Atkins Model Development Report, PFMv4.3 to PFMv5.2: Updating the Exogenous Forecasts

HS2 Ltd.

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Plan Design Enable

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Introduction

As part of the contract HS2/116 Work Package 2: Updating the Exogenous Forecasts, HS2 Ltd. commissioned Atkins to update the exogenous demand forecasts for all modes – rail, highway and air – in order to update the PLANET Framework Model (PFM) with the latest available inputs and methodology. This forms the update from version 4.3 to version 5.2 of PFM as part of the 2014 analytical work programme.

Work Package 1 (WP1) involves updating the networks and model assumptions, which is being undertaken by Mott MacDonald/Systra. The outputs from WP2 are required by the WP1 team to determine the impact of the updated assumptions within PFM. This technical note details the outputs that Atkins has provided to the WP1 team, as well as the methodology and assumptions that underpin those outputs.

The highway and air forecasts were updated using the latest inputs from the Department for Transport (DfT), based on the methodology used during the previous forecasting for PFM version 4.3. The rail demand inputs and methodology were updated through the following steps:

1. Automation of Existing Process: Several automated tools have been developed in order to make the process easier to use, provide greater transparency and robustness, and improve the efficiency of the process to reduce the time and cost of producing updated demand forecasts;
2. Migration to EDGE 1.5: The demand forecasting now uses EDGE version 1.5.0.0, which was released by DfT in spring 2013, replacing EDGE v1.4.0.3, which had been used in previous updates of PFM.
3. NTEM Case Study: The current RIFF based case studies have been converted to ones based on NTEM zones to ensure the rail forecasting is undertaken at the most disaggregate spatial level and to allow a more transparent mapping to the PLANET model zone systems. This follows the process developed in 2012 whilst creating the NTEM based PLANET North EDGE case study.
4. WebTAG 2014 Updates: In order to update the HS2 demand forecasting in line with the latest government guidance, it was necessary to run EDGE using the revised parameters recommended in WebTAG 2014, which was published in draft form in June 2014.
5. Amendments to Previous Process: A number of amendments were made to the previous rail demand forecasting process used in PFMv4.3. These had been identified during the audit of PFMv4.3 and added to the Development Opportunities Log (DOL), or during the present update of the forecasting process.
6. Revised Economic Forecasts: The exogenous demand forecasts were updated in light of the latest input assumptions from DfT, such as GDP per capita, employment, population, rail fares, and the cost of travel for competing modes.

A quality assurance process has been undertaken, including a comparison with forecasts undertaken by the DfT, which combined with the AGILE project management methodology implemented by HS2 Ltd., provides additional robustness to the process.

The remainder of the document is structured as follows:

- Chapter 1 provides a summary of the outputs provided to the WP1 consultants for PFMv5.1 (see also Chapter 4);
- Chapter 2 presents the revised demand forecasts for PFM version 5.1, and compares these with the forecasts used in PFM version 4.3;
- Chapter 3 summarises the step through of the updates to the rail inputs and methodology, including the relative impacts of each step on the demand forecasts;
- Chapter 4 presents the demand forecasts for PFM version 5.2;
- Chapter 5 describes the quality assurance processes that have been undertaken;
- Appendices A and B provide a more detailed description of the methodology and assumptions used for the updates to the rail and highway forecasts, respectively, and Appendix C details the quality assurance processes undertaken.

1. Outputs provided to WP1 Consultants, PFMv5.1

This section provides the information of the outputs provided to WP1 Consultants for all PFM models – PLANET Long Distance (PLD) and regional Models: PLANET North (PN), PLANET Midlands (PM) and PLANET South (PS). The outputs are disaggregated by model and mode, and where relevant, details of the naming convention and format of the outputs are provided. Note that all matrix files will be in the format 'Origin Destination:Value' unless explicitly stated otherwise. Matrices have been supplied as both "full" (with all demand included) and "controlled" versions (with the control matrix applied), with the exception of PLANET South. In addition an adjustment has been made to the PLD matrices so that demand in Zone 90 (Heathrow) is transferred to Zone 123 (West London).

Chapter 4 presents a summary of rail forecasts used in PFMv5.2.

1.1. PLANET Long Distance

1.1.1. Rail

Forecast year demand matrices have been provided for 2026 and the cap year. The forecasts are based on financial rather than calendar years, i.e. the model year 2026 represents the 2026/27 financial year. These are in text file format with the following information.

