

HS2

PFMv9 Assumptions Report

May 2020



Department
for Transport

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PFMv9 Assumptions Report

Revision: Rev01

1 Introduction

1.1.1 The PLANET Framework Model (PFM) has been developed by HS2 Ltd as a modelling tool to forecast the demand and economic benefits of the HS2 project. As modelling assumptions are updated and modelling techniques are revised, new versions of the model are released. The current version of PFM is PFMv9 which has been released following a variety of updates to model inputs.

1.1.2 The modelling techniques and methodology that is used within the PFM is separately described in detail in the PFM Model Description Report.

1.1.3 This document provides a summary of the input modelling and forecasting assumptions used by PFMv9 to generate what is known as the HS2 Reference Case which forms part of the economic business case for the HS2 project.

1.1.4 Throughout this document, reference will be made to 'Do Minimum' and 'Do Something'. These two expressions can generally be defined as:

- **Do Minimum** – The Do Minimum is the forecast future year scenario in which HS2 has not been constructed. It is a scenario in which currently committed infrastructure projects and expected service level agreements are implemented, providing the Reference Case against which the HS2 scheme is to be compared;
- **Do Something** – The Do Something is the forecast future year scenario in which the HS2 project has been constructed and implemented, along with any resulting changes to conventional rail services.
- **Phasing definition in PFM scenarios** - There are numerous Do Something future year scenarios available for modelling within PFMv9:
 - **Phase 1a / 1bi / 2ai** – A Phased Opening scenario: The extent of the high-speed network is *Old Oak Common – Birmingham* expected to be operational from 2029;
 - **Phase 1b** – The extent of the high-speed rail network is *London Euston – Birmingham* expected to be operational from 2031;
 - **Phase 2a** – The extent of the high-speed rail network is *London Euston – Birmingham – Crewe* and is expected to be operational from 2031; and,
 - **Phase 2b** – The full high-speed rail network is in place from *London Euston – Birmingham – Manchester and Leeds* which is expected to be operational from 2035.
 - The detailed service pattern for each scenario above is set out in the 'Train Service Specifications' section of this report.

1.1.5 For the purpose of modelling the Reference Cases for the Phase 1 Full Business Case, the phases are grouped into the following scheme proposals:

- **Parliamentary Powers** which assumes:
 - Phase 1bi opening in 2029 followed by
 - Phase 1b opening in 2031
- **Statement of Intent** which assumes:
 - Phase 2ai opening in 2029 followed by
 - Phase 2a opening in 2031
- **Full Network** which assumes:
 - Phase 2ai opening in 2029 followed by
 - Phase 2a opening in 2031 followed by
 - Phase 2b opening in 2035

1.1.6 The remainder of this document is set out using the following structure:

- Chapter 2: Forecasting Assumptions – This chapter details the information that has been used to forecast demand for transport for the two modelled forecast years;
- Chapter 3: Economic Appraisal – This chapter details the information that has been used in the economic appraisal of the project;
- Chapter 4: Highway and Air Networks – This chapter provides details on what has been included in the air and highway networks for two modelled forecast years;
- Chapter 5: Train Service Specifications – This chapter contains an overview of the rail services coded into the PFM in both the Do Minimum and Do Something scenarios; and,
- Chapter 6: Modelling Reliability – This chapter provides details on how the increased reliability of HS2 services is modelled in the forecast Do Something scenarios.

2 Forecasting Assumptions

2.1 Forecasting Approach

2.1.1 PFMv9 has been developed to model two future years for the PFMv9 Reference Case: the financial years 2029/30 and 2039/40. To model these years, it is necessary to forecast the level of demand for travel in the forecast years. Forecasts of 'Do Minimum' passenger demand are produced by travel mode (rail / air / highway) and journey purpose (Commute / Business / Leisure).

2.1.2 For the PFM, the processes for forecasting demand makes use of the recommended Department for Transport (DfT) modal forecasting procedures for air, highway, and rail:

- Rail demand forecasts are generated in line with DfT's Transport Appraisal Guidance (WebTAG) using the DfT's Exogenous Demand Growth Estimation (EDGE) forecasting software and the methodology from the Passenger Demand Forecasting Handbook (PDFH);
- Highway demand forecasts are generated using the National Trip End Model in the DfT's TEMPro software; and,
- Domestic air demand forecasts are generated using the DfT's Aviation Model.

2.1.3 The remaining sections in this chapter outline the input assumptions used by the demand forecasting models to produce 'Do Minimum' demand forecasts for each of these travel modes.

2.2 Rail Demand Growth

Elasticities

2.2.1 Rail demand growth is generated using the DfT's EDGE software which is based on current WebTAG guidance for forecasting rail demand. This uses the Passenger Demand Forecasting Handbook (PDFH) Version 6 demand elasticities for all demand driver generators (DDGs).

Demand Drivers

- 2.2.2 Rail demand growth between the modelled base year and the modelled forecast years is generated by the DfT's EDGE forecasting software which utilises various demand driver generators (DDGs) to feed into the future year forecasts of rail demand growth. The rail demand drivers generally fall into two categories:
- Macro-economic drivers, such as: GDP per capita growth; growth in employment; and growth in population; and,
 - Costs associated with competing modes of transport.
- 2.2.3 The base year of PFMv9 is the financial year 2014/15, and so the demand drivers are utilised to calculate the forecast change in demand from the base year in 2014/15 to the forecast years in 2029/30 and 2039/40 for PFMv9.
- 2.2.4 The demand drivers for the modelling were provided by the DfT in June 2019 using the latest economic forecasts from the Office for Budget Responsibility (OBR) and Centre for Economics and Business research (CEBR).
- 2.2.5 The following sections detail the source data and assumptions used for each of these drivers in PFMv9. It should be noted that in the following tables the growth is presented from 2018/19 rather than 2014/15. This is because the 2014/15 Base demand is uplifted to 2018/19 using observed growth as reported by the Office for Rail and Road (ORR), to account for actual observed growth. Forecast growth is then calculated on top of this for each of the forecast years.
- 2.2.6 PFMv9 uses the PDFHv6 release. Further detail on the demand forecasting for PFMv9 can be found within the "PFMv9 Forecasting Report".

Population Growth

2.2.7 The growth in population used in PFMv9 is based on Office of National Statistics (ONS) population projections, November 2017, with regional and national shares-based data provided by the Centre for Economics and Business Research (CEBR), March 2019.

2.2.8 Table 2-1 presents the projected growth of the population for the forecast years from 2018/19.

Table 2-1: Regional and national population growth used in rail demand forecasts

Region	Growth in Population from 2018/19	
	2029/30	2039/40
North East	2%	3%
North West	3%	6%
Yorkshire & Humberside	4%	6%
East Midlands	6%	10%
West Midlands	6%	10%
East of England	8%	13%
London	8%	14%
South East	7%	11%
South West	7%	12%
Wales	2%	3%
Scotland	2%	3%
Great Britain	5%	9%

Employment Growth

- 2.2.9 The growth in employment used in PFMv9 has been sourced from the Office for Budget Responsibility (OBR) Economic and Fiscal Outlook Report March 2019. Regional/national distributions are based on CEBR forecasts, March 2019.
- 2.2.10 Table 2-2 presents the predicted growth in employment as used in PFMv9 for the forecast years from 2018/19.

Table 2-2: Regional and national employment growth used in rail demand forecasts

Region	Growth in Employment from 2018/19	
	2029/30	2039/40
North East	2%	0%
North West	1%	2%
Yorkshire & Humberside	3%	12%
East Midlands	6%	10%
West Midlands	6%	11%
East of England	4%	7%
London	8%	10%
South East	3%	3%
South West	7%	13%
Wales	2%	8%
Scotland	3%	3%
Great Britain	4%	7%

Growth in Gross Domestic Product per Person

- 2.2.11 As with employment growth, the economic growth (measured by GDP per person) in PFMv9 has been sourced from the Office for Budget Responsibility (OBR) 'Economic and Fiscal Outlook Report March 2019' using the ONS principle forecast numbers for population. Regional and national shares are based on CEBR, March 2019.
- 2.2.12 In 2012, HM Treasury changed its method of calculation for the GDP deflator from arithmetic to a geometric mean. This means the GDP deflator now corresponds more closely to a Consumer Price Index (CPI) measure of inflation than Retail Price Index (RPI), although it is not quite the same as either. ONS back-calculated historic GDP using this new approach as well as using it in its GDP forecasts.

- 2.2.13 The PDFH GDP to rail demand elasticity parameter was estimated using GDP forecasts defined with the previous definition of the GDP deflator (similar to RPI), rather the new deflator (similar to CPI). Consequently, to maintain consistency with the original calibration of the PDFH the GDP forecasts have to be rebased to the old GDP deflator.
- 2.2.14 The OBR has estimated that the new deflator increases real GDP growth by approximately 0.2 percentage points per annum; the real GDP growth forecasts have therefore been reduced by 0.2 percentage points every year to ensure the growth rates are consistent with the elasticities that are applied to them. The resulting growth is shown in Table 2-3. The Great Britain figures are a population weighted average of the regional figures.
- 2.2.15 For this reason, the GDP forecasts used for forecasting rail growth are different to the ones used to forecast future Value of Time (VoT). The GDP series used for VoT is discussed in Chapter 3.

Table 2-3: Regional and national GDP growth used in rail demand forecasts

Region	Growth in GDP per capita from 2018/19	
	2029/30	2039/40
North East	19%	47%
North West	14%	37%
Yorkshire & Humberside	15%	38%
East Midlands	17%	41%
West Midlands	10%	29%
East of England	23%	55%
London	13%	34%
South East	17%	43%
South West	11%	32%
Wales	18%	45%
Scotland	20%	46%
Great Britain	15%	39%

National Rail and London Underground Fares

- 2.2.16 All National Rail fares in PFMv9 are assumed to grow at a rate of RPI+1% per calendar year, except for the forecast period 2014/15-2019/20, when RPI+0% applies, in line with the Government’s current policy on rail fares. Table 2-4 shows the cumulative growth used in the model from 2018/19 to the forecast years 2029/30 and to 2039/40.

2.2.17 The assumption of RPI+1% has been used for London Underground fares in PFMv9 forecast period, except for 2014/15-2015/16 when the actual increase of RPI+0% applies, and for the period 2017/18-2020/21 in which a nominal fare freeze has been applied.

Table 2-4: Rail fare growth used in rail demand forecasts

	Growth in Rail Fares from 2018/19	
	2029/30	2039/40
National Rail	10%	21%

Car Ownership

2.2.18 The change in car ownership in PFMv9 has been sourced from the National Trip End Model (NTEM) in TEMPro version 7.2. This provides forecasts for the number of car-owning households.

2.2.19 Table 2-5 shows the growth in proportion of car-owning households for key cities.

Table 2-5: Car ownership growth used in rail demand forecasts

	Growth in Car Ownership from 2018/19	
	2029/30	2039/40
Total Manchester	5%	9%
Total Birmingham	5%	10%
Total Leeds	4%	8%
Total London	5%	10%
Total Great Britain	3%	6%

Car Journey Times

2.2.20 The change in average car journey times used in the EDGE model for PFMv9 has been sourced from the DfT's TAG Databook. The assumptions for travel times to London from the rest of Great Britain are shown in Table 2-6.

Table 2-6: Car journey time growth used in rail demand forecasts

	Growth in Car Journey Times from 2018/19	
	2029/30	2039/40
LTA to LTA	5%	9%
ROSE to LTA	1%	3%
ROSE to ROSE	0%	2%
ROC to LTA	1%	3%
Core Centre to Core Centre	1%	3%
Non-London other	1%	3%

Car Cost

2.2.21 This parameter represents the forecast cost of car use taking account of growth in car fuel prices and projected changes in the fuel efficiency of the vehicle fleet. This method is consistent with a change in WebTAG since February 2014 to include vehicle efficiency; previously WebTAG had recommended using only car fuel price growth as a proxy for growth in all car costs.

Table 2-7: Car cost growth used in rail demand forecasts

	Growth in Car Costs from 2018/19	
	2029/30	2039/40
LTA to LTA	-12%	-15%
ROSE to LTA	-13%	-17%
ROSE to ROSE	-13%	-16%
ROC to LTA	-13%	-16%
Core Centre to Core Centre	-13%	-17%
Non-London other	-14%	-17%

Bus and Coach Fares

2.2.22 Bus and coach fares are based on projections by DfT Local Economics of bus fare and bus service forecasts updated in June 2019. Forecast growth from 2018/19 is shown in Table 2-8.

Table 2-8: Bus and coach fare growth used in rail demand forecasts

	Growth in Bus and Coach Fares from 2018/19	
	2029/30	2039/40
LTA to LTA	17%	46%
ROSE to LTA	28%	61%
ROSE to ROSE	28%	61%
ROC to LTA	28%	61%
Core Centre to Core Centre	28%	61%
Non-London other	28%	61%

Bus and Coach Journey Times

2.2.23 The forecast change in average bus and coach journey times has been sourced from the WebTAG Databook, the same as for Car Journey Times. The change for travel times to London from the rest of Great Britain is shown in Table 2-9.

Table 2-9: Bus and coach journey time growth used in rail demand forecasts

	Growth in Bus Journey Times from 2018/19	
	2029/30	2039/40
LTA to LTA	8%	16%
ROSE to LTA	1%	4%
ROSE to ROSE	1%	3%
ROC to LTA	3%	6%
Core Centre to Core Centre	2%	4%
Non-London other	1%	4%

Bus and Coach Frequency

2.2.24 The forecast change in average bus and coach frequency are based on projections by DfT Local Economics of bus fare and bus service forecasts. The change is shown in Table 2-10.

Table 2-10: Bus and coach frequency growth used in rail demand forecasts

	Growth in Bus frequency from 2018/19	
	2029/30	2039/40
LTA to LTA	-1%	-1%
ROSE to LTA	1%	1%
ROSE to ROSE	1%	1%
ROC to LTA	1%	1%
Core Centre to Core Centre	1%	1%
Non-London other	1%	1%

Air Passengers

2.2.25 The forecast change in domestic air passengers has been sourced from outputs of DfT's aviation model. Table 2-11 shows forecasts growth of air passengers by airport.

Table 2-11: Air passenger growth used in rail demand forecasts

Region	Growth in air passengers from 2018/19	
	2029/39	2039/40
Gatwick Airport	2%	14%
Heathrow Airport	60%	72%
Stansted Airport	-8%	27%
Birmingham Airport	17%	59%
Manchester Airport	7%	34%
Southampton Airport	-11%	-13%
Cardiff Airport	-36%	-24%

2.3 Rail Demand Forecasts

Forecast years

2.3.1 The forecast years for PFMv9 are taken as:

- an opening year for the first phase of the scheme – assumed to be 2029/30; and,
- a second forecast year of 2039/40.

- 2.3.2 Using the rail demand drivers detailed in Section 2.2, the EDGE software produces rail growth forecasts for the opening year 2029/30 and the second forecast year 2039/40. The growth is summarised in Table 2-12 for PLD and in Table 2-13 for the regional PLANET models. These summarise the aggregate growth in each demand matrix, however the aggregate growth rates will be different for the range of flow types and zone combinations within each of the models.
- 2.3.3 The PFM model Base year is 2014/15, the change to the rail demand forecasting approach to incorporate observed growth since the Base year (see paragraph 2.2.7) means that demand forecasts include observed growth to 2018/19 and then forecast growth from 2018/19 onwards.

Table 2-12: Input forecast PLD matrices – growth in rail demand by journey purpose

Journey Purpose	Growth in Rail Demand from 2014/15	
	2029/30	2039/40
Commuting NCA	18%	21%
Commuting CA from	28%	39%
Commuting CA to	28%	39%
Business CA from	37%	57%
Business CA to	37%	57%
Leisure NCA	26%	39%
Leisure CA from	36%	57%
Leisure CA to	37%	59%
Total	33%	51%

NCA = No Car Available. CA = Car Available.
The car available/non-car available split does not apply for rail business trips.

Table 2-13: Input forecast regional matrices – growth in rail demand by journey purpose

Regional Model	Journey Purpose	Growth in Rail Demand from 2014/15	
		2029/30	2039/40
PLANET South (PS)	Business	29%	53%
	Leisure	27%	48%
	Commute	25%	42%
	Total	25%	43%
PLANET Midlands (PM)	Business	29%	48%
	Leisure	29%	48%
	Commute	26%	36%
	Total	26%	38%
PLANET North (PN)	Business	24%	39%
	Leisure	24%	39%
	Commute	16%	22%
	Total	18%	24%

2.4 Highway Demand Forecasts

Economic Growth

2.4.1 The highway demand forecasts were developed using factors derived from TEMProv7.2. To ensure consistency between these TEMPro based forecasts and the rail forecasts, which used a more recent OBR GDP growth forecast, a GDP elasticity was applied to the matrices to correct for the discrepancy.

