.4	-20.6%
13	BCR with WEIs (ratio) = (6)/(11)	2.6	2.0	-0.6	-22.1%

PFM v7.1 Step-through report: Summary of key changes to modelling assumptions

1.3.4 As well as changes to the modelled demand, benefits and revenues, there have been modelling updates to the economic cost estimates which are outlined in chapter 4.

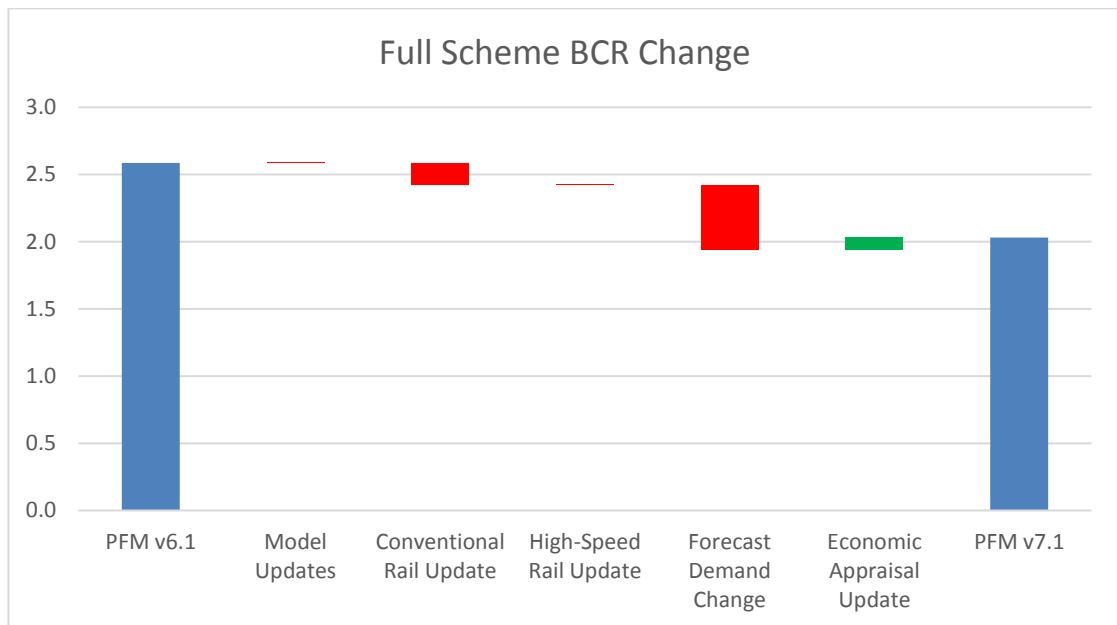
1.3.5 In order to make understandable the overall change in benefits between the previous model release, PFMv6.1c, and the latest model release, PFMv7.1, the various updates that have been incorporated into PFMv7.1 have been categorised into the following key steps so that their impacts can be isolated:

- Step 1 – Upgrade to EMME4;
- Step 2 – Conventional Rail TSS Updates;
- Step 3 – High-Speed Rail TSS Updates;
- Step 4 – Demand forecasting update; and,
- Step 5 – Economic appraisal update.

1.3.6 Full details of the updates contained within each of the listed steps is contained within the remainder of this document. Figure 1 illustrates the overall full scheme BCR change with the application of each category of updates to the model between the previous release of PFMv6.1c and the latest release, PFMv7.1.

1.3.7 The figure shows that the central estimate BCR fell from 2.6 in PFMv6.1c (left of chart) to 2.0 in PFMv7.1 (right of chart), with the steps between showing the impact of each category of model update.

Figure 1: Change in BCR between PFMv6.1c and PFMv7.1 by step.



1.3.8 This figure is for illustrative purposes only to show the BCR change with each category of update. Each of the steps is a required stage in the development of the modelling suite as assumptions and model inputs are updated between model release versions.

1.3.9 As can be seen from the figure, overall the updates that have been incorporated have lowered the full scheme BCR. The largest reduction in the BCR is a result of the updates to demand forecasts which are dependent on economic forecasts.