Table 1-1 PLD Rail Matrices Details in 2026/27

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
mf11.txt	mf11	Commuting non car available	342,134	11,667
mf12.txt	mf12	Commuting car available from	969,959	45,694
mf13.txt	mf13	Commuting car available to	969,959	45,694
mf14.txt	mf14	Business non car available[1]	-	-
mf15.txt	mf15	Business car available from	371,414	70,224
mf16.txt	mf16	Business car available to	233,460	56,825
mf17.txt	mf17	Other non car available	315,791	38,484
mf18.txt	mf18	Other car available from	736,902	93,981
mf19.txt	mf19	Other car available to	471,856	73,127

Table 1-2 PLD Rail Matrices Details in the Cap Year (2040/41)

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
mf11.txt	mf11	Commuting non car available	357,016	12,713
mf12.txt	mf12	Commuting car available from	1,098,066	56,833
mf13.txt	mf13	Commuting car available to	1,098,067	56,833
mf14.txt	mf14	Business non car available	-	-
mf15.txt	mf15	Business car available from	515,861	99,662
mf16.txt	mf16	Business car available to	322,366	80,757
mf17.txt	mf17	Other non car available	399,822	47,766
mf18.txt	mf18	Other car available from	1,011,515	130,632

[1] Note that the demand in this matrix is zero, but the matrix is retained for functionality purposes.

mf19.txt	Mf19	Other car available to	649,750	102,204

Note that the name of the matrices is the same for each year and are placed in separate clearly marked folders. The header information inside the matrices denotes the matrix description and the year the matrix refers to.

Demand matrices have been produced for five-yearly increments from 2026/27 to 2046/47. Although we have only provided matrices for 2026/27 and the cap year, matrices for other years are available upon request.

1.1.2. Highway

Forecast year demand matrices have been provided for 2026/27 and the cap year. These are in text file format with the following information.

Table 1-3 PLD Highway Matrices Details in 2026/27

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
mf21.txt	mf21	Daily commuting highway matrix	357,423	155,666
mf22.txt	mf22	Daily business highway matrix	561,739	320,204
mf23.txt	mf23	Daily other highway matrix	1,641,682	884,996

Table 1-4 PLD Highway Matrices Details in the Cap Year (2040/41)

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
mf21.txt	mf21	Daily commuting highway matrix	375,843	164,137
mf22.txt	mf22	Daily business highway matrix	600,099	343,452
mf23.txt	mf23	Daily other highway matrix	1,784,145	957,464

1.1.2.1. Highway Preloads

In addition, preload files have been provided for 2026/27 and the cap year, in the form of the link attribute ul1. Details of the highway preload files are given below.

Table 1-5 PLD Highway Preload Files Details

Name	Description	Format	Total Demand (Daily Trips)
ul1_2026.txt	2026/27 highway preloads	i-node j-node ul result	3,274,401
ul1_2040.txt	Cap year highway preloads	i-node j-node ul result	3,837,786

1.1.3. Air

Forecast year demand matrices have been adapted from the DfT's Aviation Model and have been provided for 2026/27 and the cap year. Details of these matrices are given below.

Table 1-6 PLD Air Matrices Details

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix in 2026/27	Total Demand (Daily Trips) in Full Matrix in the Cap Year
mf160.txt	mf160	Business air demand	19,769	26,748
mf161.txt	mf161	Other air demand	15,082	20,234

In addition there are a number of other items used within PFM that are derived from the DfT Aviation Model.

1.1.3.1. Air Supply

The DfT Aviation Model matches air supply to the air demand for each modelled year. Revised air networks have been provided for 2026/27 and the cap year. Detail of these files is given below.

Table 1-7 Summary of Air Network Files Provided

Name	Description	Format
PLD_d_DM_lin.in	2026/27 air networks	Transit line data to be directly imported to PFM
PLD_d_DM_lin.in	Cap year air networks	Transit line data to be directly imported to PFM
PLD_air_links.in	Additional base air link between Exeter and Stansted	i-node j-node length mode ul1

1.1.3.2. Air Fares

Base year air fare matrices for business and leisure trips are also provided from the DfT Aviation Model and these are coded on to the transit lines in the air network for input to PFM. Factors for air fare growth are also obtained from the DfT Aviation Model. These factors should be applied to the fares on the transit lines. The air fares data has been supplied in the HS2_Fare_Matrix.xlsx spreadsheet.

1.2. PLANET South

PLANET South is a rail only model, and therefore only rail matrices have been provided. These have been provided for 2026/27 and the cap year; details of these matrices are given below. As full base year matrices were not created for PLANET South, only controlled forecast matrices have been provided.