2.4.2 Use was made of the DfT Long Distance Model forecasts using a high and low GDP estimate to derive implied arc elasticities of highway demand to GDP. The elasticities that were derived are shown in Table 2-14.

Table 2-14: Implied elasticity of highway demand with respect to GDP

Attribute	Purpose		
	Commuting	Business	Other
Implied Elasticity	0.087	0.151	0.147

2.4.3 The elasticities shown above were applied to the relative growth in GDP and global factors were calculated with these values, which are shown in Table 2-15. These values were applied to the forecast matrices to correct for the change in GDP forecast.

Table 2-15: Growth applied highway demand to correct for change in GDP forecasts

Year	Growth applied to TEMProv7.2 outputs		
	Commuting	Business	Other
2029/30	-0.6%	-1.0%	-1.0%
2039/40	-0.6%	-1.0%	-1.0%

Highway Forecasts by Purpose

2.4.4 Including the adjustment described above, Table 2-16 shows the highway forecasts applied to the base matrices by the three trip purposes.

Table 2-16: Highway forecasts for long distance trips

Journey Purpose	Growth in Highway Trips from 2014/15	
	2029/30	2039/40
Commuting	4%	9%
Business	8%	14%
Leisure	9%	16%
Total	8%	14%

2.5 Air Demand Forecasts

2.5.1 The PFM model description report provides a detailed description of the DfT Aviation Model and its components. PFMv9 uses outputs from the most recently published DfT aviation forecasts, at the time of model development.

2.5.2 The resulting matrix growth used is shown Table 2-18, it should be noted that the 2014/15 base year air demand matrices were calculated using interpolation from the existing 2010/11 and 2029/30 matrices.

Table 2-17: DfT Aviation Matrices – Growth in Domestic Air Passengers in PFMv9 (annual domestic trips)

Journey Purpose	Growth in Domestic Air Passengers from 2014/15	
	2029/30	2039/40
Business	13%	36%
Leisure	29%	53%
Total	20%	43%
Note: There is no Air Passenger Commuting Matrix in PFM.		

3 Economic Appraisal

3.1 Background

3.1.1 The appraisal of HS2 requires a range of assumptions to compare costs and benefits in accordance with WebTAG guidance. This section outlines the assumptions that have been adopted and their sources.

3.1.2 The economic appraisal uses outputs from the 'Do Minimum' and 'Do Something' (with HS2) scenarios from the PFM to produce an appraisal of the economic benefits of each phase of the scheme over the construction period and 60 years of operation.

3.1.3 The section describes the assumptions used in the economic appraisal of the scheme.

3.2 Price Base

3.2.1 The costs and benefits presented in the appraisal of HS2 are based on 2015/16 prices using the HM Treasury GDP deflator as a measure of inflation. The definition of this deflator has been changed from being more consistent with an RPI metric to being more consistent with a CPI metric.

3.3 Appraisal Period

3.3.1 In line with WebTAG guidance the appraisal period is based on 60 years of operation of the scheme.

3.3.2 The key assumptions used for the modelling and appraisal in PFMv9 are listed below.

- **Parliamentary Powers:**
 - Phased Opening (Phase 1bi) - December 2029;
 - Full 10 tph service from Euston (Phase 1b) – December 2031;
- **Statement of Intent**
 - Phased Opening (Phase 2ai) – December 2029;
 - Full 10 tph service from Euston (Phase 2a) – December 2031;
- **Full Network**
 - Phased Opening (Phase 2ai) – December 2029;
 - Full 10 tph service from Euston (Phase 2a) – December 2031;
 - Full Network service (Phase 2b) – December 2035;

3.3.3 Modelled years in the PLANET Forecast Model:

- First Forecast Modelled Year – 2029/30; and,
- Second Forecast Modelled Year – 2039/40.

3.4 Parameters

3.4.1 Within the PFMv9 appraisal process there are a series of weights that are applied to each benefit component by journey purpose. These are shown in Table 3-1.

Table 3-1: Generalised cost element weights for rail

Rail Element	Business	Commute	Other
In Vehicle Time	1.0	1.0	1.0
Wait Time	2.0	2.0	2.0
Access/Egress Costs PLD	1.0	1.0	1.0
Access/Egress Costs Regional PLANETS	1.0	1.0	1.0
Board Time Penalty (mins)	30.0	30.0	30.0

Values of Time

3.4.2 The values of time in the appraisal are assumed to increase with income. The measure of income used is GDP per person (as recommended by TAG Unit A1.3).

3.4.3 The appraisal is based on the same GDP and population sources that feed into the PFM demand (choice) model’s forecasts as outlined in Chapter 2.

3.4.4 The precise inputs to the appraisal are GDP growth forecasts and population growth data taken from the DfT’s WebTAG Databook Annual Parameters table in May 2018. GDP growth is measured in real terms using the GDP deflator which is based on CPI (WebTAG Databook, May 2018).

3.4.5 These inputs to the appraisal differ slightly from their use in the demand model which is based on mainland Great Britain transport networks that exclude Scottish islands and with income growth adjusted for inflation using the retail prices index.

Table 3-2: Growth in GDP used to derive value of time in the appraisal

Attribute	Growth from 2014/15	
	2029/30	2039/40
GDP, UK	31%	63%
Population, UK	9%	12%
GDP per person, UK	20%	46%

- 3.4.6 In October 2015, the Department for Transport published the report 'Understanding and Valuing the Impact of Transport Investment' (DfT, 2015). The report set out proposals for changing the way time savings are valued within transport, and particularly, to allow the value of time applied to each impact to vary according to the trip distance.
- 3.4.7 The values of time by distance band are shown in Table 3-3 along with the previous values. In line with guidance (TAG Unit A1.3, May 2019), the values of working and non-working time are assumed to increase with income with an elasticity of 1.0.

Table 3-3: Values of Time by Distance Band

Purpose/Mode	Distance Band	Values of Time by Purpose (£/hr) (2010/11 prices)
Business – Highway Driver Business – Highway Passenger	0-50km	10.02
	50-75 kms	14.32
	75-100 kms	17.05
	100-125 kms	19.63
	125-150 kms	21.92
	150-175 kms	23.83
	175-200 kms	25.35
	200-225 kms	26.51
	225-250 kms	27.38
	250-275 kms	28.01
	275-300 kms	28.46
	300-325 kms	28.78
	325-350 kms	29.01
	350-375 kms	29.16
	375-400 kms	29.27
	>400 kms	29.32
Business – Rail Passenger	0-50km	10.02
	50-75km	14.43
	75-100 kms	18.41
	100-125 kms	22.63
	125-150 kms	26.77
	150-175 kms	30.56
	175-200 kms	33.80
	200-225 kms	36.40
	225-250 kms	38.40
	250-275 kms	39.89
	>275 kms	40.96
Commuting	All	9.95
Other	All	4.54

Annualisation Factors

3.4.8 PFMv9 provides outputs for an average weekday. To undertake an appraisal of HS2, these weekday values are annualised to represent a full year. Table 3-4 shows the annualisation factors that have been derived for each mode and journey purpose for use in PLD.

3.4.9 The factors for rail and air are consistent with the method adopted to de-annualise weekday demands from annual matrices. In the case of highway there is no de-annualisation in the matrix development process and the factors have been sourced from an analysis of NTS.

Table 3-4: Annualisation Factors - PLD

Purpose	Rail	Air	Highway
Business	255	313	275
Commuting	264	n/a	282
Other	428	313	361
<i>Average¹</i>	<i>316</i>	<i>313</i>	<i>306</i>

3.4.10 In addition, there are a set of factors used to annualise information from the regional PLANET models which are given in Table 3-5. The regional PLANET models represent the morning peak period and so higher annualisation factors are used.

Table 3-5: Annualisation Factors – Regional PLANETs

Purpose	7AM to 10 AM	10AM to 4PM	4PM to 7PM	7PM to 7AM	Total (incl. Weekend)
Business User	304	539	365	169	1,376
Commuting User	278	86	260	73	697
Other User	303	1,181	602	476	2,562
Business Crowding	253	0	304	0	557
Commuting Crowding	253	0	237	0	490
Other Crowding	253	0	503	0	756

¹ This value is for information only – it is not used in PFM modelling

Fares

- 3.4.11 In accordance with WebTAG, benefits and costs in the appraisal are presented in real terms using the GDP deflator. As such the definition of inflation used in the calculation of revenue (RPI) and the definition of inflation used in the rest of the appraisal (GDP deflator) are inconsistent.
- 3.4.12 To define fares growth based on the GDP deflator, revenues are uplifted by the difference in the RPI and GDP deflator indices over time. The difference between these indices is around 0.9% per annum; in effect, this means real fares growth defined on the basis of RPI+1% per annum is equivalent to growth of the GDP deflator +1.9% per annum.
- 3.4.13 For our modelling, all National Rail and London Underground fares are assumed to grow at a rate of RPI+1% per year between 2014/15 and the second forecast year except between 2014/15 and 2020/21, when RPI+0% applies. Within the appraisal there is no further real growth in fares for the remainder of the appraisal period beyond that point.
- 3.4.14 The regional uni-modal sub-models do not contain a fares matrix, and revenue is therefore calculated based on average fares per kilometre as shown in Table 3-6.

Table 3-6: Fares yields

Purpose	Fares £/passenger kilometre (2015/16 prices)		
	PLANET South	PLANET Midlands	PLANET North
Business	0.153	0.172	0.164
Commuting	0.143	0.154	0.174
Other	0.139	0.157	0.153

Ramp-up Effects

- 3.4.15 The full benefits of HS2 will not be experienced in the first few years of operation as not all additional demand will be realised from day one. To reflect this, a series of ramp up assumptions for demand benefits are applied within the appraisal as shown by Table 3-7.

Table 3-7: Assumptions related to ramp-up effects

Year After Opening	Year Phase 1	Year Phase 2a	Year Phase 2b	Growth Adjustment applied to Demand and Benefits
0	2029	2031	2035	-20%
1	2030	2032	2036	-10%
2	2031	2033	2037	-5%
3 and beyond	2032	2034	2038	0%

Discount Rates

3.4.16 In line with TAG Unit A1.1 and the WebTAG Databook, May 2019, a series of discount rates are applied from 2011. The annual discount rates assumed are:

- Until 2049: annual discount rate is 3.5%;
- Between 2050 and 2094: annual discount rate is 3.0%; and,
- After 2095 the discount factor applied is 2.5%.

Highway Factors Used in the Appraisal

3.4.17 Vehicle operating costs are derived using the approach outlined in TAG Unit A1.3. Fuel consumption is estimated using the function:

$$L = \frac{(a + b.v + c.v^2 + d.v^3)}{v}$$

3.4.18 Where L = fuel consumption, expressed in litres per kilometre;

v = average speed in kilometres per hour; and,

a, b, c, d and parameters defined for each vehicle category.

3.4.19 The input for speed of highway traffic, v, is taken from the PLD’s highway model, which estimates average traffic speed using DfT link type specific volume delay functions and traffic estimates. The vehicle operating cost parameters adopted within the HS2 appraisal are based on the parameters used by TAG Unit A1.3.

3.4.20 The impacts of road decongestion are assessed in line with TAG A5.4. In the absence of more specific evidence, TAG suggests the use of a diversion factor based on results from the DfT’s National Transport Model (NTM) which suggests 26% of a change in rail passenger kilometres would be diverted from car kilometres.

Wider Impacts

- 3.4.21 The wider impacts of HS2 that are additional to transport user benefits have been estimated in line with TAG Unit A2.1. The impacts are estimated by using DfT's Wider Impacts in Transport Appraisal (WITA) software. In the case of the output change in imperfectly competitive markets, WebTAG recommends these are estimated as being equivalent in value to 10% of the business user transport benefits.

Carbon Impacts

3.4.22 The impacts of HS2 on emissions of carbon from highway and diesel train use have been appraised using a bespoke model which applies PFM assumptions. These are:

- Assumptions for car fuel consumption, car emissions and the value of a non-traded tonne of carbon from WebTAG;
- Train KMs and highway KMs from PFM;
- Car speeds for long distance and local trips from DfT's National Transport Model; and,
- Diesel train energy consumption is sourced from DfT's Rail Emissions Model.

4 Highway and Air Networks

4.1 Background

4.1.1 Within PLD and the regional PLANET models are a series of networks for the “Do Minimum” and “Do Something” scenarios. This chapter outlines the assumptions made for the air and highway networks, whilst the following chapters outlines the assumptions for the rail networks.

4.2 Do Minimum and Do Something Highway Networks

4.2.1 Within the PFM, no additional highway schemes are added between 2026/27 and 2039/40, hence the highway networks for these years are identical. In addition, they are also identical in the “Do Minimum” and “Do Something” scenarios.

4.2.2 The schemes that are included in the PFMv9 are listed in Table 4-1. Note that the infrastructure schemes include the DfT’s list of under-construction and committed Road Investment Scheme Period 1 (RIS1) infrastructure programs.

Table 4-1: Highway Schemes included in the PFM Forecast Years

Schemes Assumed	
A1 Bramham – Wetherby	A11 Fiveways to Thetford Improvement
A3 Hindhead Improvement	A160 / A180 Improvements, Immingham
A421 Bedford to M1 Junction 13	A465 Dualling Scheme between Abergavenny and Hirwaun
M1 Junctions 25-28 Widening Scheme	A556 Knutsford to Bowdon Environmental Improvement
M25 Junctions 16-23 Widening	M1 Junctions 28-31 Managed Motorways
M25 Junctions 27-30 Widening	M1 Junctions 32-35a Managed Motorway
M27 J3-4 Widening	M1 Junctions 39-42 Managed Motorway
M42 J7-9 Hard Shoulder Running	M25 Junctions 23-27 Managed Motorways
M6 J4-5 Hard Shoulder Running	M25 Junctions 5-7 Managed Motorways
M6 Junctions 8-10A Managed Motorways (Birmingham Box Phase 2)	M60 Junctions 15-12 Lane Gain
M74 Completion	M60 Junctions 8-12 Managed Motorways
M80 Steps to Haggs	M62 Junctions 18-20 Managed Motorway
A1 Dishforth to Leeming Improvement Scheme (A1 Dishforth to Barton)	M8 M73 M74 Motorway Improvements

Schemes Assumed	
A23 Handcross to Warninglid	A453 Widening (M1 Junction 24 to A52 Nottingham)
A46 Newark to Widmerpool Improvement	A494 Drome Ewloe Improvement
M1 Junction 10-13 Improvements	A5-M1 Link (A505 Dunstable Northern Bypass)
M4 Junction 19-20 and M5 Junction 15-17 Managed Motorways	A9 Dualling
M4 Junction 3-2 Bus Lane Suspension Scheme	M3 Junctions 2-4a Managed Motorway
M6 Junctions 5-8 Managed Motorways (Birmingham Box Phase 3)	M4 Junctions 3-12 Managed Motorway
M62 Junctions 25 to 30 Managed Motorway	M54 to M6 / M6 (Toll) Link Road
M6 Junction 10A - 13 Managed Motorway	A500 Etruria Valley Widening
A1(M) Jn 5 - 9 Welyn-Baldock	M5 Junctions 4a - 6 south of Birmingham
A1(M) Jn 6 - 8 Stevenage	M53 J11 - 5 Capacity Improvements
M1 J23a - M1 J24 Smart Motorways	M56 J6 - J8
M1 Junctions 13 - 19 south of Rugby	M6 J10a-13 Widening
M1 Junctions 24 - 25 (Long Eaton)	M6 J5-8w Widening. Birmingham Box Ph3
M20 Jn3 - 5 (Maidstone)	M6 Jn16 - 19 Birmingham - Manchester
M23 Junctions 8 - 10 (Gatwick)	M6 Junctions 13 - 15 between Birmingham and Manchester
M25 J 10-12 SM widening	M6 Junctions 2 - 4 between Coventry and Birmingham
M25 J 14-16 SM Widening (a)	M6 Junctions 21a - 26 west of Manchester
M25 J 14-16 SM widening (b)	M60 J1 - 4 Widening (link to M56 Junction 3 not coded)
M27 Junctions 4 - 11 (Southampton)	M60 J24-27 Widening
M3 Junctions 9 - 14 (Southampton)	M60 J8 -12 Widening
M4: Jn 3 (Uxbridge) to Jn 12 (Reading west): upgrading to Smart Motorway, linking Reading to Heathrow	M62 J25 to J30 Widening
M40/M42 interchange: upgrading to Smart Motorway from junction 16 of the M40 and from junction 3 to 3a of the M42	M62 Junctions 10 - 12 (Manchester)
A1 Leeming to Barton Upgrade to Motorway Standard	A5036 Access to Port of Liverpool
A1 Lobley Hill	M4 J3-12 Widening
A14 Cambridge to Huntingdon	M42 J10 to M69 J1 (1) - A5 Hinckley
A19 Norton to Wynyard	M54 to M6 (Toll) Link - [New Road but upgrade A460]

Schemes Assumed	
A21 Tonbridge to Pembury	M60 J8 -12 Widening
A5: Hinckley: widening of the section of A5 near Hinckley to dual carriageway where it carries traffic for both the A5 and A47	New junction 11A M1, link road to A5

4.3 Do Minimum and Do Something Air Networks

4.3.1 The air passenger supply in PFM represents domestic air services wholly within mainland Great Britain, thus excludes services to Northern Ireland, the Channel Islands, Isle of man, and Scottish Islands. Within PFM, the networks are taken directly from the DfT's Aviation Model.