PFM v7.1 Step-through report: Summary of key changes to modelling assumptions

- 1.3.10 The remaining chapters of the report provide further information on the updates that have been incorporated into PFMv7.1, and the impact that they have had on the benefits of the scheme.
- 1.3.11 In order to provide a direct comparison with PFMv6.1c, all of the benefits reported in this document assume there is no growth in population after the second forecast year (i.e. a cap on demand is applied).

2 Modelling Updates

2.1 Introduction

- 2.1.1 This chapter provides added detail on the updates that have been incorporated into the PFM modelling suite between PFMv6.1c and PFMv7.1. Between model release versions it is routine for a variety of updates to be incorporated into the new model release version.
- 2.1.2 In order to present the various updates in a clear and understandable way, they have been grouped into a series of steps so that the incremental impact on modelled benefits of each step can be isolated.
- 2.1.3 For the latest model release, the following steps have been identified as significant to understanding the impact of updates between PFMv6.1c and PFMv7.1:
- PFMv6.1c – Previous model release.
 - Step 1
 - Red Check Amendments to PFMv6.1c;
 - Migration of the Model to EMME₄; and,
 - Incorporation of Enhanced Standard Outputs.
 - Step 2
 - Updates to TSS for conventional rail services.
 - Step 3
 - Updates to high-speed TSS based on revised scheme design and service provision.
 - Step 4
 - New rail demand matrices following the release of revised demand drivers such as socio-economic forecasts;
 - Update of the second forecast year from 2036/37 to 2037/38 as part of the 20-year appraisal horizon for the economic assessment; and,
 - Revised WebTAG parameters such as those related to vehicle operating costs, efficiency and fleet characteristics.
 - Step 5 – PFMv7.1
 - Updates to the Economic Appraisal template following the release of revised WebTAG annual parameters and GDP deflators.
- 2.1.4 This chapter contains a sub-section detailing the impact of each of these steps on the forecast benefits from the HS2 scheme.

2.2 Step 1 – Red Check Amendments & EMME₄ Migration

Summary of Key Updates

- 2.2.1 The first grouping of updates are predominantly related to functionality within the PFM suite. The software developers of the EMME modelling platform, INRO, have released a new version of the modelling software, EMME_{4.2.9}. This new version of the software has received several upgrades compared with the previous EMME₃ software, however a notable advantage is the software's ability to decrease the time required for a model to complete.
- 2.2.2 Compared with the previous version of the EMME software that the PFM was utilising there are also some significant improvements in the functionality to extract information from the model.
- 2.2.3 This has allowed the development of an array of enhanced standard outputs from the model which have been automated to be produced each time the model is deployed. Not only does this allow greater interrogation of model outputs, but it also allows greater efficiency in data extraction making the process of reporting model results more automated.
- 2.2.4 In addition to the migration of the model to EMME_{4.2.9} and the development of enhanced Standard Outputs, there were a number of minor amendments to model inputs that were detected during the detailed Red Check of PFMv6.1c.
- 2.2.5 The purpose of a Red Check is to undertake a detailed and thorough check of input updates that have been incorporated to the PFM since the previous Red Check. During the Red Check of PFMv6.1c, several minor amendments were identified for the following model inputs:
- Rail network files;
 - Rail transit lines;
 - Rail preload transit line mappings;
 - Station Choice Model inputs; and,
 - Economic Appraisal template.

Impact on Benefits

- 2.2.6 Overall, the updates that have been incorporated into this step do not have a significant impact on the scheme benefits. The majority of the updates are related to functionality, with minor amendments to some of the model inputs.
- 2.2.7 Table 2 presents the impact on modelled benefits between PFMv6.1c and Step 1. During model development testing, the migration to the EMME4.2.9 software platform was found to have a negligible impact upon the modelled benefits, whilst the minor amendments to the inputs that were updated in this step were also found to have only marginal impacts upon the modelled benefits.
- 2.2.8 The slight reduction in the overall benefits is caused by the update to model inputs which result in a slight reduction in the agglomeration benefits from the wider economic impacts analysis of the HS2 scheme.