5 Train Service Specifications

5.1 Background

- 5.1.1 The rail networks within PFM include a representation of a timetable and its associated capacity. The 'Do Minimum' provides a reference against which the 'Do Something' HS2 option is compared.
- 5.1.2 A summary of the key assumptions used within the PLD sub-model of PFM for the Train Operating Companies (TOC) affected by HS2 are given in this chapter. For each TOC, a summary of the service pattern is presented.
- 5.1.3 With a few exceptions, the 'Do Minimum' timetable assumptions are based on future committed schemes only. The 'Do Minimum' makes use of information provided by the DfT for National Rail services and Transport for London (TfL) for London Underground Limited (LUL) services. The national rail and LUL 'Do Minimum' networks are assumed to be identical in the 2029/30 (first forecast year model) and 2039/40 (second forecast year).
- 5.1.4 In the PLD model these assumptions relate to the average service pattern on weekdays. Information used within the regional PLANET models relates to services during the morning peak period on an average weekday.
- 5.1.5 **These assumptions are designed only for the purpose of providing a suitable reference case for the appraisal of HS2. Decisions have not yet been taken about train service requirements – or which stock will operate them – in any of the relevant franchises in any of the forecast years, and therefore these service patterns should be considered indicative.**

5.2 PFMv9 Update

- 5.2.1 For PFMv9 the Train Service Specification (TSS) for all TOCs have been updated as the development of the Timetable Database (TTDB) has automated the production of Emme transit lines from TSS '.spg' files. See section 5.3.
- 5.2.2 It should be noted that reliability time is no longer removed from HS2 service journey times as the methodology for modelling the impacts of reliability has been updated to follow latest guidance.
- 5.2.3 Finally, PFMv9 also considers a number of 'Phased Opening' scenarios which operate either 3 trains per hour (tph) or 6tph from Old Oak Common.

5.3 TSS Development and DfT Ownership / Sign-Off

5.3.1 For each Train Operating Company (TOC) a Train Service Specification (TSS) '.spg' file has been obtained from the Department for Transport (DfT) which provides a breakdown of each individual train service including rolling stock type and station arrival / departure times. HS2 Ltd have developed a tool, the Timetable Database (TTDB), which converts '.SPG' files into PFM EMME transit line coding, this was used first used in PFMv71 for London Midland and Greater Anglia TOCs.

5.3.2 The agreed process between HS2 Ltd. and DfT for implementing the TSS updates in PFM were as follows:

- Do-Minimum SPGs for each TOC would be provided by DfT for implementation within PFM (using the TTDB) from their National Model Framework (NMF) or more recent sources such as a franchise team;
- Do-Something SPGs were developed in collaboration with the DfT and HS2 Ltd with DfT providing final sign-off on each '.SPG' file;
- Throughout the process there was constant dialogue between consultants, HS2 Ltd, and the DfT to ensure effective management and oversight of this process. This includes DfT approval of assumptions, as well as allowing consultants to challenge assumptions following analysis.

5.4 Rolling Stock Capacities

PDFH and PFM Crowding Penalties

5.4.1 Under PDFH, if there are more passengers than seats, then standing passengers are calculated and then divided by the standing area to calculate passengers per square metre. PDFH then provides the In-Vehicle Time crowded penalties to apply.

5.4.2 In PFM these fixed PDFH recommended crowding penalties (IVT multipliers) are used at 100% Load Factor and at a point on the crowding curve (at 2.5 passengers per metre squared). This provides the PFM gradient of crowding curves to apply.

5.4.3 Each TOC is allocated a set of PDFH crowding curve parameters based on the passenger market of the TOC: London and South East, Regional or Intercity. These are based on Stated Preference research of passenger and not allocated by rolling stock type.

PFM Rolling Stock Capacity Assumptions

- 5.4.4 All vehicle types and their capacities have been supplied from DfT’s NMF model. In discussion with DfT it has been established that the standing capacity assumption for the number of passengers standing per square metre varies by rolling stock. Long-distance services typically assume a standing capacity of 0.45 metres per passenger (2.22 passengers per square metre), then for regional it is 0.35 metres per passenger (2.86 passengers per square metre) and finally for modern metro-style rolling stock (such as the new Thameslink Class 700s) it is 0.25 metres per passenger (4 passengers per metre squared.)
- 5.4.5 Therefore, it was necessary to convert the standing capacities provided from NMF to the PFM / PDFH crowding curve assumption of 2.5 passengers per square metre. This was done in consultation with DfT. It should be noted that the total capacity of rolling stock in PFM (seats and standing using 2.5 passengers per square metre) does not necessarily cap capacity at this point but is used as a basis for calculating the crowding curves.

Full Rolling Stock Capacity List

- 5.4.6 A full list of the vehicle types used in PFM and their seated and total capacities are provided in *Appendix A – Modelled Rolling Stock*.

5.5 Arriva Wales

Do-Minimum

- 5.5.1 For PFMv9 the following ‘.SPG’ was used: AW_2019_v2.SPG. The main service provision for this TOC within PFM is provided below:

Table 5-1: Arriva Wales Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Aberystwyth / Pwllheli to Birmingham International	8	7	Pwllheli is not within the PFM network so all services start/terminate at Aberystwyth. Uses 158 2car.
Bridgend to Cardiff	18	17	These services extend from Cardiff to the valleys although this is not within the PFM network so all services start/terminate at Cardiff

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
			Central. Mixture of 150 2car, 142 2car and 142 4car.
Bidston to Wrexham General	13	14	None. Uses 150 2car.
Birmingham International to North Wales	9	9	6tpd run all the way to Holyhead, 2tpd run Llandudno and 1tpd Chester. Mixture of 158 2car, 158 4car, 175 2car and 158 6car.
Cardiff to Holyhead	7	8	1tpd extends to Maesteg. Mixture of 175 2car, 175 3car and 67 6car.
Crewe to Chester	17	15	None. Mixture of 150 2car, 158 2car and 175 2car.
Crewe to Shrewsbury	5	7	None. Uses 153 1car.
Manchester to North Wales	16	16	There are some additional peak services between Manchester – Chester and North Wales – Chester. Mixture of 158 2car, 175 2car and 175 3car.
Manchester to South Wales	17	16	South Wales destinations include Cardiff Central, Carmarthen, Milford Haven, Tenby, Maesteg and Fishguard Harbour. Uses 175 3car.
Shropshire / Cardiff to South Wales	24	22	10tph extend beyond Cardiff Central to Cheltenham Spa / Gloucester. Mixture of 143 2car, 150 2car, 153 1 and 2car, 158 2car and 175 2car.

Released Capacity – All Phases

5.5.2 There are no released capacity changes for this TOC.

5.6 C2C

Do-Minimum

5.6.1 The CC_2022.SPG was provided by DfT for use in PFMv9. The C2C network is only represented within the PLANET South Regional Model which presents the AM peak period. The main service provision for this TOC within PFM PLANET South is as follows:

Table 5-2: C2C Service Provision Summary (PLANET South)

Core Service	Trains Per Peak Hour	Trains Per Peak Hour (Reverse)	Notes / Vehicles Used
London to Grays	8	12	More inbound London services due to model covering AM peak period. Mixture of 357 4/8 car.
London to Laindon	2	4	None. Mixture of 357 4/8 car.
London to Southend	7	13	More inbound London services due to model covering AM peak period. Mixture of 357 4/8 car.
London to Pitsea	4	6	None. Mixture of 357 4/8 car.
London to Shoeburyness	19	22	None. Mixture of 357 4/8 car.

Released Capacity – All Phases

5.6.2 There are no released capacity changes for this TOC.

5.7 Chiltern

Do-Minimum

5.7.1 The CH_2019.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is listed below:

Table 5-3: Chiltern Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Aylesbury to Marylebone	7	8	The Aylesbury – Marylebone route via Harrow-on-the-hill is not included within the PFM PLD network. Services in the model run via Princes Risborough. Mixture of 165 2/3car and 168 3/4car.
Banbury to Marylebone	9	9	All services call at Bicester North, Haddenham & Thame Parkway, Princes Risborough and Gerrard’s Cross. Limited calls at other stations such as Kings Sutton. Mixture of 165 2/3car and 168 3/4car.
Bicester North to Marylebone	18	20	Services run fast from either High Wycombe or Gerrard’s Cross. Mixture of 165 2/3/6car, 168 3/4car, 172 2car and a combined 165car with 172 2car.
Birmingham Moor St. to London	29	31	17tpd extend to Snow Hill. 3tpd extend to Kidderminster as well 1tpd Stourbridge Junction to London. Services run fast between Bicester – London. Mixture of 168 3/4/7car, locomotive 6car and combined 168 3car with 172 2-car.
Birmingham Moor St to Leamington Spa	5	5	None. Uses 165 2car.
Gerrard’s Cross to London	18	16	No services run all stations but each station is served by a train running this core route. Mixture of 165 2/3car and 172 2car.
High Wycombe to Marylebone	20	23	Main calls are: Beaconsfield, Seer Green & Jordans, Gerrard’s Cross, South Ruislip and

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
			Wembley Stadium with limited calls at intermediate stations. Mixture of 165 2/3/4/5car, 172 2car and combined 165 3car with 172 2car.
Oxford to London	32	36	Variant calling patterns but normally includes: High Wycombe, Haddenham Thame Parkway and Bicester Town. Uses 168 4car.
Oxford to Bicester Town	10	10	Calls at Islip as Oxford Parkway is not included in PFM. Uses 165 2car.
Princes Risborough to Marylebone	10	8	Services run fast between Gerrard's Cross – London with main calls at High Wycombe and Beaconsfield. Uses mixture of 165 2/3car and 168 3/4car.
Stratford-Upon-Avon to Marylebone	5	5	Services run fast between High Wycombe – London. Majority of services then call all stations except Claverdon or Bearley. Uses mixture of 165 3car, 168 3/4car and 172 2car.
West Ruislip to Marylebone	3	3	None. Uses 165 2car.

Released Capacity – All Phases

5.7.2 There are no released capacity changes for this TOC. Sensitivity tests could be considered around released capacity assumptions for this TOC. Potentially it could be beneficial for Birmingham – London services to have additional calls between Bicester and London as faster Birmingham-London connections are provided by HS2.

5.8 East Coast

Do-Minimum

5.8.1 Due to changes in service provider and on-going development of the InterCity Express programme the future year timetable for the East Coast mainline are still under development. For use in PFMv9 DfT were able to provide a core provisional timetable with information on the core hourly service patterns. With this information, an 'SPG' was developed for DfT to review and sign-off.

5.8.2 The core service provision, as specified by DfT, is listed below:

Table 5-4: East Coast Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
King's Cross to Edinburgh (fast)	16	16	Calling at York and Newcastle with a total journey time of 240 minutes. Mainly uses electric 9car IEP with some 9-car 225s.
King's Cross to Edinburgh (slow)	10	10	Regular calls at Peterborough, Doncaster, York, Darlington, Durham, Newcastle, Alnmouth, Berwick and Edinburgh with a journey time to Edinburgh of 260 minutes. Mainly uses electric 9car IEP with some 9-car 225s.
King's Cross to Edinburgh (slow) extension to Aberdeen	3	3	Extended via Haymarket, Inverkeithing, Kirkcaldy, Leuchars, Dundee, Arbroath, Montrose taking an additional 2hr 20 minutes. Uses Bi-mode 9car IEP.
King's Cross to Edinburgh (slow) extension to Inverness	1	1	Extended via Haymarket, Falkirk, Stirling, Gleneagles, Perth, Pitlochry, Kingussie, Aviemore taking additional 3hrs 18 minutes. Uses electric 9car IEP.
King's Cross to Edinburgh (slow)	1	1	Extended via Haymarket and Motherwell taking additional 57 mins. Uses electric 9car IEP.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
extension to Glasgow Central			
King's Cross to Edinburgh (slow) extension to Stirling	1	1	Extended via Haymarket, Falkirk, Grahamston taking additional 50 mins. Uses electric 9car IEP.
King's Cross to Harrogate	6	6	Calling at Stevenage, Grantham, Newark North Gate, Retford, Doncaster, Leeds, Horsforth taking 186 minutes northbound and 170 southbound. Mixture of 9car IEP or 2x 5car IEP.
King's Cross to Leeds via Doncaster	15	15	Calling at Doncaster and Wakefield Westgate only. Journey of 122 minutes northbound and 117 southbound. Mixture of 9car IEP, 2x 5car IEP and some 225s.
King's Cross to Leeds via Peterborough	5	5	Calling at Peterborough and Wakefield Westgate only. Journey of 122 minutes northbound and 117 southbound. Mixture of 9car IEP, 2x 5car IEP and some 225s.
King's Cross to Leeds via Peterborough extension to Bradford Forster Square	7	6	Extended via Shipley taking an additional 22 minutes (exc. 4-minute dwell at Leeds). Mainly 9car IEP with some 5car IEP, 2x 5car IEP and 225s operating.
King's Cross to Leeds via Peterborough extension to Huddersfield	2	2	Extended via Dewsbury taking an additional 17 minutes (exc. 4-minute dwell at Leeds). Uses 9car IEP Bi-mode
King's Cross to Leeds via Peterborough extension to Skipton	1	1	Extended via Keighley taking an additional 43 minutes (exc. 4-

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
			minute dwell at Leeds). Uses 5car IEP electric.
King's Cross to Middlesbrough	6	6	Calls at: Peterborough, York, Northallerton and Thornby taking 156 minutes northbound and 159 minutes southbound. Uses 5car IEPs.
King's Cross to Newcastle	13	13	Main calls: Stevenage, Peterborough, Grantham, Newark North Gate, Doncaster, York, Durham taking 190 minutes. Services alternate between calling at Retford or Northallerton. Mainly uses 9car electric IEP with 1 tpd operating as 5car IEP and 225.
King's Cross to Newcastle extension to Sunderland	2	2	Additional 20 minutes for Sunderland call. Uses 9car Bi-Mode IEP.
King's Cross to Lincoln	7	6	Calling at Stevenage, Grantham, Newark North Gate, Swinderby and Lincoln Central taking 105 minutes. Uses a mixture of 9/5car Bi-mode IEP.

Post PFMv9 Release

5.8.3 It has been identified that platform lengths at Middlesbrough and Lincoln may require all services to operate as 5c IEPs rather than a mixture 5/9c.

5.8.4 It is recommended that once the agreed May 2021 timetable for East Coast services is available the '.SPG' file is incorporated into PFM. Until this, it is recommended that sensitivity tests are undertaken if the proposed service pattern is changed significantly from the one listed in Table 5-4. For example, in addition to the test outlined above it is understood that Lincoln services may have to route via Spalding and Sleaford instead of Grantham.

Released Capacity – Phase 2b

5.8.5 In Phase 2b the following released capacity assumptions are assumed:

Table 5-5: East Coast Service Provision Summary

Assumption	Notes / Vehicles Used
King’s Cross to Edinburgh (fast) services are removed.	Once HS2 is operational only 1tph EC service is permitted north of Northallerton.
King’s Cross to Edinburgh (slow) with extensions are unchanged.	None.
King’s Cross to Leeds converted to 1tph via Peterborough, Doncaster and Wakefield Westgate only.	1tpd Skipton extension is kept 6tpd extend to Harrogate 2tpd extension to Huddersfield removed 7tpd extension to Bradford removed.
King’s Cross to Middlesbrough services are converted to slow services but the frequency increased to 16ptd in each direction.	Calls at: Stevenage, Peterborough, Grantham, Newark North Gate, Doncaster, York and Northallerton.
King’s Cross to Newcastle/Sunderland service is truncated at York with a call at Peterborough only.	Once HS2 is operational only 1tph EC service is permitted north of Northallerton.
King’s Cross to Lincoln service is increased to 16tpd in each direction.	None.
New King’s Cross to Hull 16tpd service is added.	Calls at: Stevenage, Grantham, Newark North Gate, Retford and Doncaster. Uses 9car Bi-mode IEP.
New King’s Cross to Nottingham 16tpd service is added.	Calls at: Peterborough and Grantham taking 100 minutes. Assumed 9-car IEP Bi-mode rolling stock. Uses 9car Bi-mode IEP.

5.8.6 It should be noted that an hourly Leeds – Doncaster semi-fast Northern service is added to replace reduced service provision between Doncaster and Leeds.

5.9 East Midlands

Do-Minimum

5.9.1 The EM_DM_SPG.spg was used in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-6: East Midlands Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Crewe to Derby	13	15	Calls all stations except for Peartree which is just 1tpd. Uses either 153 1car or 158 2car.
St. Pancras to Corby	32	32	Corby is not in the PFM network therefore all trains start/terminate at Kettering. Mixture of BR Class 222 5/7/10car.
St. Pancras to Sheffield	31	30	Main calls at: Chesterfield, Derby, East Midlands Parkway and Leicester. Half the services also call at Long Eaton. Mixture of BR Class 222 5/7/10car.
St Pancras to Nottingham	31	30	Calling at: Markey Harborough, Leicester, Loughborough and East Midlands Parkway. Mixture of BR Class 222 5/7/10car.
Liverpool to Norwich	17	19	11tpd cover entire route in each direction. Uses 2 and 4car 158.
Lincoln to Cleethorpes	10	11	Not all services cover the entire route. Uses 153 1car.
Lincoln to Leicester	17	18	Leicester – Nottingham is 5tpd and 3tpd in the reverse. In addition, 3ptd is Nottingham – Lincoln in each direction. Uses mixture of 153 2car, 156 2car, 158 2car, 377 2car and a combined 156 2car with 158 2car.
Mansfield to Nottingham	10	9	None. Uses 156 2car.
Matlock to Nottingham	18	18	14tpd run Matlock – Nottingham in either direction. Uses mixture 153 1/2car, 156 2car, 158 2car and a combined 156 2car with 158 2car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Nottingham to Worksop	16	15	None. Uses 156 2car.
Doncaster to Peterborough	14	14	OD patterns within this route vary. Uses mixture of 153 1/2car and 156 2car.
Skegness to Nottingham	16	14	None. Uses mixture of 153 1/2car and 156 2car.

Post PFMv9

5.9.2 It should be noted that this ‘.SPG’ does not assume electrification of the Midland Mainline as the scheme is currently on hold. In addition, it is noted that a number of committed rolling stock upgrades are not assumed within the above TSS assumptions. It is recommended that these updated for the next PFM release.

Released Capacity – Phase 2b

5.9.3 The following released capacity assumptions are applied in the Do-Something for Phase 2b only:

Table 5-7: East Midlands Released Capacity Assumptions – Phase 2b

Assumption	Notes / Vehicles Used
St. Pancras – Sheffield services is reduced from 2tph to 1tph by truncating half the Sheffield services at Derby.	Derby maintains 2tph to/from London.
All Liverpool – Nottingham services (or variants passing through Ilkeston) diverted to call at HS2 Toton.	Langley Mill - HS2 Toton: 8 minutes Nottingham – HS2 Toton: 11 minutes
Matlock – Nottingham (and all variants running between Derby-Nottingham) diverted to call at HS2 Toton and extended to Newark Castle.	Derby – HS2 Toton: 20 minutes HS2 Toton – Nottingham: 17 minutes Additional 3-minute dwell at HS2 Toton.

5.10 East-West Rail

Do-Minimum

5.10.1 As East-West Rail is not yet operational a deliverable timetable has not yet been developed and it agreed to code a high-level ‘.SPG’ based on information from the East West Rail scheme website². This file (Test_EWR_DM_SPG_080819.SPG) has been reviewed and signed-off by DfT for inclusion in PFMv9. The service summary is as follows:

² <https://www.eastwestrail.org.uk/train-services/>

Table 5-8: East-West Rail Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Bedford to Oxford	16	16	None. 185 3c
Milton Keynes to Oxford	32	32	None. 185 3c

Released Capacity – All Phases

5.10.2 From Phase 1b/2a onwards, an additional hourly Milton Keynes – Aylesbury service is included. This also uses 185 3-car rolling stock and calls at all stations.

5.11 Grand Central

Do-Minimum

5.11.1 The GC_2014.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-9: Grand Central Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Bradford Interchange to King’s Cross	4	4	Calls at: Halifax, Brighouse, Mirfield, Wakefield Kirkgate, Pontefract Monkhill and Doncaster. Uses 180 5car.
Sunderland to King’s Cross	5	5	Calls at: York, Thirsk, Northallerton, Eaglescliffe and Hartlepool. Mixture of 4/5car IC 125.

Released Capacity – All Phases

5.11.2 There are no released capacity changes for this TOC.

5.12 Great Western

Do-Minimum

5.12.1 GW_2019.SPG was provided by the DfT for use in PFMv9. However, it was noted that there were some significant capacity imbalances by direction on several services. Therefore, these were corrected and an updated '.spg' file (GW_DM.SPG) was used in PFMv9.

Table 5-10: Great Western Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Barnstaple to Exeter	14	14	None. Uses 165 3car.
Basingstoke to Reading	32	32	None. Uses 387 4car.
Bedwyn to Newbury	8	7	None. Uses 150 2car.
Bedwyn to Paddington	17	15	EB: 5tpd start from Newbury and 1tpd from Westbury. WB: 2tpd end at Newbury and 1tpd at Frome. Mixture of 800 5car and 387 4/8car.
Bristol to Paddington	46	43	Roughly 2tph runs via Bath Spa and 1tph via Bristol Parkway. Mixture of 800 5car and 801 9car.
Bristol to Westbury	11	10	None. Mixture of 150 2car, 165 3car and combined 165 3car with a 166 3car.
Bristol to Weymouth	7	8	None. Mixture of 150 2car and 165 3car.
Cardiff to Portsmouth	16	18	None. Mixture of 150 2car, 165 3car then combined 5/6car trains.
Cardiff to South West	17	18	11/12tpd run Taunton – Cardiff. Mixture of 165 3car and 158 2/4car.
Cardiff to Paddington	12	12	Calls at: Newport, Bristol Parkway, Swindon, Didcot Parkway and Reading. Mixture of 800 5car and 801 9car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Cheltenham Spa to Paddington	16	15	Calls at: Gloucester, Stonehouse, Stroud, Swindon, Didcot Parkway and Reading. Mixture of 800 5car and 801 9car.
Oxford to Reading	34	36	20tpd run just Oxford – Didcot Parkway. 8tpd run as far as Banbury. Mixture of 165 3car, 165 2car and 387 4car.
Exeter to Paddington	7	8	2tpd start/end at Taunton. Mixture of 800 5car and 801 9car.
Exmouth to Paignton	32	31	None. Uses 150 2car.
Gatwick Airport to Reading	30	28	Additional 16/13tpd run Redhill – Reading. Uses 165 3car.
Gloucester to Weston-Super-Mare	17	17	None. Mixture of 165 3car and 158 2car.
Hereford to Paddington	19	17	5tpd run from Hereford, 8/7tpd from Great Malvern and 6/5tpd from Worcester. Mixture of 800 5car and 801 9car.
Newbury to Reading	19	18	None. Uses 387 4car.
Oxford to Paddington	51	48	16tpd run as far as Oxford whilst rest are Didcot Parkway – Paddington. Mixture of 387 4/8car, 800 5car and 801 9car.
Paddington to Plymouth / South West	18	19	3tpd to/from Paignton, 7tpd to/from Plymouth and 8/9tpd to/from Penzance. Uses mixture of 387 4/8car.
Paddington to Swansea	20	20	1tpd extends to/from Carmarthen. Uses mixture of 387 4/8car.
Paddington to Weston-Super-Mare	5	5	4tpd run fast London – Bristol Parkway. 1tpd via Bath Spa. Uses mixture of 387 4/8car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Paddington to Reading	50	44	None. Uses mixture of 387 4/8car.
Swindon to Westbury	6	8	None. Uses 165 3car.

Released Capacity – All Phases

5.12.2 All GW services to/from Paddington have an additional call at Old Oak Common. The changes to journey times as a result are as follows:

- 3 minutes Paddington – Old Oak Common
- 1 minute dwell at Old Oak Common

5.13 Hull Trains

Do-Minimum

5.13.1 The HT_2014.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-11: Hull Trains Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Hull to King's Cross	7	7	Calling at: Grantham, Retford, Doncaster, Selby, Howden, Brough. Rolling stock assumed to be 5car 180.

Released Capacity – All Phases

5.13.2 There are no released capacity changes for this TOC.

5.14 Heathrow Express

Do-Minimum

5.14.1 The HX_2014.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-12: Heathrow Express Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Paddington to Heathrow Terminal 5 via Terminals 1-2-3	66	66	Journey times from Paddington to Heathrow 1-2-3 around 16 minutes and 5 minutes between airport terminals. Uses 332 5car.

Post PFMv9

5.14.2 It is noted that the 332 rolling stock operated on the route is to be replaced by 387s.

Released Capacity – All Phases

5.14.3 All HX services have an additional call at Old Oak Common. The changes to journey times as a result are as follows:

- Paddington to/from Old Oak Common – 3 minutes
- Old Oak Common to/from Heathrow Terminal 1-2-3 – 17 minutes

5.15 London Eastern

Do-Minimum

5.15.1 The LE_2020.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is provided in the following table:

Table 5-13: London Eastern Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Colchester to Sudbury	17	17	None. Mixture of HYB3 and B4.
Liverpool St to Cambridge	39	37	2tpd extend to/from Ely and 2/3tpd run King's Lyn. Mixture of OS06 and OS12.
Liverpool St to East Essex	117	119	Destinations include: Braintree, Colchester, Clacton-on-Sea, Harwich, Southminster, Southend Victoria, Walton-on-the-Naze. Mixture of S06 and S12.
Liverpool St to Hertford East	41	47	None. Mixture of OS06 and OS12.
Liverpool St to Ipswich	17	14	None. Mixture of HYB4 and OS06 x1 and x2 formations.
Liverpool St to Norwich / Lowestoft	51	53	4tpd extend to/from Lowestoft. Mixture of OS06, OS12 and HYB4.
Liverpool St to Bishops Stortford / Stansted Airport	79	82	64/66tpd run to/from Stansted Airport. Mixture of OS06 and OS12.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Stansted Airport to Norwich	16	16	None. Uses HYB4.
Stratford to Bishop's Stortford	32	32	None. Uses mixture of OS06 x1/x2 and OS06 12car.

Released Capacity – All Phases

5.15.2 There are no released capacity changes for this TOC.

5.16 London Midland

Do-Minimum

5.16.1 The WMNC_WMT_SX_DEC19_EJ_SPG.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-14: London Midland Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Bedford to Bletchley	16	15	Intermediate stops not included in PFM. Uses 230 2car.
Bromsgrove to Lichfield Trent Valley	52	51	2tph run full route in each direction. Mixture of 323 3/6car and 170 2car.
Birmingham to Crewe	18	17	Run via Walsall. Mixture of 350 4/8car.
Birmingham to Hereford	17	18	3/4tpd run to/from Great Malvern. Mixture of 172 2/3car, and 170 4/6car.
Birmingham to Rugeley Trent Valley	13	16	None. Uses 350 4car.
Birmingham to Shrewsbury	31	32	1tph Birmingham – Shrewsbury 1tph Kings Norton – Shrewsbury. Uses

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Birmingham to Walsall	31	32	All stations. Mixture of 323 3car, 350 4car and 170 2/4/6car.
Birmingham to Worcester Shrub Hill	14	14	Run fast Birmingham – Bromsgrove. Uses 170 2/3/4car.
Coventry to Liverpool Lime Street	20	20	15tpd Coventry – Liverpool 5tpd Birmingham to Coventry 1tpd Northampton to Birmingham 1tpd Birmingham Int to New St 3tpd Coventry to Birmingham Uses 350 4car.
Coventry to Nuneaton	15	14	None. Uses 172 2car.
Dorridge to Kidderminster via Birmingham Snow Hill	31	32	10tpd extend to Worcester. Around 10tpd run shortened versions such as Leamington Spa – Snow Hill. Uses a mixture of 172 2/3car and some combined 5car.
Euston to Crewe	16	15	Runs fast Milton Keynes – Euston. Uses 350 4car and combined 8car.
Euston to Stafford	12	13	Call at majority of stops between Milton Keynes and Stafford via Birmingham and Wolverhampton. Uses 350 4car and combined 8car.
Euston to Liverpool Lime St	13	11	None. Uses 350 4car and combined 12car.
Euston to Northampton / Milton Keynes / Bletchley	27	30	9/5tpd to/from Northampton 18/17tpd to/from Milton Keynes. 3/4tpd to/from Bletchley. Uses 350 4car and combined 8/12car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Euston to Tring	31	33	1/3tpd to/from Watford Junction. Uses 350 4car and combined 8/12car.
Euston to Walsall	18	18	8/4tpd to/from Birmingham New St. Uses 350 4car and combined 8/12car.
Leamington Spa to Nuneaton	16	16	Via Coventry and Bedworth. Uses 350 4car.
Redditch to Litchfield Trent Valley	46	47	13/14tpd run to/from Four Oaks 3/5tpd run to/from Litchfield City 29/27tpd run full route 2tpd run Redditch to Birmingham New St. Uses 323 3/6car.
Stourbridge Junction to Town Shuttle	96	96	Runs every 10 mins. Uses 139 people mover.
Stratford to Kidderminster	57	55	Includes services starting/terminating at Whitlocks End and Worcester. Uses a mixture of 172 2/3 car, combined 4car and 170 3car.

Released Capacity – Phased Opening Scenario

5.16.2 For the 6tph 'phased opening' scenario the following additional LM services are added. These are to replace WC paths removed for HS2 services.

- 1tph London Midland Bletchley – Euston
- 1tph London Midland Tring - Euston

Released Capacity – Phase 1 and 2a

5.16.3 The released capacity assumptions for Phase 1 and 2a are detailed below:

Table 5-15: London Midland Released Capacity Assumptions – Phase 1 and 2a

Assumption	Notes
New hourly Euston – Manchester Piccadilly service calling at: Watford Junction, Milton Keynes, Stoke, Macclesfield, Poynton, Bramhall, Cheadle, Hulme and Stockport.	Uses 8car class 350 rolling stock.
Euston to Watford Junction increased to 6tpd.	In DM, it is 1/3tpd to/from Watford Junction as part of Tring service group.
Euston to Tring increased to 48tpd.	Existing calling patterns and rolling stock used.
Euston to Crewe updated to 16tpd in each direction	In DM, it is 16 and 15tpd.
Above service extended to Manchester Victoria via: Milton Keynes, Rugby, Nuneaton, Atherstone, Tamworth, Litchfield Trent Valley, Rugeley Trent Valley, Stafford, Crewe and Warrington Bank Quay	Service Changes in Phase 2b.
Euston to Birmingham New St. remains at 32tpd.	This is made up of Euston services to/from Liverpool, Stafford and Walsall.
New 2tpd Euston – Rugby service introduced.	Assumed to be peak services.
New 1tpd Euston to Lichfield Trent Valley service introduced.	Assumed to be peak service.
Euston to Northampton / Milton Keynes / Bletchley altered to: 16tpd to/from Milton Keynes 16tpd to/from Northampton 32tpd to/from Bletchley	None.
Northampton to Crewe removed	1/2tpd in DM only.
Northampton to Birmingham New Street removed.	1tpd Northbound only in DM.
Coventry to Birmingham New Street removed.	3/5tpd in DM. Part of Coventry – Liverpool service group.
Coventry to Euston removed.	1tpd Southbound only in DM.
Birmingham New Street to Wolverhampton removed.	1tpd Southbound only in DM.
Shrewsbury to/from Birmingham New Street services extended to Birmingham International.	16tpd currently run Shrewsbury – Birmingham New St.

Released Capacity – Phase 2b

5.16.4 The released capacity assumptions for Phase 1 and 2a are detailed below:

Table 5-16: London Midland Released Capacity Assumptions – Phase 2b

Assumption	Notes
Extended Euston – Crewe to Manchester Victoria services altered to run to Manchester Piccadilly (see red row in Table 5-15).	Assumes same calling points and journey times as existing AW services running between Crewe and Manchester Piccadilly.