Table 2: Step 1 change in the benefits of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network		
		PFMv6.1c	Step 1	Change
		2015/16 present value prices		
Transport User Benefits	Business	62.0	62.0	0.1%
	Other	21.4	21.4	0.2%
Other quantifiable benefits		0.4	0.4	0.6%
Loss to Government of Indirect Taxes		-4.1	-4.1	0.1%
Net benefits including WEIs (PVB)		100.8	100.7	-0.1%

2.3 Step 2 – Conventional Rail TSS Updates

Summary of Key Updates

- 2.3.1 Since the release of PFMv6.1c, revised information has been produced on the service patterns of conventional (non-high speed HS2) rail services in the forecast years. In some cases, these are large scale updates following the re-letting of whole rail franchises, and in other cases the updates have involved targeted schemes where specific improvements are being implemented on the rail network.
- 2.3.2 As with all updates to forecast conventional rail services, the impact on the benefits of the HS2 scheme will be dependent on the scale of the change in service levels, and on the extent to which the changes affect markets served by the HS2 scheme.
- 2.3.3 Within the updates to the PFMv7.1 conventional rail updates, there is a combination of updates to services remote from HS2, and services which will overlap with the HS2 scheme.
- 2.3.4 The conventional rail updates incorporated include:
- **London Midland** – Full recoding of the franchise based upon the specifications within the franchise Invitation to Tender (ITT) issued for the franchise competition. Final award of the franchise to the operator is expected in Summer 2017. Since London Midland operates services that will compete with the new High Speed services, this is a significant change to the conventional rail service provision;
 - **Greater Anglia** – Full recoding of the franchise based on the award of the franchise and the agreements within the new franchise including new timetable and rolling stock assumptions. This also includes the remapping of some services to London Overground. Though these changes are fairly large in scale, as neither of these franchises serves markets affected by the HS2 scheme, these changes have relatively little impact on the scheme benefits;
 - **Midland Mainline (MML)** – Updates to the journey time and service patterns for East Midlands services to/from London following new assumptions related to the upgrade and electrification of the Midland Mainline. This impacts upon the coding assumptions for the East Midlands and East-West Rail TOCs;
 - **West Coast Mainline (WCML)** – There are revised assumptions regarding the provision of WCML services. In PFMv7.1, all WCML Pendolino services in the Do Something scenario will be provided by 11-car train sets whereas previously there were some services operated by 9-car train sets. Since WCML competes directly with HS2 services, this represents a significant change to the modelling assumptions; and,
 - **WCML \ TPE** – There has been an amendment to the forecast Do Something service pattern assumptions for WCML and TPE. Previously there was an assumption that in the Do Something a Manchester Airport to Scotland service operated by TPE in the Do Minimum would be removed and replaced by extending a WCML Euston-Manchester service to Scotland. However, this has now been revised to terminate the WCML service at Manchester Piccadilly,

and reinstate the TPE Manchester Airport to Scotland service in the Do Something.

Impact on Benefits

- 2.3.5 Updates to the TSSs of conventional rail services can have a significant impact on the modelled benefits of the HS2 scheme, both positive and negative.
- 2.3.6 Improving the service provision of conventional rail services in the Do Minimum scenario for markets that will be served by HS2 services reduces the potential benefits of these services. Similarly, if better representation of conventional rail services in the PFM improves the forecast Do Minimum scenario, it will also reduce the benefit of the scheme.
- 2.3.7 Where improvements to conventional rail services improve accessibility to HS2 services this will result in generation of further rail demand and increases in benefits.
- 2.3.8 Table 3 presents the impact on modelled benefits between Step 1 and Step 2. Overall, the updates that have been incorporated into this step reduce overall benefits by ~5%. This reflects the significant updates that have been applied to three TOCs that compete directly with HS2 on key routes.
- 2.3.9 The updates to London Midland on the London-West Midlands and London-North West routes, as well as the updates to East Midlands services on the London-East Midlands route combined have reduced the overall benefits of the scheme by improving the Do Minimum scenario against which HS2 is assessed. The changes to the WCML\TPE Do Something specifications has reduced the benefits to be realised from the scenario with HS2 in place.
- 2.3.10 There is a significant difference between the impact on user benefits for 'Business' and 'Other' which can be attributed to the updates affecting different flows with different journey purpose characteristics. For example, the change to the WCML\TPE service patterns in the Do Something on North West – Scotland flows is more likely to impact 'Other', whereas changes to London Midland and Midland Mainline is more likely to affect 'Business'.