5.17 Mersey Rail

Do-Minimum

5.17.1 The ME_2014.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is provided below:

Table 5-17: MerseyRail Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Chester – Liverpool Loop	54	54	None. Uses combined 507/8a 6car.
Ellesmere Port – Liverpool Loop	35	35	None. Uses 507 3car.
West Kirby – Liverpool Loop	55	55	None. Uses 507 3car.
New Brighton – Liverpool Loop	56	56	None. Uses 507 3car.
Hunts Cross to Southport	65	67	None. Uses mixture of 507 3car, 508a 3car and combined 6car.
Kirkby to Liverpool Central	57	56	None. Uses mixture of 507 car and combined 507/8a 6car.
Ormskirk to Liverpool Central	58	58	None. Uses mixture of 507 3car, 508a 3car and combined 6car.

Released Capacity – All Phases

5.17.2 There are no released capacity changes for this TOC.

5.18 Northern

Do-Minimum

5.18.1 The NT_DM_v9_4.SPG file was used for Northern services in PFMv9. A further review by DfT was undertaken with consideration given to known operational issues.

5.18.2 It should be noted that in the ‘.SPG’ file a number of services use the rolling stock 386a / 386b. It is assumed that this is in reference to the soon to be used 195 Diesel and 331 Electric *Civity* rolling stock. Therefore, the following table lists rolling stock as *Civity* whether 386a or 386b is used on a service.

5.18.3 The main service provision for this TOC within PFM is as follows:

Table 5-18: Northern Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicle Used
Adwick to Sheffield	17	17	None. Uses mixture of 150 2car and 176 2car.
Bishop Auckland to Saltburn	15	13	None. Uses 156 2car.
Bradford Forster Square to Ilkley	29	29	None. Uses mixture of 333 4car and Civity 4/8car.
Bradford Forster Square to Leeds	26	25	
Bradford Forster Square to Skipton	31	30	
Barrow-in-Furness to Manchester Airport	17	17	8/7tpd run the full route. Uses mixture of 156 2car, 158 2car and Civity 4/8car.
Blackburn to Rochdale via Manchester Victoria	16	14	Includes 4tpd running Manchester to Bolton only. Uses a mixture of 150 2car, 156 2car and 319 4car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicle Used
Blackpool North to Manchester Airport	16	16	Runs via Bolton, Manchester Piccadilly. 4tpd run to/from Wilmslow. Uses Civity 4/5/8car.
Blackpool North to Manchester Victoria	16	15	Runs via Preston, Bolton and Salford. Uses Civity 4/5/8car.
Blackpool North to Liverpool	16	16	1tpd runs Blackpool to Preston only. Uses mixture of 319 4car, 150 2/4car, 176 6car and Civity 5car.
Blackpool North to Macclesfield	16	16	None. Uses Civity 4/5/8car.
Blackpool North to York	16	14	Runs via Burnley and Bradford Interchange. Uses Civity 4/5/8car.
Blackpool South to Preston	16	16	None. Uses 150 2car.
Bradford Interchange to Nottingham	14	14	Via Leeds, Sheffield and Meadowhall. Uses 176 2/4car.
Carlisle to Middlesbrough	16	16	Extensions to Nunthorpe and Whitby (not in PLD). Uses 158 2car.
Morpeth to Metrocentre	13	13	3tpd Extension to Chathill (PLD only as far as Alnmouth). Uses mixture of 156 and 158 2car.
Huddersfield to Castleford	15	16	All stations via Wakefield Kirkgate. Uses 155 2car.
Colne to Preston	16	15	All stations via Accrington and Blackburn. Uses 150 2car.
Cleethorpes to Habrough / Barton-on-Humber	14	14	PFM network does not extend beyond Habrough. Uses a mixture of 2car 150 or 156s.
Darlington to Saltburn	14	15	None. Uses 156 2car.
Doncaster to Scunthorpe	15	16	None. Uses 155 2car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicle Used
Leeds to Huddersfield	14	13	None. Uses mixture of 176 4car and 152 2car.
Hull to Scarborough	13	15	Intermediate stops not included within PFM. Uses 158 2car.
Hull to Sheffield	16	16	None. Uses mixture of 176 2car, 158 2car, 155 2car and 150 2car.
Hull to York	16	16	None. Uses mixture of 176 2car and 158 2/4car.
Leeds to Chester	15	15	1/2tpd extends from/to Ellesmere Port. Uses 176 2/4car.
Leeds to Doncaster	18	17	Calling all stations. Uses mixture of 333 4car and Civity 4car.
Leeds to Carlisle	14	16	7/8tpd run full route with 6/7tpd running Leeds to Lancaster 1tpd running Leeds – Ribbleshead. Uses a mixture of 156 2car, 158 2car, and combined 158 2car with 156 or 150 2car.
Leeds to Harrogate	52	53	16/17tpd run Leeds – Harrogate 4tpd run Leeds – Horsforth 15tpd run Leeds – Knaresborough. Uses a mixture of 150 2/4car and 170 2/4car.
Leeds to York	2	2	Only 2tpd run direct via Church Fenton. 17tpd run Leeds – York via Harrogate. Uses 150 2car.
Leeds to Ilkley	34	33	None. Uses mixture of 333 4car and Civity 4/8car.
Leeds to Knottingley	31	32	1tpd runs Leeds – Goole. Uses mixture of 176 2/4car, 150 2car and Civity 5car.
Leeds to Lincoln	14	16	12/14tpd runs Leeds – Lincoln

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicle Used
			2tpd runs Sheffield – Lincoln. Uses mixture of 176 2car and 150 2car.
Leeds to Liverpool Lime St via Halifax - Manchester Victoria – Huyton	17	18	16tpd run full length with 1/2tpd starting / ending at Manchester Victoria. Uses mixture of 176 2/4car, 319 4car and 150 4car.
Leeds to Selby	16	16	None. Uses 150 2car and 158 2car.
Leeds to Sheffield (all routes)	47	48	Service pattern is essentially; 1tph all stations via Dearne Valley 1tph all stations via Barnsley 1tph semi-fast via Barnsley. Uses mixture of 150 2car, 158 2car and 176 2car.
Leeds to Skipton	34	34	None. Uses mixture of Civity 4/8car and 333 4car.
Leeds to Southport via Dewsbury – Rochdale – Manchester Victoria – Wigan	16	18	3ptd Leeds to Wigan Wallgate 4tpd Manchester Vict. To Southport. Uses mixture of 158 2/4car, 170 2car and combined 158 2car with 170 2car.
Liverpool Lime St to Wigan NW	28	33	None. Uses 319 4car.
Liverpool Lime St to Warrington BQ	12	13	None. Uses 319 4car.
Manchester Piccadilly to Hadfield	35	36	None. Uses 319 4car.
Manchester Piccadilly to New Mills Central	30	33	1/3tpd run to/from Marple only. Uses 150 2/4car.
Manchester Piccadilly to Rose Hill Marple	25	28	None. Uses 150 2/4car.
Manchester Piccadilly to Hazel Grove	13	16	None. Uses 319 4car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicle Used
Manchester Piccadilly to Alderley Edge	13	13	None. Uses 319 4car.
Manchester Piccadilly to Buxton	30	31	1tpd to Chinley. Uses 150 2/4car.
Manchester Piccadilly to Chester	18	19	Via Northwich and Stockport. Uses 150 2/4car.
Manchester Victoria to Kirkby / Wigan	25	27	12/14tpd to/from Kirkby. Uses 150 2car.
Manchester Airport to Windermere	4	4	None. Uses Civity 4car and combined 4car and 5car.
Manchester Piccadilly to Huddersfield	4	4	None. Uses 150 2/4car.
Manchester to Liverpool Lime St	59	61	27/29tpd Oxford Road – Liverpool 32tpd Airport – Liverpool. Uses 150 2car, 319 4car and 176 2car.
Manchester Piccadilly to Crewe	16	16	Run all stations Crewe – Stockport. Uses mixture of 319 4car and Civity 4/5car.
Liverpool Lime Street to Crewe	16	16	Runs via Manchester Airport, Piccadilly, Newton-Le-Willows and Huyton. Uses Civity 2car.
Ormskirk to Preston	16	16	1tpd runs Preston to Liverpool Lime St. Uses mixture of 319 4car, 150 2car and Civity 4/8car.
Manchester Piccadilly to Stoke	16	16	None. Uses Civity 4/5car.
Rochdale to Clitheroe via Manchester Victoria – Bolton – Blackburn	17	17	None. Uses mixture of 150 2car, 156 2car and combined 150/156 as 4cars.
Sheffield to Huddersfield	16	17	None. Uses mixture of 150 2car, 158 2car and 176 2car.
Sheffield to York	3	3	None. Uses 156 2car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicle Used
Sheffield to Gainsborough Central	13	14	1tpd runs Sheffield to Worksop. Uses 156 2car.
Sheffield to Manchester Victoria	15	15	Runs via New Mills Central. Uses mixture of 158 2/4car, 170 2car and combined 158/150 as 4cars.
Southport to Blackburn	16	16	Runs via Wigan, Manchester Victoria, Rochdale. Uses mixture of 158 2/4car, 170 2car and combined 158/150 as 4cars.
Wigan to Stalybridge	31	32	Via Manchester Victoria and Bolton. Uses 319 4car.

Released Capacity – Phase 1/2a

- 5.18.4 For Phase 1/2a it is stated that the hourly Stoke-Manchester Piccadilly and Macclesfield-Blackpool North services are combined. Therefore, these trains are replaced with an hourly Stoke – Blackpool North service serving the same stations as the previous two services.

Released Capacity – Phase 2b

- 5.18.5 On top of the Phase 1/2a changes the following changes are made for Phase 2b; The Manchester Piccadilly to Hazel Grove service is increased from 1 to 2tph and an hourly semi-fast Doncaster – Leeds service is added to replace the hourly King's Cross – Leeds EC service which is removed. There is also a new Manchester Piccadilly – Greenbank via Stockport service. The details of this new service are provided below:

Table 5-19: Northern Released Capacity Assumptions – Phase 2b

Assumption	Notes
Hourly Doncaster – Leeds semi-fast service. Calling at: Bentley, Adwick, South Elmsall and Wakefield Westgate.	Assumed to use 333 4car rolling stock.
10tpd between Manchester Piccadilly – Greenbank. Calling at: Stockport, Navigation Road, Altringham then all-stations.	Assumes to use mixture of 150 2car and 156 2car.

Post PFMv9

5.18.6 It should be noted that during implementation of the updated Northern ‘.SPG’ into PFM it was noted that total service provision between Leeds – Harrogate does not match the actual timetable of:

- 1tph Leeds – Harrogate – York
- 1tph Leeds – Harrogate – Knaresborough
- 2tph Leeds – Harrogate (although 4th train does not run when LNER Harrogate runs)

5.19 Open Access

Do-Minimum

5.19.1 The OA_DM_TTDB_080918.SPG was developed by HS2 Ltd and approved by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-20: Open Access Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Blackpool North to Euston	6	6	Calls at: Poulton le Fylde, Kirkham & Wesham, Preston, Nuneaton, Milton Keynes. Uses 225 7car.
Edinburgh to King’s Cross	5	5	Calls at: Morpeth and Newcastle. Uses IEP 5car Bi-Mode.

Released Capacity – All Phases

5.19.2 In the DS (all phases) the Open Access routes to/from Blackpool on the West Coast are removed. Services to/from Edinburgh on the East Coast are retained.

5.20 London Overground

Do-Minimum

5.20.1 The LO_2019.SPG was provided by DfT for use in PFMv9. It should be noted that only services to/from London Terminals are represented within the PFM PLD model. The main service provision for this TOC within PFM is as follows:

Table 5-21: London Overground Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Euston to Watford Junction	64	63	None. Uses 170 4car.
Liverpool St to Cheshunt	33	33	None. Uses 170 4/8car.
Liverpool St to Chingford	66	65	None. Uses 170 4/8car.
Liverpool St to Enfield Town	41	44	None. Uses 170 4/8car.

Released Capacity – All Phases

5.20.2 There are no released capacity changes for this TOC.

5.21 South Eastern

Do-Minimum

5.21.1 The SE_2023.SPG was provided by DfT for use in PFMv9. It should be noted that the PFM PLD network is not as detailed as PLANET South, especially for commuter routes. For example, Cannon St is not in the PLD network meaning services start/end at London Bridge. The main service provision for this TOC within PFM is as follows:

Table 5-22: South Eastern Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Ashford International to Charing Cross	2	1	None. Uses 375 8/12car.
Charing Cross to Dartford	89	94	PFM only includes section of network between Charing Cross and London Bridge. Uses 346 4/6/10car.
Charing Cross to Dover	40	41	Via Sevenoaks, Ashford, Folkestone. Uses 375 4/7/8/11car.
Charing Cross to Ramsgate	18	18	2tpd run Ramsgate to Cannon St. Uses 375 4/7/8/11car.
Charing Cross to Hastings	33	32	2tpd run to/from Cannon St. Uses 375 4/8/12car
Charing Cross to Tonbridge Wells	33	34	None. Uses 375 4/8/12car
Charing Cross to Hayes	36	34	PFM only includes section of network between Charing Cross and London Bridge. Uses 346 8/12car.
Cannon St. to Hayes	32	33	PFM only includes section of network between London Bridge and St Johns. Uses 346 8/12car.
Charing Cross to Orpington	39	40	11/12tpd run as far as Orpington only. Uses mixture of 346 4/6/10car, 465 6car and 377 4car.
Cannon St. to Orpington	32	34	27/28tpd run as far as Orpington only. Uses 346 4/6/10car.
Charing Cross to Gravesend	30	31	PFM only includes section of network between Charing Cross and London Bridge. Uses 346 4/6/10car.
Charing Cross / Cannon Street loops	n/a	n/a	Not fully represented within PFM Network.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Strood to Tonbridge	32	32	None. Uses 375 3car.
St. Pancras to South East (HS1)	38	39	4tpd to/from Dover Priory 5tpd to/from Dover Priory - loop 5tpd to/from Ashford - loop 1tpd to/from Faversham 19tpd to/from Margate 2tpd to/from Ramsgate 2tpd to/from Sandwich. Uses 395 6/12car.

Released Capacity – All Phases

5.21.2 There are no released capacity changes for this TOC.

5.22 Scot Rail

Do-Minimum

5.22.1 The SR_2019.SPG was provided by DfT for use in PFMv9. The majority of the ScotRail network is on the edge of the PFM PLD model network. Therefore, the representation of this TOC within PFM is not fully representative. The main service provision for this TOC **within PFM** is as follows:

Table 5-23: ScotRail Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Aberdeen to Edinburgh	10	10	Via Dundee. Uses InterCity 125 7car.
Aberdeen to Glasgow	13	13	1tpd Aberdeen to Perth. Uses InterCity 125 7car.
Aberdeen to Inverness	5	5	1tpd Montrose to Inverness. Uses InterCity 125 6car.
Cumbernauld to Milngavie	16	16	PFM only includes section between Motherwell and Glasgow. Uses 320 3/6car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Carlisle to Glasgow	6	9	2/3tpd run onto Newcastle via Hexham. Uses 156 2car.
Dalmuir to Lanark	24	24	PFM only includes section between Motherwell and Glasgow. Uses 320 3/6car.
Dunblane to Edinburgh	32	31	PFM only includes section between Edinburgh and Stirling. 385 3/6car.
Dundee to Edinburgh	16	16	PFM only includes section between Edinburgh and Stirling. Uses InterCity 125 7car.
Edinburgh to Glasgow Central	34	32	Intermediate stops not included in PFM Network. Uses mixture of 380 7car and 385 3/4car.
Edinburgh to Glasgow Queen St.	58	60	Via Falkirk. Runs to/from Glasgow Central as Queen St is not included within PFM. Uses 385 4/8car.
Edinburgh to Glenrothes with Thornton	29	31	PFM only includes section between Edinburgh and Kirkcaldy. Uses 170 3/6car.
Edinburgh to Perth	9	10	None. Uses InterCity 125 6car.
Edinburgh to Dunbar	5	3	None. Uses 385 3/6car.
Edinburgh to Inverness	8	7	None. Uses
Glasgow Queen St. to Arbroath	12	14	PFM only includes section between Dundee and Glasgow. Uses InterCity 125 7car.
Glasgow to Inverness	12	12	None. Uses InterCity 125 6/7car.
Lanark to Partick	9	8	PFM only includes section between Motherwell and Glasgow. Uses 320 3/6car.
Partick to Milngavie	16	16	PFM only includes section between Motherwell and Glasgow. Uses 320 3/6car.

Released Capacity – All Phases

- 5.22.2 There are no released capacity changes for this TOC as EC services are planned to continue running north of Edinburgh.

5.23 South Western Railway

Do-Minimum

- 5.23.1 The SW_2020.SPG was provided by DfT for implementation in PFMv9. The following table displays the service provision for this TOC:

Table 5-24: South Western Railway Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Guildford to Farnham	32	32	None. Uses 450 4car.
Romsey to Salisbury	15	16	None. Uses mixture of 159 3car and 158 2car.
Waterloo to Alton	34	34	3tpd to/from Farnham. Uses 450 4/8/12car.
Waterloo to Basingstoke	35	35	None. Uses 450 4/8/12car.
Waterloo to Chessington South	32	32	None. Uses mixture of 705 10car and 711 10car.
Waterloo to Dorking	36	36	4tpd to/from Epsom. Uses mixture of 705 10car and 711 10car.
Waterloo loop services	68	68	Network not fully represented within PFM Network. Uses mixture of 705 10car and 711 10car.
Waterloo to Exeter	12	13	None. Mixture of 159 3/6/9car, 158 4car or combined 159/158 5cars.
Waterloo to Salisbury	17	18	11/12tpd to/from Salisbury 1tpd to/from Honiton 1tpd to/from Gillingham (Dorest) 4tpd to/from Yeovil Junction

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
			2tpd to/from Yeovil Pen Mill. Mixture of 159 3/6/9car, 158 4car or combined 159/158 5cars.
Waterloo to Guildford	70	68	None. Uses mixture of 450 12car, 705 10car and 711 10car.
Waterloo to Hampton Court	32	33	None. Uses mixture of 705 10car and 711 10car.
Waterloo to Hounslow	32	32	PFM network only includes section between Waterloo and Clapham Junction. Uses mixture of 705 10car and 711 10car.
Waterloo to Portsmouth	85	86	56tpd to/from Portsmouth Harbour 27/25tpd to/from Portsmouth Southsea 3/4tpd to/from Haslemere. Uses mixture of 444 5/10car and 450 4/8/12car.
Waterloo to Reading	64	64	Intermediate stops between Wokingham and Clapham Junction not included within PFM. Uses mixture of 705 10car and 711 10car.
Waterloo to Shepperton	35	35	PFM network only includes section between Waterloo and Clapham Junction. Uses mixture of 705 10car and 711 10car.
Waterloo to Southampton	16	17	None. Uses mixture of 444 5/10car and 450 4/8/12car.
Waterloo to Weymouth	32	32	18/17tpd to/from Poole. Uses mixture of 444 5/10car and 450 12car.
Waterloo to Windsor & Eton Riverside	64	65	None. Uses mixture of 705 10car and 711 10car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Waterloo to Woking	32	34	None. Uses mixture of 705 10car and 711 10car.
Weymouth to Portsmouth	32	32	14/13tpd run full route. Uses mixture of 444 5car and 450 4car.

Released Capacity - All Phases

5.23.2 There are no released capacity changes for this TOC.

5.24 Thameslink and Southern (Govia)

Do-Minimum

5.24.1 The GTR_2019.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-25: Govia Thameslink Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Blackfriars to Sevenoaks	27	24	None. Uses 165 6car.
Bognor Regis to Littlehampton	14	15	In PFM only runs Barnham – Ford. Uses 377 4/8/12car.
Brighton to Hove	30	32	Shuttle. Uses 313 3car.
Brighton to West Worthing	16	17	None. Uses 313 3car.
Brighton to Littlehampton	5	8	In PFM runs as far as Angmering. Uses 313 3car.
Brighton to Portsmouth	18	18	16/15tpd to/from Portsmouth Harb. 2/3tpd to/from Portsmouth Southsea. Uses mixture of 313 3car and 377 4car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Brighton to Southampton Central	15	15	None. Uses 377 4car.
King's Cross to Ely	2	2	Calls at Cambridge only. Uses 377 4car.
King's Cross to Kings Lyn	30	30	Runs fast to Cambridge. Uses 377 8/12car.
King's Cross to Peterborough	5	5	Fast KGX – St. Neots. Uses 365 8/12car.
King's Cross to Welwyn Garden City	9	9	Majority call all stations between New Southgate and WGC. Uses 365 8car.
London Bridge to Caterham	35	39	None. Uses mixture of 455 4car and 377 4car.
London Bridge to Tattenham Corner	32	32	None. Uses 455 4car.
London Bridge to Uckfield	18	20	None. Uses 171 2/4/6/10car.
London Bridge to West Croydon	39	32	None. Uses mixture of 377 5/10car and 455 4/8car.
Littlehampton to Portsmouth	15	16	3/4tpd start/end at Portsmouth Harbour. Uses mixture of 313 3car and 377 4car.
Milton Keynes to East Croydon	25	22	Multiple ODs operate this route between Milton Keynes, Watford Junction, Kensington Olympia, Clapham Junction, South Croydon and East Croydon. Uses 377 4/6/7/8car.
Moorgate to Gordon Hill	13	11	None. Uses 717 6car.
Moorgate to Hertford North	31	35	None. Uses 717 6car.
Moorgate to Stevenage	30	30	None. Uses 717 6car.
Moorgate to Letchworth	1	2	None. Uses 171 6car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Moorgate to Welwyn Garden City	63	62	None. Uses mixture of 377 4/10car and 455 8car.
Bedford to Brighton	32	32	Via Thameslink Core. Uses 700 12car.
Bedford to Gatwick Airport	29	26	Via Thameslink Core. Uses 700 8/12car.
Bellingham to Luton	2	2	Via Thameslink Core. Uses 700 8car.
Brighton to Cambridge	30	31	Via Thameslink Core. Uses 700 8/12car.
Bedford to Littlehampton	5	4	5tpd Southbound run from West Hampstead only. Uses 700 8/12car.
Maidstone East to Cambridge	28	25	Via Thameslink Core. Uses 700 8car.
Maidstone East to Thameslink Core	14	14	2tpd to Kentish Town 2tpd to Luton 3/7tpd to/from St Albans 7tpd to/from West Hampstead. Uses 700 8car.
Orpington to Thameslink Core	32	32	18tpd to/from Kentish Town 11tpd to/from Luton 3tpd to/from West Hampstead. Uses 700 8car.
Horsham to Peterborough	32	32	Via Thameslink Core. Uses 700 8/12car.
Rainham (Kent) to Thameslink Core	32	31	2tpd from Bedford 29/28 to/from Luton 4tpd to West Hampstead. Uses 700 8car.
Sevenoaks to Welwyn Garden City	8	6	Via Thameslink Core. Uses 700 8car.
Thameslink to Sutton Loop	65	62	PFM does not include the Sutton branch so services run to/from Blackfriars. 2tph to/from Luton and 2tph to/from St Albans. Uses 700 8car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
East Grinstead to Thameslink Core	10	8	6tpd to Bedford 4/6tpd to/from West Hampstead 1tpd from Flitwick 1tpd from Luton. Uses 700 8/12car.
Additional Thameslink Bedford to the South services	14	17	8tpd East Croydon to Bedford 5/3tpd Three Bridges to/from Bedford 1/3tpd Three Bridges to/from West Hampstead 9tpd Bedford to Blackfriars 2tpd Flitwick to Blackfriars.
Victoria to Brighton	64	67	Runs as extended Gatwick Express. Uses 387 4/8/12car.
Victoria to Caterham	21	19	None. Uses a mixture of 377 4/5/8car and 455 4/8car.
Victoria to Dorking	17	16	None. Uses a mixture of 377 5/10car and 455 8car.
Victoria to East Croydon	3	4	None. Uses 377 4/10/10car.
Victoria to East Grinstead	32	32	None. Uses 377 4/8/10/12car.
Victoria to Epsom	37	33	None. Uses mixture of 377 4/8/10/12car and 455 4/8car.
Victoria to Epsom Downs	22	23	None. Uses mixture of 377 5/6/10car and 455 8car.
Victoria to Gatwick Airport	29	33	Stopping service. Uses 387 4/8/12car.
Victoria to Horsham	17	23	None. Uses 387 4/5/6/8/10car.
Victoria to London Bridge	32	32	None. Uses mixture of 377 4/8/10/12car and 455 4/8car.
Victoria to Littlehampton / Bognor Regis	14	15	In PFM runs as far as Angmering. Uses 377 8/12car.
Victoria to Reigate	10	11	None. Uses 377 4/8/12car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Victoria to Southampton	14	14	None. Uses 377 4/8/12car.
Victoria to Portsmouth	13	13	None. Uses 377 8/12car.
Victoria to Sutton	46	40	In PFM runs as far as Norwood Junction. Uses mixture of 377 4/8/10/12car and 455 4/8car.
Victoria to Tattenham Corner	5	4	In PFM runs as far as Purley. Uses 337 4/5/10car.

Released Capacity – Phase 2b

5.24.2 The only change for this TOC is that an extra 2tpd between King’s Cross and Peterborough are added in Phase 2b. These services replicate the calling pattern and rolling stock of existing services in the DM:

Table 5-26: Thameslink Phase 2b Released Capacity Assumptions

Assumption	Notes
Additional 2tpd between King’s Cross and Peterborough in either direction. Calling at: St Neots and Huntingdon	Assumes 365b 4-car Rolling stock

5.25 Transpennine Express

Do-Minimum

5.25.1 TP_DM_SPG.SPG was reviewed and signed-off by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-27: Transpennine Express Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Liverpool Lime St to Newcastle	17	16	2tpd run Liverpool to York. Uses 802e 5car.
Liverpool Lime St to Scarborough	15	17	1tpd runs Scarborough to York. Uses 802 5car.
Liverpool Lime St to Glasgow Central	3	3	3tpd along with the Manchester Airport – Scotland via Carlisle route. Uses 397 5car.
Hull to Manchester Piccadilly	16	16	Runs via Stalybridge, Mossley, Slaithwaite, Huddersfield and additional calls to Leeds/Hull. Uses 802 5car.
Leeds to Manchester Piccadilly	16	16	Runs via Stalybridge, Greenfield, Marsden and all stations from Huddersfield. Uses 802 5car.
Manchester Airport to Cleethorpes via Sheffield	15	16	1tpd to/from Doncaster. Uses 185 3car.
Manchester Airport to York	17	17	None. Uses 802e 5car.
Manchester Airport to Middlesbrough	15	15	None. Uses 802 5car.
Manchester Airport to Scotland via Carlisle	16	15	1tpd runs Lancaster – Manchester Airport 7tpd to/from Edinburgh 8tpd to/from Glasgow Central. Uses 397 5car.

Post PFMv9

- 5.25.2 It is understood the TOC has plans to extend Liverpool Lime Street – Newcastle services to/from Edinburgh along the ECML with some services currently operating. This will be updated for the next version of PFM and will impact the TOC's released capacity assumption – see below.

Released Capacity – Phase 2b

5.25.3 In Phase 2b the following released capacity assumptions are applied:

- The 1tph Liverpool – Newcastle service is extended to Edinburgh calling at Morpeth, Alnmouth and Berwick;

5.26 West Coast

Do-Minimum

5.26.1 The VT_2019.SPG was provided by DfT for use in PFMv9. Euston – Blackpool services were then added to this '.SPG' to create VT_2019_withBlackpool.SPG. The service provision for this TOC within PFM is listed below:

Table 5-28: West Coast Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Euston to Blackpool North	2	3	Runs fast Warrington Bank Quay. Uses 390 9car.
Euston to Liverpool Lime St.	17	16	None. Uses 390 11car.
Euston to Manchester Piccadilly	43	46	Overall pattern is: 1tph via Stoke Macclesfield Stockport 1tph via Crewe Wilmslow Stockport 1tph via Milton Keynes Stoke Stockport. Uses 390 9/11car.
Euston to North Wales	14	14	2/1tpd to/from Bangor 8/7tpd to/from Chester 3/4tpd to/from Holyhead 1tpd in each direction splits at Chester serving Wrexham and Holyhead. 1tpd runs Bangor to Birmingham. Uses 221 5/10car.
Euston to Birmingham	32	34	9/8tpd runs to/from Wolverhampton 23/24tpd runs to/from Birmingham New St 1tpd Birmingham Int to Euston

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
			1tpd Rugby to Euston. Uses mixture of 390 9/11car and 221 5/10car.
Euston to Scotland	30	28	Overall pattern is: 1tph Euston to Scotland via Warrington Fast 1tph Euston to Scotland via Birmingham. 5/6tpd run to/from Edinburgh via Birmingham only. Uses mixture of 390 9/11car and 221 5/10 car.

Released Capacity – Phased Opening Scenario

5.26.2 For the 6tph ‘Phased Opening’ scenario the following changes are applied to West Coast services:

- 1tph West Coast Liverpool Lime Street – Euston service removed for HS2 path;
- 1tph West Coast North Wales – Euston services additional call at Stafford to maintain London connectivity;
- 1tph West Coast Manchester Piccadilly – Euston via Crewe service removed for HS2 path;
- 1tph West Coast Glasgow Central – Euston via Warrington fast service removed for HS2 path;

Released Capacity – Phase 1/2a

5.26.3 The following table sets out the released capacity assumptions for this TOC in Phase 1 and 2a:

Table 5-29: West Coast Phase 1 / 2a Released Capacity Assumptions

Assumption	Notes
3tph Euston to Manchester Piccadilly services removed.	Replaced by HS2.
1tph Euston to Glasgow Central via Warrington Fast removed.	Replaced by HS2.
1tph Euston to Liverpool removed	Replaced by HS2.
All Euston to Blackpool / Preston services removed.	No capacity with HS2.
Euston to Birmingham altered to 16tpd with all services extending to Wolverhampton.	2tpd extend to Shrewsbury. All services will have additional calls at Rugby and Milton Keynes.
All services except (North Wales and Shrewsbury) are updated to have 11-car electric rolling stock.	None.
1tph Euston to Glasgow Central / Edinburgh via Birmingham to have additional calls.	Additional calls at Milton Keynes and Watford Junction.

Released Capacity – Phase 2b

5.26.4 The following table sets out the released capacity assumptions for this TOC in Phase 2b (these are applied on-top of the changes applied for Phase 1 /2a):

Table 5-30: West Coast Phase 2b Released Capacity Assumptions

Assumption	Notes
Remaining Euston to Scotland via Birmingham services at curtailed at Preston but frequency increased to 1tph.	All services will have additional calls at Watford Junction and Milton Keynes.
1tpd Euston - Chester and 1tpd Euston - Holyhead added in each direction.	All Chester / North Wales services have additional calls at Milton Keynes, Rugby, Nuneaton, Tamworth, Lichfield Trent Valley, Stafford and Crewe.

5.27 Cross Country

Do-Minimum

5.27.1 The XC_2024.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is as follows:

Table 5-31: Cross Country Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Cardiff to Nottingham	14	14	1tpd runs Cardiff to Birmingham. Uses 170 2/3/4car.
Birmingham to Nottingham	15	15	None. Uses 170 2/3/4car.
Manchester to the South Coast	13	15	12/13tpd to/from Bournemouth 1/2tpd to/from Southampton 1tpd runs via Crewe. Uses mixture of 220 4car and 221 5car.
Manchester to the South West	13	12	9/7tpd runs to/from Bristol 4tpd runs to/from Penzance, Paignton or Exeter. Uses mixture of 220 4car and 221 5car.
Newcastle to South Coast via Doncaster	15	16	2/1tpd runs to/from Birmingham 6tpd runs to/from Reading 4tpd runs to/from Southampton 4tpd runs to/from Southampton 1tpd runs to/from Guildford 1tpd runs Leeds to Southampton 1tpd runs Southampton to Edinburgh. Uses mixture of 220 4car and 221 5car.
Scotland to the South West via Leeds	15	15	1tpd covers full route of Aberdeen – Penzance. Majority of services cover Edinburgh – Bristol. Uses mixture of 220 4car, 221 5car and InterCity 8car.

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Birmingham New St to Cambridge	2	1	None. Uses 170 2/3car.
Birmingham New St to Stansted Airport	12	15	None. Uses 170 2/3/5car.
Birmingham New St to Leicester	16	17	None. Uses 170 2/3/5car.

Post PFMv9

5.27.2 It is noted that since the provision of the ‘SPG’ file assumes current rolling stock operates in the future year. It is anticipated that a new franchise will be agreed in the near future which would likely include new rolling stock assumptions. Once available these will be incorporated into the next version of PFM.