Table 3: Step 2 change in the benefits of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network		
		Step 1	Step 2	Change
2015/16 present value prices				
Transport User Benefits	Business	62.0	62.0	-0.1%
	Other	21.4	19.1	-11.0%
Other quantifiable benefits		0.4	0.3	-10.5%
Loss to Government of Indirect Taxes		-4.1	-4.0	-3.4%
Net benefits including WEIs (PVB)		100.7	96.1	-4.6%

2.4 Step 3 – HS2 Scheme Design and Service Provision

Summary of Key Updates

- 2.4.1 As the HS2 scheme develops over time, the project is subject to revisions to the design and operating parameters which impact upon the train service specification and vehicle capacities. Between PFMv6.1c and PFMv7.1 there have been updates to the scheme specification, particularly in Phase 2b.
- 2.4.2 In the Phase 1 and Phase 2a train specifications there have been some minor amendments to journey times following revisions of the scheme design. The stopping patterns for Phase 1 and Phase 2a have not changed and remain as they were in PFMv6.1c.
- 2.4.3 The Phase 2b train service specification for HS2 is considerably altered from the previous model release. As in Phase 1 and Phase 2a, there have been some minor adjustments to journey times on services between London-Birmingham and the Western arm of the full high-speed network to Manchester, Liverpool and Scotland.
- 2.4.4 On the Eastern arm of the Phase 2b network, the most significant update to the high-speed specification is that high-speed services now serve Sheffield Midland station instead of Meadowhall station. This is a significant change to service patterns and results in some journey times increasing because of the added time to access Sheffield Midland via conventional rail lines, whilst other services (e.g. London-Leeds) have lower journey times because they no longer need to stop at Meadowhall and so continue direct to their other calling points.
- 2.4.5 All modelled phases have also been updated with revisions to vehicle capacities for HS2 services.
- 2.4.6 Full details of the modelled service pattern in PFMv7.1 are contained within the "PFMv7.1 Assumptions Report".

Impact on Benefits

- 2.4.7 The updates that have been incorporated into this step have a positive impact on the scheme benefits. The updates to the journey times, capacity and station calling points around Sheffield impact upon rail demand patterns and the benefits that are realised by the scheme.
- 2.4.8 Table 4 presents impact on modelled benefits between Step 2 and Step 3. These show that there is forecast to be an increase in scheme benefits as a result of the updates to high-speed service patterns.
- 2.4.9 The largest increases in benefits are related to the revisions to journey times as a result of the revised service patterns. In particular there is a reduction in journey time on HS2 services between London and Leeds due to services no longer stopping at Meadowhall, which increases the journey time savings for those movements.
- 2.4.10 The updates to vehicle capacity assumptions for HS2 services has a relatively minor impact on the benefits realised by the scheme compared to the updates to stopping patterns and journey times, and so does not have a material impact on the economic case.

PFM v7.1 Step-through report: Summary of key changes to modelling assumptions

Table 4: Step 3 change in the benefits of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network		
		Step 2	Step 3	Change
2015/16 present value prices				
Transport User Benefits	Business	62.0	62.7	1.2%
	Other	19.1	19.2	0.8%
Other quantifiable benefits		0.3	0.4	4.1%
Loss to Government of Indirect Taxes		-4.0	-4.0	1.1%
Net Transport Benefits (PVB)		96.1	96.9	0.8%

2.5 Step 4 – Revised Demand Forecasts and WebTAG Parameters

Summary of Key Updates

- 2.5.1 The growth in rail demand between the Base Year and the Future Year models is calculated using forecasts of growth in key rail demand drivers. These key rail demand drivers reflect several factors that significantly impact on rail demand growth, e.g. GDP, population, employment, cost of competing modes etc.
- 2.5.2 Rail demand drivers are subject to regular updates throughout the year as new and revised forecasts are released by national bodies such as the Office for Budget Responsibility (OBR), the Department for Transport (DfT), and the Treasury.
- 2.5.3 Since the release of PFMv6.1c, new demand drivers and WebTAG parameters have been released and incorporated into the demand forecasting and into the PFM. The following principal updates have been incorporated into PFMv7.1 which have varying impacts on the overall level of modelled rail demand:
- New forecast rail demand matrices have been produced following the release of new demand drivers. Significant updates to the demand drivers include the revised GDP forecasts released by the OBR in November 2016. The socio-economic demand drivers used in PFMv7.1 are forecasting lower growth in rail demand than in the previous model release;
 - The new rail demand matrices also take into account observed growth in rail demand between the model Base year and the present as recorded by the Office for Road and Rail (ORR). Incorporating the observed growth since the Base Year into the demand forecasting increases the demand in the model since observed growth has exceeded expectations;
 - In keeping with the 20-year economic appraisal horizon approach, the second forecast year has been forecast for 2037/38 rather than 2036/37. The net impact of changing the second forecast year is to allow for an additional year of growth between the Base year and the second forecast year thus increasing growth in demand compared to the previous release; and,
 - Updates to WebTAG parameters such as those concerning vehicle operating costs have been incorporated into the demand model inputs. The updates to these parameters impact upon the demand forecasting, but also on the mode choice within the model since the cost of operating a vehicle is a determining factor in mode choice.
- 2.5.4 The demand matrices are key to modelling the benefits of the scheme, since many of the scheme benefits are affected by either the level of demand using the scheme, or the volume of trips being made on the wider rail network. As such, revisions to the demand matrices can have a significant impact on the modelling, and the benefits realised by the scheme.
- 2.5.5 During model development of PFMv7.1, analysis of the demand drivers revealed lower growth in rail demand than had been forecast for the previous model release version. Rail demand is still forecast to increase significantly from the modelled base year, however at a slower rate than in the previous model release.

- 2.5.6 The implication of the lower growth in demand is that there will be fewer modelled benefits from the scheme because not only would there be fewer people to benefit directly from the scheme, but also less demand in the forecast years reduces the overall levels of congestion in the forecast years impacting on wider benefits.
- 2.5.7 However, it should be noted that whilst overall levels of growth might have reduced, growth can be distributed differently across the country, implying that whilst overall growth in demand is reduced, it might be concentrated on different flows at a disaggregate level which could increase demand on some geographical movements.
- 2.5.8 Table 5 shows the % change in Do Minimum long distance rail demand originating from each government office region in the forecast years between PFMv6.1c and PFMv7.1. The figures in the table show how the change in demand forecasts varies by geographical location, demand drivers, and by forecast year. As is shown in the table, the level of demand originating in the London region is reduced by the largest proportion with varying reductions in other regions.

Table 5: Change in Origin Rail Demand at Sector level for Do Minimum for 2026/27 and 2037/38 between PFMv6.1c and PFMv7.1.

Sector	2026/27 % Change	2036/37 % Change
East Anglia	-1%	-2%
East Midlands	-3%	-6%
London	-6%	-10%
North East	0%	-5%
North West	-1%	-6%
Scotland	-4%	-8%
South East	-2%	-4%
South West	-1%	-6%
Yorkshire and Humberside	-2%	-7%
Total	-2%	-7%

- 2.5.9 Further detailed analysis of the demand forecasting process is contained with the “PFMv7.1 Forecasting Report”.

Impact on Benefits

- 2.5.10 The updates that have been incorporated into this step have a significant impact on the scheme benefits. The updates to the demand matrices will impact upon rail demand patterns and overall volumes of rail demand thus significantly impacting upon modelled benefits.
- 2.5.11 Table 6 presents impact on modelled benefits between Step 3 and Step 4. These show that the updates to the demand forecasting have reduced modelled benefits by ~12% from the previous step.