Released Capacity – Phase 2b

5.27.3 The following table displays the released capacity assumptions for this TOC applied in Phase 2b only:

Table 5-32: Cross Country Phase 2b Released Capacity Assumptions

Assumption	Notes
All Manchester services to call at Macclesfield.	Except the 1tpd via Crewe.
Newcastle to South Coast services are diverted to run to/from Hull and by-passing Sheffield between Doncaster – Chesterfield.	Re-routing away from Sheffield provides 5-minute journey time saving.
New 1tph Sheffield – Doncaster – York shuttle introduced to replace diverted Hull services.	Uses 3-car Class 170 rolling stock.
All services to/from the South Coast route via Birmingham International and Coventry. None to run nonstop to Leamington Spa through Solihull.	In the DM only Manchester – South Coast services route this way. Above Hull -South Coast services diverted to run via Birmingham International and Coventry.

5.28 Crossrail

Do-Minimum

5.28.1 The XR_2019.SPG was provided by DfT for use in PFMv9. The main service provision for this TOC within PFM is provided in the table below. The overall pattern through the Core section is 22tph which reflects the Crossrail service pattern of 24tph during the peak and 22tph in the off-peak.

Table 5-33: Crossrail Service Provision Summary

Core Service	Trains Per Day	Trains Per Day (Reverse)	Notes / Vehicles Used
Abbey Wood to Heathrow Terminal 4	34	34	Abbey Wood branch is not in PFM PLD network so services run as far as Liverpool St. Uses 345 9car.
Abbey Wood to Heathrow Terminal 5	32	32	As above. Uses 345 9car.
Abbey Wood to Paddington	60	60	As above. Uses 345 9car.
Abbey Wood to Maidenhead	10	9	As above. Uses 345 9car.
Abbey Wood to Reading	36	36	As above. Uses 345 9car.
Gidea Park to Liverpool St.	11	12	Does not route via Crossrail tunnel therefore runs non-stop Stratford – Liverpool St. Uses 345 9car.
Paddington to Shenfield	120	117	None. Uses 345 9car.
Heathrow Airport Terminal 4 to Shenfield	30	30	None. Uses 345 9car.
Shenfield to Maidenhead	21	18	None. Uses 345 9car.
Shenfield to Reading	2	6	None. Uses 345 9car.

Released Capacity – All Phases

5.28.2 For the Do-Something all Crossrail services will call at Old Oak Common. Services starting / terminating at Paddington are also extended to Old Oak Common. Journey time changes is as follows:

- 3-minute journey time between Paddington – Old Oak Common; and
- 2-minute dwell at Old Oak Common for through services.

5.29 High Speed

3tph Phased Opening to/from Old Oak Common

5.29.1 This is a phased opening of the Phase 1 scheme with 3tph running between Old Oak Common and Birmingham Curzon Street. For modelling purposes this has been called Phase 1a. As all services run on HS2 infrastructure only there are no released capacity assumptions for this Phase, except that Great Western, Heathrow Express and Crossrail services call at Old Oak Common. The train specification is as follows:

Table 5-34: Phase 1a HS TSS

Train Path	Service	Train Type
1	Old Oak Common – Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
2	Old Oak Common – Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
3	Old Oak Common – Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible

6tph Phased Opening to/from Old Oak Common

5.29.2 This scenario represents a Phased Opening for the 10tph scenarios providing new HS2 infrastructure between Euston – Birmingham – Handsacre Junction and the Crewe extension (P2a). For modelling purposes these have been called Phase 1bi and 2ai. In the phased opening 6tph operates to/from Old Oak Common with the following service pattern:

Table 5-35: Phase 1bi/2ai HS TSS

Train Path	Service	Train Type
1	Old Oak Common to Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
2	Old Oak Common to Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
3	Old Oak Common to Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
4	Old Oak Common to Manchester Piccadilly via Wilmslow and Stockport	200m Classic Compatible
5	Old Oak Common to Liverpool via Crewe and Runcorn	200m Classic Compatible
6	Old Oak Common to Glasgow via Warrington, Wigan, Preston and Carlisle	200m Classic Compatible

Phase 1b

5.29.3 The train specification for Phase 1b, which assumes the Parliamentary Powers for 10tph service to/from Euston – Birmingham/Manchester/Liverpool/Preston/Scotland is as follows.

Table 5-36: Phase 1b HS TSS

Train Path	Service	Train Type
1	London Euston to Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
2	London Euston to Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
3	London Euston to Birmingham Curzon Street via Birmingham Interchange	400m Classic Compatible
4	London Euston to Manchester Piccadilly via Old Oak Common and Stockport	200m Classic Compatible
5	London Euston to Manchester Piccadilly via Old Oak Common and Stockport	200m Classic Compatible
6	London Euston to Manchester Piccadilly via Old Oak Common, Wilmslow and Stockport	200m Classic Compatible
7	London Euston to Liverpool Lime Street via Old Oak Common, Crewe and Runcorn.	200m Classic Compatible
8	London Euston to Liverpool Lime Street via Old Oak Common, Stafford, and Runcorn.	200m Classic Compatible
9	London Euston to Preston via Old Oak Common, Crewe, Warrington Bank Quay and Wigan North Western.	200m Classic Compatible
10	London Euston to Glasgow Central via Old Oak Common and Preston.	200m Classic Compatible

Phase 2a

5.29.4 The TSS specification for Phase 2a is as follows:

Table 5-37: Phase 2a HS TSS

Train Path	Service	Train Type
1	London Euston to Birmingham Curzon Street via Old Oak Common and Birmingham Interchange	400m Classic Compatible
2	London Euston to Birmingham Curzon Street via Old Oak Common and Birmingham Interchange	400m Classic Compatible
3	London Euston to Birmingham Curzon Street via Old Oak Common and Birmingham Interchange	400m Classic Compatible
4	London Euston to Manchester Piccadilly via Old Oak Common and Stockport	200m Classic Compatible
5	London Euston to Manchester Piccadilly via Old Oak Common and Stockport	200m Classic Compatible
6	London Euston to Manchester Piccadilly via Old Oak Common, Wilmslow and Stockport	200m Classic Compatible
7	London Euston to Liverpool Lime Street via Old Oak Common, Crewe and Runcorn.	200m Classic Compatible
8a	<i>London Euston to Liverpool Lime Street via Old Oak Common, Crewe and Runcorn.</i>	<i>400m Classic Compatible splits at Crewe</i>
8b	<i>London Euston to Preston via Old Oak Common, Crewe, Warrington Bank Quay and Wigan North Western.</i>	<i>400m Classic Compatible splits at Crewe</i>
9	London Euston to Glasgow Central via Old Oak Common and Preston.	200m Classic Compatible
10	London Euston to Macclesfield via Old Oak Common, Stafford and Stoke.	200m Classic Compatible

Phase 2b

5.29.5 The TSS for HS2 Phase 2b is as follows:

Table 5-38: Phase 2b HS TSS

Train Path	Service	Train Type
1	London Euston to Birmingham Curzon Street via Old Oak Common and Birmingham Interchange	400m Captive
2	London Euston to Birmingham Curzon Street via Old Oak Common and Birmingham Interchange	400m Captive
3	London Euston to Birmingham Curzon Street via Old Oak Common	400m Captive
4	London Euston to Manchester Piccadilly via Old Oak Common, Birmingham Interchange and Manchester Airport.	400m Captive
5	London Euston to Manchester Piccadilly via Old Oak Common and Manchester Airport.	400m Captive
6	London Euston to Manchester Piccadilly via Old Oak Common and Manchester Airport	400m Captive
7	London Euston to Liverpool Lime Street via Old Oak Common, Crewe and Runcorn.	200m Classic Compatible
8a	<i>London Euston to Liverpool via Old Oak Common, Crewe (splits) and Runcorn.</i>	<i>400m Classic Compatible splits at Crewe</i>
8b	<i>London Euston to Preston via Old Oak Common, Crewe (splits), Warrington Bank Quay and Wigan North Western.</i>	<i>400m Classic Compatible splits at Crewe</i>
9	London Euston to Macclesfield via Old Oak Common, Stafford and Stoke-On-Trent.	200m Classic Compatible
10a	<i>London Euston to Glasgow Central via Old Oak Common, Preston and Carstairs (to split).</i>	<i>400m Classic Compatible splits at Carstairs</i>
10b	<i>London Euston to Edinburgh Waverley via Old Oak Common, Preston, Carstairs (to split) and Haymarket.</i>	<i>400m Classic Compatible splits at Carstairs</i>
11a	<i>London Euston to Glasgow Central via Old Oak Common, Birmingham Interchange, Preston and Carstairs (to split).</i>	<i>400m Classic Compatible splits at Carstairs</i>
11b	<i>London Euston to Edinburgh Waverley via Old Oak Common, Birmingham Interchange, Preston, Carstairs (to split) and Haymarket.</i>	<i>400m Classic Compatible splits at Carstairs</i>

Train Path	Service	Train Type
12	London Euston to Leeds via Old Oak Common and Toton.	400m Captive
13	London Euston to Leeds via Old Oak Common, Birmingham Interchange and Toton.	400m Captive
14a	<i>London Euston to Leeds via Old Oak Common and Toton.</i>	<i>400m Classic Compatible splits at Toton</i>
14b	<i>London Euston to Sheffield Midland via Old Oak Common and Toton.</i>	<i>400m Classic Compatible splits at Toton</i>
15	London Euston to Newcastle via Old Oak Common, York and Darlington.	200m Classic Compatible
16	London Euston to Newcastle via Old Oak Common and York.	200m Classic Compatible
17a	<i>London Euston to Sheffield Midland via Toton and Chesterfield.</i>	<i>400m Classic Compatible splits at Toton</i>
17b	<i>London Euston to York via Toton.</i>	<i>400m Classic Compatible splits at Toton</i>
21	Birmingham Curzon Street to Manchester Piccadilly via Manchester Airport	200m Captive
22	Birmingham Curzon Street to Manchester Piccadilly via Manchester Airport	200m Captive
23a	(Alternate Hours) Birmingham Curzon Street to Glasgow Central via Wigan North Western, Preston, Lancaster, Oxenholme, Carlisle, Lockerbie and Motherwell.	200m Classic Compatible
23b	(Alternate Hours) Birmingham Curzon Street to Edinburgh Waverley via Wigan North Western, Preston, Lancaster, Penrith, Carlisle, Lockerbie and Haymarket.	200m Classic Compatible
24	Birmingham Curzon Street to Leeds via Toton.	200m Classic Compatible
25	Birmingham Curzon Street to Leeds via Toton.	200m Classic Compatible
26	Birmingham Curzon Street to Newcastle via Toton, York, Darlington and Durham.	200m Classic Compatible

5.30 Summary

Released Capacity – 6tph Phased Opening Scenario

5.30.1 The changes occur to classic rail services in 6tph Phased opening scenarios:

- 1tph West Coast Liverpool Lime Street – Euston service removed for HS2 path;
- 1tph West Coast North Wales – Euston services additional call at Stafford to maintain London connectivity;
- 1tph West Coast Manchester Piccadilly – Euston via Crewe service removed for HS2 path;
- 1tph West Coast Glasgow Central – Euston via Warrington fast service removed for HS2 path;
- 1tph London Midland Bletchley – Euston service added;
- 1tph London Midland Tring – Euston service added.

Released Capacity – Phase 1b

5.30.2 The following changes occur to classic rail services in Phase 1b:

- Great Western services call at Old Oak Common;
- Heathrow Express services call at Old Oak Common;
- London Midland timetable re-cast;
 - Service increases between London – Milton Keynes
 - New 1tph Euston – Manchester Piccadilly via Crewe
 - 1tph Euston – Crewe service extended to Manchester Victoria via Warrington Bank Quay
 - 1tph Shrewsbury – Birmingham New Street extended to Birmingham International
- Northern Trains 1tph Blackpool North – Macclesfield and Manchester Piccadilly – Stoke services combined into a Blackpool North – Stoke service. Manchester Piccadilly – Hazel Growth increased from 1 to 2tph;
- Open Access services on the WCML (to/from Blackpool North) removed;
- West Coast services changes:
 - 3tph Euston – Manchester Piccadilly replaced by HS2
 - 1tph Euston – Liverpool Lime Street replaced by HS2
 - 1tph Euston – Glasgow Central via Warrington Fast replaced by HS2
 - All Euston – Preston / Blackpool services removed
 - Euston – Birmingham reduced to 1tph with all trains extending to Wolverhampton (2tpd extend to Shrewsbury)
 - All services (except North Wales and Shrewsbury) rolling stock updated to 11-car electric pendolinos
- Crossrail services call at Old Oak Common

Released Capacity – Phase 2a

5.30.3 Classic rail services are expected to be unchanged between Phase 1 and Phase 2a with the only difference being for HS services.

Released Capacity – Phase 2b

5.30.4 The following changes occur to classic rail services in Phase 2b (this includes all the changes listed as part of Phase 1):

- East Coast service changes;
 - King's Cross – Edinburgh fast services removed
 - King's Cross – Leeds reduced to 1tph with extensions to Skipton and Harrogate only
 - King's Cross – Middlesbrough increased to 1tph but converted to slow service with extra calls
 - 1tph King's Cross – Newcastle service replaced by a fast King's Cross – York service
 - King's Cross – Lincoln increased to 1tph
 - New 1tph King's Cross – Hull service introduced
 - New 1toh King's Cross – Nottingham service introduced
- East Midlands alterations mainly around serving HS2 Toton;
 - Liverpool – Norwich services call at HS2 Toton
 - Matlock – Nottingham services call at HS2 Toton and extended to Newark Castle
 - 2tph St. Pancras – Sheffield reduced to 1tph by truncating at Derby
- London Midland Euston – Manchester Victoria diverted to Manchester Piccadilly
- Northern Trains new 1tph Doncaster – Leeds semi-fast to replace reduced East Coast services;
- Thameslink Govia additional 2tpd King's Cross – Peterborough added;
- Transpennine Express Liverpool – Newcastle services extended to Edinburgh and Manchester Airport – Newcastle services truncated at York;
- West Coast service alterations:
 - Remaining Euston – Scotland services from Phase 1 truncated at Preston with frequency increased to 1tph;
 - Additional 2tpd Euston-Chester (with 1tpd extending to/from Holyhead) and all Chester/North Wales services having additional calls;
- Cross Country services to Manchester to all call at Macclesfield. South Coast – Newcastle services diverted to avoid Sheffield and run Doncaster to/from Hull. New Sheffield – Doncaster – York services added to replace diverted trains.

5.31 Post PFMv9 Released Capacity Development

- 5.31.1 At present the released capacity assumptions within PFM are specified by the DfT and there is no testing of alternative scenarios. Therefore, the reference case may not reflect the 'optimum' released capacity scenario.

6 Modelling Reliability

6.1 PFMv9 Methodology

- 6.1.1 The approach to modelling reliability in PFMv9 involves adjusting the journey times on all rail services by adding delay minutes to scheduled journey times. The approach considers the improvement in reliability that HS2 can deliver by examining one measure of reliability – Average Minutes Lateness (AML).
- 6.1.2 PFM uses HS2 Ltd.'s design assumption that on dedicated HS2 track the average delay will be 0.003 minutes/km; this is equivalent to an average delay of 30 seconds delay between Old Oak Common and Birmingham Curzon Street.
- 6.1.3 For conventional rail services, an average delay (measured as minutes per km) is calculated for each rail service group. These values are calculated using PEARS data (covering a period from 2010 to 2019), which contains industry approved train delay values. Train miles data for all services (provided by Network Rail) has been used to convert train delay values to a measure per km.
- 6.1.4 Where HS2 services operate on the conventional rail network, the level of delay per km is assumed to be equivalent to the corresponding West Coast or East Coast Main Line values.
- 6.1.5 The new approach has been developed in consultation with the DfT and is in line with latest guidance. The update has improved the representation of reliability in the latest release of the PFM, in so far as it uses a larger historic data set and allows greater disaggregation of train delay by service group.

Appendix A – Modelled Rolling Stock

Vehicle	Description	Seats	Total Capacity
25	'[AW] 1X143 2-car'	119	159
26	'[AW] 1X143 2-car : 1X150b 2-car'	258	351
29	'[AW] 1X150b 2-car'	139	192
30	'[GW] 1X150b 2-car'	139	192
31	'[AW] 1X150b 2-car : 1X153 1-car'	211	289
32	'[AW] 2X150b 2-car'	278	383
33	'[AW] 1X153 1-car'	72	97
34	'[AW] 2X153 1-car'	144	195
35	'[SR] 1X156 2-car'	162	225
40	'[AW] 1X158b 2-car'	133	187
41	'[AW] 2X158b 2-car'	266	375
42	'[CH] 1X165a 2-car'	178	241
43	'[CH] 1X165a 2-car: 1X165c 3-car'	466	621
44	'[CH] 1X165b 2-car'	186	242
45	'[CH] 1X165b 2-car : 1X168d 4-car'	464	745
46	'[CH] 3X165b 2-car'	558	727
47	'[CH] 1X165c 3-car'	288	380
48	'[GW] 1X165c 3-car'	288	380
49	'[CH] 1X168c 3-car'	205	374
50	'[CH] 1X168d 4-car'	278	503
52	'[SR] 1X170d 3-car'	196	341
53	'[SR] 2X170d 3-car'	392	682
54	'[AW] 1X175a 2-car'	134	213
55	'[AW] 1X175a 2-car : 1X175b 3-car'	332	529
56	'[AW] 1X175b 3-car'	198	316
58	'[GC] 1X180 5-car'	278	432
59	'[HT] 1X180 5-car'	278	432
60	'[TH] 1X313 3-car'	232	309
63	'[SR] 1X320 3-car'	230	328
64	'[SR] 2X320 3-car'	460	656

Vehicle	Description	Seats	Total Capacity
68	'[SE] 2X377c 4-car'	474	728
69	'[SE] 3X377c 4-car'	711	1200
70	'[TH] 1X455b 4-car'	317	388
71	'[ME] 1X507 3-car'	210	261
72	'[ME] 1X507 3-car : 1X508a 3-car'	394	495
73	'[ME] 2X507 3-car'	420	521
74	'[ME] 2X508a 3-car'	368	469
75	'[AW] 1X67/0c 6-car'	153	181
76	'[SR] 1X43/0b 7-car'	394	458
78	'[CH] 1X168d 4-car : 1X168c 3-car'	483	877
79	'[CH] 2X165b 2-car : 1X165c 3-car'	660	865
80	'[AW] 3X158b 2-car'	399	562
81	'[SR] 1X43/0h 6-car'	317	396
84	'[HX] 1 X 360/2 5-car'	340	478
85	'[CH] 2X165 2'	356	516
86	'[EM] DMU 125mph'	254	306
87	'[XC] 1X220b 4-car'	202	258
88	'[AW] 1X142 2-car'	106	146
89	'[AW] 2X142 2-car'	212	293
92	'[CH] 1X172m 2-car'	125	191
95	'[GC] 1X43/2m 5-car'	271	472
98	'[SR] 1X380m 3-car : 1X380m 4-car'	490	894
99	'[HX] 1X332m 5-car'	201	318
100	'[CH] 1X67 6-car'	432	495
102	'[GW] 2X158k 2-car'	280	404
103	'[GW] 1X158k 2-car'	140	202
105	'[GC] 1X43/0a 4-car'	179	209
106	'[AW] 4X158b 2-car'	532	749
107	'[CH] 1X168c 3-car : 1X172b 2-car'	349	601
108	'[CH] 1X165c 3-car : 1X172b 2-car'	432	608
110	'[CH] 1X165a 2-car : 1X172b 2-car'	322	485
111	'[WC] 1X09-Car 390e'	439	505

Vehicle	Description	Seats	Total Capacity
112	'[WC] 1X5-Car 221'	258	310
113	'[WC] 2X5-Car 221'	516	620
114	'[WC] 1X11-Car 390e'	591	692
115	'[TH] 1X700 12-car'	654	1342
116	'[TH] 1X700 8-car'	416	872
117	'[TH] 2X365b 4-car'	528	735
118	'[TH] 1X387 4-car'	223	527
119	'[TH] 3X365b 4-car'	792	1102
120	'[TH] 1X171b 2-car : 2X171a 4-car'	634	964
121	'[TH] 2X171b 2-car'	232	395
122	'[TH] 2X377b 3-car'	338	513
123	'[TH] 2X377b 3-car : 1X377g 4-car'	580	869
124	'[TH] 2X377b 3-car : 1X377a 4-car'	576	865
125	'[TH] 2X377a 4-car'	476	704
127	'[TH] 2X377a 5-car'	596	922
128	'[TH] 2X455c 4-car'	614	891
129	'[TH] 1X377b 3-car'	169	257
130	'[TH] 1X377a 4-car'	238	352
131	'[TH] 1X377a 5-car'	298	461
132	'[TH] 3X171b 2-car : 1X171a 4-car'	607	975
133	'[TH] 1X455c 4-car'	307	445
134	'[TH] 4X171b 2-car'	464	790
135	'[TH] 5X171b 2-car'	580	987
136	'[TH] 1X171b 2-car'	116	197
137	'[TH] 1X171b 2-car : 1X171a 4-car'	375	581
138	'[TH] 1X171a 4-car'	259	383
140	'[SE] 1X395a 6-car'	349	556
146	'[XC] 1X170a 3-car'	191	275
147	'[XC] 1X170e 2-car'	111	164
148	'[XC] 1X221a 5-car'	236	313
149	'[XC] 1XHST 8-car'	387	552
150	'[XC] 2X220b 2-car'	348	474

Vehicle	Description	Seats	Total Capacity
152	'[XC] 2X170e 2-car'	222	328
153	'[XC] 1X170e 2-car : 1X170a 3-car'	302	439
154	'[XC] 2X221a 5-car'	472	625
156	'[SE] 2X395a 6-car'	698	1112
157	'[SE] 3X375d 4-car'	831	1125
160	'[SE] 2X375d 4-car'	554	750
164	'[GW] 1X165h 2-car'	186	279
177	'[GW] 1X801 9-car'	611	886
178	'[TH] 2X387 4-car'	446	1054
179	'[GW] 1XAT300 9-car'	647	819
181	'[TH] 3X387 4-car'	669	1580
182	'[GW] 1X800a 5-car'	303	439
183	'[GW] 1X387a 4-car'	223	493
184	'[GW] 2X387a 4-car'	446	986
241	'[XR] 1X345 9-car'	450	1106
249	'[TH] 1X377g 4-car'	242	356
250	'[TH] 2X442b 5-car'	692	911
251	'[TH] 3X377a 4-car'	714	1055
252	'[SR] 1X385 3-car'	226	332
289	'[SR] 2X385 3-car'	452	664
290	'[SR] 1X385 4-car'	293	442
291	'[SR] 2X385 4-car'	586	883
292	'[GA] 1XAIR12'	748	1081
293	'[GA] 1XHYB4'	224	309
294	'[GA] 1XIC12'	752	966
295	'[GA] 1XOS06'	544	607
296	'[GA] 2XHYB4'	448	618
297	'[GA] 2XOS06'	1088	1214
298	'[GA] 3XHYB4'	672	927
317	'[GW] 1X165h 2-car : 1X166a 3-car'	442	604
320	'[GW] 1XAT300 5-car'	359	433
322	'[GA] 1XOS12'	1145	1268

Vehicle	Description	Seats	Total Capacity
325	'[GA] 1XHYB3'	166	219
327	'[GW] 1X165c 3-car : 1X166a 3-car'	544	705
331	'[SE] 2X346 4-car'	384	1180
332	'[SE] 2X346 6-car'	592	1786
344	'[SE] 1X346 4-car : 1X346 6-car'	488	1483
345	'[SW] 2X158l 2-car'	250	423
346	'[SW] 2X158l 2-car : 2X159d 3-car'	644	1083
347	'[SW] 2X159d 3-car'	394	660
348	'[SW] 1X158l 2-car : 2X159d 3-car'	519	871
349	'[SW] 3X159d 3-car'	591	989
359	'[SW] 2X442d 5-car'	736	1292
360	'[SW] 1X159d 3-car'	197	330
361	'[TH] 1X717 6-car'	312	655
362	'[SE] 1X375c 3-car'	175	258
363	'[SE] 1X375e 4-car'	241	351
380	'380_4c '	275	399
383	'[SE] 1X375c 3-car : 1X375e 4-car'	416	609
384	'[SE] 2X375e 4-car'	482	703
385	'[SE] 1X375e 4-car : 1X375d 4-car'	518	726
387	'[SE] 1X375c 3-car : 2X375e 4-car'	657	961
388	'[SE] 3X375e 4-car'	723	1054
389	'[SE] 2X375e 4-car : 1X375d 4-car'	759	1078
392	'[SE] 1X375e 4-car : 2X375d 4-car'	795	1101
393	'[SE] 2X465e 4-car : 1X466b 2-car'	792	1104
395	'[SE] 1X375c 3-car : 1X375e 4-car : 1X375d 4-car'	693	984
396	'[SE] 1X375c 3-car : 2X375d 4-car'	729	1008
398	'[SW] 1X159/OR 3-car'	210	392
399	'[SW] 1X158/OR 2-car'	134	252
405	'IEP_5c_EL'	317	442
406	'IEP_9c_EL'	631	875
408	'IEP_5c_BI'	317	442
409	'IEP_9c_BI'	631	875

Vehicle	Description	Seats	Total Capacity
412	'[SW] 2X158/OR 2-car'	268	504
434	'[SW] 2X158/OR 2-car : 1X159/OR 3-car'	478	897
436	'[SW] 2X159/OR 3-car'	420	785
437	'[SW] 2X158/OR 2-car : 2X159/OR 3-car'	688	1289
438	'[SW] 3X159/OR 3-car'	630	1177
439	'[SW] 1X158/OR 2-car : 2X159/OR 3-car'	554	1037
447	'[SW] 1X444/OR 5-car'	369	612
448	'[SW] 2X444/OR 5-car'	738	1224
449	'[SW] 1X450/OR 4-car'	281	489
450	'[SW] 2X450/OR 4-car'	562	978
451	'[SW] 3X450/OR 4-car'	843	1467
453	'[SW] 2X705 5-car'	542	1177
454	'[SW] 1X711 10-car'	550	1180
455	'[LO] 1X710 4-car'	195	443
456	'[LO] 2X710 4-car'	390	886
457	'[NT] 1X156b 2-car'	150	204
458	'[NT] 1X319f 4-car'	280	378
459	'[NT] 1X386a 4-car'	204	327
460	'[NT] 1X176a 2-car : 1X176b 2-car'	328	537
461	'[NT] 1X176a 2-car'	204	328
462	'[NT] 1X150d 2-car'	124	194
463	'[NT] 1X386b 5-car'	284	446
464	'[NT] 1X158c 2-car'	138	209
465	'[NT] 1X170d 2-car'	198	347
466	'[NT] 1X150e 2-car'	148	192
467	'[NT] 1X155b 2-car'	160	213
468	'[NT] 1X176b 2-car'	124	209
469	'[NT] 3X176b 2-car'	372	627
470	'[NT] 1X158ff 2-car'	207	314
471	'[NT] 2X386a 4-car'	408	655
472	'[NT] 1X333a 4-car'	360	454
473	'[NT] 2X176b 2-car'	248	418

Vehicle	Description	Seats	Total Capacity
474	'[NT] 2X158c 2-car'	276	418
475	'[NT] 1X150d 2-car : 1X156b 2-car'	276	409
476	'[NT] 3X150d 2-car'	372	582
477	'[NT] 1X150d 2-car : 1X150e 2-car'	272	386
478	'[NT] 2X150d 2-car'	248	388
479	'[NT] 2X156b 2-car'	304	430
480	'[NT] 1X158c 2-car : 1X170d 2-car'	336	522
481	'[NT] 1X156b 2-car : 1X158c 2-car'	290	424
482	'[NT] 2X150e 2-car'	296	384
483	'[NT] 1X386a 4-car : 1X386b 5-car'	488	773
484	'[NT] 1X150d 2-car : 1X170d 2-car'	322	508
485	'[NT] 1X150d 2-car : 1X158c 2-car'	262	403
486	'[NT] 1X155b 2-car : 1X158c 2-car'	298	421
487	'[NT] 2X170d 2-car'	396	627
492	'[NT] 1X150e 2-car : 1X158c 2-car'	286	401
500	'[LM] 350/1+350/1+350/3'	734	1207
501	'[LM] 350/1'	230	403
502	'[LM] 172/3'	219	368
503	'[LM] 172/2'	139	234
504	'[LM] 172/2+172/3'	358	601
505	'[LM] 230/2'	114	209
506	'[LM] 350/2+350/2'	540	803
507	'[LM] 172/3+172/3'	438	735
508	'[LM] 323/0'	289	364
509	'[LM] 350/2'	270	402
510	'[LM] 350/4'	206	360
511	'[LM] 323/0+323/0'	578	729
512	'[LM] 172/0'	124	208
513	'[LM] 170/3+170/3'	392	682
514	'[LM] 170/3'	196	341
515	'[LM] 170/2+170/2'	244	442
516	'[LM] 170/2'	122	221

Vehicle	Description	Seats	Total Capacity
517	'[LM] 350/1+350/1+350/1'	690	1210
518	'[LM] 350/1+350/2'	500	805
519	'[LM] 350/1+350/2+350/2'	770	1207
520	'[LM] 350/3'	234	402
521	'[LM] 170/2+170/3'	318	562
522	'[LM] 170/2+170/2+170/2'	366	663
523	'[LM] 172/2+172/2'	244	442
524	'[LM] 350/1+350/1+350/2'	730	1208
525	'[LM] 319/0+319/0+319/0'	909	1267
526	'[LM] 350/1+350/1+350/4'	666	1167
527	'[LM] 350/2+350/2+350/2'	810	1205
528	'[LM] 350/1+350/3'	464	805
530	'[LM] 350/1+350/1'	460	807
531	'[LM] 350/2+350/2+350/4'	746	1163
532	'[LM] 350/2+350/3'	504	803
533	'[LM] 350/2+350/4'	476	762
534	'[LM] 350/3+350/4'	440	762
535	'[LM] 350/1+350/2+350/4'	706	1165
536	'[LM] 350/2+350/2+350/3'	774	1205
537	'[LM] 172/0+172/0'	248	417
538	'[LM] 350/3+350/3'	468	803
539	'[LM] 139/0'	22	65
540	'[LM] 350/1+350/4'	436	763
541	'[TP] 802'	342	491
542	'[TP] 802E'	286	462
543	'[TP] 185 100'	181	300
544	'[TP] 397 5-car'	206	360
547	'[EM] 1X153d 1-car'	75	104
548	'[EM] 2X153d 1-car'	150	209
549	'[EM] 1X153d 1-car: 1X156e 2-car'	223	310
550	'[EM] 1X156e 2-car'	148	205
551	'[EM] 1X156e 2-car: 1X158d 2-car'	305	397

Vehicle	Description	Seats	Total Capacity
553	'[EM] 1X158d 2-car'	157	204
554	'[EM] 2X158d 2-car'	314	409
556	'[EM] 1X222 5-car'	244	287
557	'[EM] 1X377 4-car'	226	368
558	'[OA] 1X225 7-car'	409	484
647	'[EM] 2X222 5-car'	512	618
648	'[EM] 1X222 7-car'	379	447
649	'x2 IEP_5c_EL'	634	884
650	'x2 IEP_5c_BI'	634	884

Glossary

AML	Average Minutes Lateness
AP	Attraction to Production
ATOC	Association of Train Operating Companies
CA	Car Available
CAA	Civil Aviation Authority
CEBR	Centre for Economics and Business Research
CPI	Consumer Price Index
DECC	Department of Energy & Climate Change
DfT	Department for Transport
DM	Do Minimum
DS	Do Something
EDGE	Exogenous Demand Growth Estimator
GDP	Gross Domestic Product
HSR	High Speed Rail
HS2	High Speed Two (the project)
HS2 Ltd	High-Speed Two Ltd. (project sponsor)
IEP	Inter-City Express Programme
IVT	In-Vehicle Time
LUL	London Underground Ltd
MOIRA	Rail forecasting software and database
NCA	Non-Car Available
NTEM	National Trip End Model (DfT)
NTM	National Transport Model (NTM)
OBR	Office for Budget Responsibility
ONS	Office of National Statistics

PFMv9 Assumptions Report

Revision: Rev01

ORR	Office of Rail and Road
PA	Production to Attraction
PDFH	Passenger Demand Forecasting Handbook
PFM	PLANET Framework Model
PLD	PLANET Long Distance
PM	PLANET Midlands
PN	PLANET North
PS	PLANET South
PT	Public Transport
RIFF	Rail Industry Forecasting Framework
RPI	Retail Price Index
RTF	Road Traffic Forecasts (DfT)
SCM	Station Choice Model
TEMPro	Trip End Model presentation Program (DfT)
TfL	Transport for London
TOC	Train Operating Company
WebTAG	DfT's web-based Transport Appraisal Guidance

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