Table 6: Step 4 change in the benefits of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network		
		Step 3	Step 4	Change
2015/16 present value prices				
Transport User Benefits	Business	62.7	54.9	-12.6%
	Other	19.2	17.4	-9.6%
Other quantifiable benefits		0.4	0.4	-2.8%
Loss to Government of Indirect Taxes		-4.0	-3.7	-8.9%
Net Transport Benefits (PVB)		96.9	85.9	-11.3%

- 2.5.12 Table 7 shows the change in the components of modelled benefits as a result of the demand forecast updates. The largest decreases in the modelled benefit components in absolute terms are from crowding and from in-vehicle time. This is to be expected given that less demand means fewer people on the railway and so less crowding, as well as fewer people on the high-speed services enjoying the faster journey times.

Table 7: Step 4 change in the disaggregate benefit components of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network			
		Step 3	Step 4	Change	% Change
2015/16 present value prices					
In-Vehicle Time Savings		55.8	51.0	-4.8	-9%
Wait Time Savings		9.9	9.1	-0.8	-8%
Board/Interchange Savings		0.9	0.6	-0.3	-30%
Crowded Time Savings		13.1	9.2	-3.9	-30%
Access/Egress Time Savings		1.0	0.9	-0.1	-10%

While the updates to WebTAG parameters will impact on aspects of the demand model, modal choice and modelled benefits, the impact of the WebTAG parameters in this step is marginal compared to the change due to the new demand forecasts.

2.6 Step 5 – PFMv7.1 – Updated Economic Appraisal Template

Summary of Key Updates

- 2.6.1 The revised economic forecasts that were incorporated into the demand matrix updates in Step 4, also impact upon the Economic Appraisal of the HS2 scheme. In particular, the updated GDP growth forecasts anticipate lower growth in GDP than the forecasts used for PFMv6.1c.
- 2.6.2 In terms of how this impacts upon the economic appraisal of the scheme, a lower rate of GDP growth rate means that the value of time in the future scenarios modelled in PFMv7.1 will be lower than it was in PFMv6.1c.
- 2.6.3 The following updates have been incorporated into this step:
- GDP growth rates have been updated from the WebTAG Databook. The growth rates are used in the economic appraisal to forecast growth in the value of time from which benefits are calculated. Lower rates of growth in the value of time results in lower values attributed to benefits;
 - GDP deflators have been updated from HM Treasury sources and will have changed in line with socio-economic forecasts;
 - In line with the 20-year appraisal horizon that led to the second forecast year changing from 2036/37 to 2037/38, the discount year in the economic appraisal has also been updated to 2017/18 i.e. the current financial year;
 - Population growth rates have been updated from the WebTAG Databook reflecting revisions to population growth forecasts since the previous model release versions;
 - Wait and Walk Time Weightings have been revised following updated guidance from WebTAG. The most significant change is to increase the weighting of Wait and Walk benefits for Business users to equal the weight for Commute and Leisure users which has a positive impact on benefits;
 - Fuel Cost Parameters & Fuel Costs have been updated in line with the latest WebTAG Databook release; and,
 - Vehicle Fleet Proportions updated in line with the latest WebTAG Databook release.

Impact on Benefits

- 2.6.4 Table 8 presents the impact on modelled benefits between Step 4 and Step 5 \ PFMv7.1. The updates to the economic appraisal inputs have overall had a marginal impact on modelled benefits. The lower annual GDP growth rate in PFMv7.1 means that the value of time in the future will be lower than in PFMv6.1c, meaning the value attributed to benefits will be lower, thus the overall benefits would be lower. This can be seen in the transport user benefits for 'Other'.
- 2.6.5 However, not all of the updates have a negative impact on the economic appraisal. The update to the Wait and Walk Time benefit weightings for example, have increased the value of those benefits components following revisions to WebTAG

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guidance. This primarily affects the Business journey purpose only, which is why the change in Business benefits is slightly positive.

Table 8: Step 5 change in the benefits of HS2 (£bn 2015/16 present value prices)

Item (£bn)		Full HS2 Network		
		Step 4	PFMv7.1	Change
		2015/16 present value prices		
Transport User Benefits	Business	54.9	56.5	3.0%
	Other	17.4	15.8	-9.0%
Other quantifiable benefits		0.3	0.3	-1.4%
Loss to Government of Indirect Taxes		-3.7	-3.8	3.7%
Net Transport Benefits (PVB)		85.9	86.0	0.1%

3 Updates to Cost Estimates

- 3.1.1 As detailed in the High Speed Two (HS2) Ltd Annual Report and Accounts 2015/16, HS2 has an overall funding envelope of £55.7 billion at 2015 prices¹. The capital costs used for this appraisal are in line with the funding envelope. The Economic Case also takes into account estimated operating costs, which include the operation and maintenance of trains and track, train crew and station staff for HS2, and any operating cost savings from changes to the classic network. All costs continue to be presented in 2015 prices.
- 3.1.2 For the benefit-cost ratio calculations in the Economic Case, these costs are converted into net present values. The following paragraphs explain the changes to this net present value cost, and reflect methodological updates relevant to the economic analysis of HS2. There has however been no change to the funding allocation of the scheme in terms of actual budget.
- 3.1.3 The main change that has occurred since the November 2016 publication is an amendment to the reference case train service specification, whereby high-speed services now call at Sheffield Midland station instead of Meadowhall station.
- 3.1.4 In terms of capital costs, moving from Meadowhall to the Sheffield Midland service results in a saving, as explained in the November 2016 publication². There has also been a methodological change of a shift in the economic appraisal base year to 2017. This increases the amount of sunk costs in line with DfT WebTAG guidance³, reducing the capital cost net present value figure. The capital cost estimates continue to reflect higher construction cost inflation, now updated to be between the years 2017 and 2022.
- 3.1.5 The operating costs for the Sheffield Midland are comparably higher than the Meadowhall service. Other methodological changes increasing the operating costs are changes to the economic appraisal start year and demand cap year, and higher real term growth in RPI estimates and wages from the latest DfT WebTAG estimates⁴.
- 3.1.6 The impact of these capital and operating cost changes is a net increase in the present value total cost estimate for the full network as set out in Table 1.

¹ High Speed Two (HS2) Ltd, Annual Report and Accounts 2015/16, available on <https://www.gov.uk>, <https://www.gov.uk/government/publications>

² HS2 Phase 2b Crewe to Manchester & West Midlands to Leeds: Economic Case, available on <https://www.gov.uk>, <https://www.gov.uk/government/publications>, page 24

³ TAG UNIT A1.2: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427087/TAG_Unit_A1.2_-_Scheme_Costs_November2014.pdf, page 2

⁴ Forthcoming Change to WebTAG – May 2017: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/605678/tag-data-book-forthcoming-change-may-2017.pdf

4 Summary

- 4.1.1 The updates that have been applied to the PLANET Framework Model (PFM) between the previous release, PFMv6.1c, and the latest release, PFMv7.1, are part of the on-going task to maintain and upgrade the PFM in support of the HS2 scheme business case.
- 4.1.2 The updates to socio-economic forecasts are published at regular intervals throughout the year by national organisations such as the Office for Budget Responsibility (OBR) and the Department for Transport (DfT). These socio-economic forecasts are used to forecast levels of demand modelled in the future years in PFM, as well as in the processes used for calculating economic benefits of the scheme.
- 4.1.3 Updates to the anticipated Do Minimum scenario and conventional rail services are updated as timetables are revised, franchises are awarded, and new rail schemes are committed. The most recent model release also includes significant updates to the specification for high-speed rail, particularly in the full network in the vicinity of Sheffield.
- 4.1.4 The updates that have been incorporated between PFMv6.1c and PFMv7.1 have had the effect of reducing the modelled benefits by ~15% through a combination of lower demand forecasts and updated rail service specifications. Some of the costs associated with the scheme have increased marginally since the previous model release, however these increases are small compared to the reductions in overall modelled benefits.

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