Table 1-8 PS Rail Matrices Details in 2026/27

Name	Matrix slot	Description	Total Demand in Controlled Matrix
2026/27_Business_PA	mf256	Business PA demand	181,759
2026/27_Business_AP	mf257	Business AP demand	11,626
2026/27_Leisure_PA	mf258	Leisure PA demand	186,445
2026/27_Leisure_AP	mf259	Leisure AP demand	21,252
2026/27_Commuting_PA	mf260	Commuting PA demand	1,571,492
2026/27_Commuting_AP	mf261	Commuting AP demand	33,144

Table 1-9 PS Rail Matrices Details in the Cap Year (2040/41)

Name	Matrix slot	Description	Total Demand in Controlled Matrix
2040/41_Business_PA	mf256	Business PA demand	263,510
2040/41_Business_AP	mf257	Business AP demand	16,334
2040/41_Leisure_PA	mf258	Leisure PA demand	258,037
2040/41_Leisure_AP	mf259	Leisure AP demand	28,426
2040/41_Commuting_PA	mf260	Commuting PA demand	1,730,696
2040/41_Commuting_AP	mf261	Commuting AP demand	37,258

1.3. PLANET Midlands

PLANET Midlands is a rail only model, and therefore only rail matrices have been provided. These have been provided for 2026/27 and the cap year; details of these matrices are given below.

Table 1-10 PM Rail Matrices Details in 2026/27

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
001PM_CA_biz.311	mf111	Business car available demand	12,433	5,905
001PM_NCA_biz.311	mf112	Business non car available demand	1,599	768
002PM_CA_lei.311	mf113	Leisure car available demand	11,115	6,456
002PM_NCA_lei.311	mf114	Leisure non car available demand	1,560	889
003PM_CA_com.311	mf115	Commuting car available demand	59,390	46,624
003PM_NCA_com.311	mf116	Commuting non car available demand	9,362	6,678

Table 1-11 PM Rail Matrices Details in the Cap Year (2040/41)

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
001PM_CA_biz.311	mf111	Business car available demand	15,960	7,990
001PM_NCA_biz.311	mf112	Business non car available demand	1,872	916
002PM_CA_lei.311	mf113	Leisure car available demand	14,373	8,669
002PM_NCA_lei.311	mf114	Leisure non car available demand	1,832	1,055
003PM_CA_com.311	mf115	Commuting car available demand	72,485	57,476
003PM_NCA_com.311	mf116	Commuting non car available demand	10,151	7,304

1.4. PLANET North

PLANET North is a rail only model, and therefore only rail matrices have been provided. These have been provided for 2026/27 and the cap year; details of these matrices are given below.

Table 1-12 PN Rail Matrices Details in 2026/27

Name	Matrix slot	Description	Total Demand (Daily Trips) in Full Matrix	Total Demand in Controlled Matrix
001PN_CA_biz.311	mf111	Business car available demand	28,866	16,291
001PN_NCA_biz.311	mf112	Business non car available demand	5,166	2,871
002PN_CA_lei.311	mf113	Leisure car available demand	23,475	12,281
002PN_NCA_lei.311	mf114	Leisure non car available demand	4,331	2,275
003PN_CA_com.311	mf115	Commuting car available demand	84,169	55,315
003PN_NCA_com.311	mf116	Commuting non car available demand	17,423	11,691

Table 1-13 PN Rail Matrices Details in the Cap Year (2040/41)

Name	Matrix slot	Description	Total Demand (Daily Trips)in Full Matrix	Total Demand in Controlled Matrix
001PN_CA_biz.311	mf111	Business car available demand	39,355	22,044
001PN_NCA_biz.311	mf112	Business non car available demand	6,243	3,467
002PN_CA_lei.311	mf113	Leisure car available demand	31,949	16,470
002PN_NCA_lei.311	mf114	Leisure non car available demand	5,231	2,727
003PN_CA_com.311	mf115	Commuting car available demand	102,428	67,139
003PN_NCA_com.311	mf116	Commuting non car available demand	19,016	12,757

1.5. Matrix Masking and PFM Control Matrix

The rail matrices used in PFM have various trips removed from each of them in two different stages. The reasons for this are to remove trips that are not of interest in relation to the HS2 scheme and to ensure that no origin-destination journey pairs are double counted.

The existing masking method is detailed below.

- For the PLD matrices, all trips internal to PS are removed. Trips that are internal to PM are also removed. This masking process is applied to the base year matrices as part of the demand forecasting;
- For the PS matrices, all trips are removed other than the internal ones. This masking process is applied to the base year matrices as part of the demand forecasting;
- Furthermore, PLD trips internal to the East Midlands Travel to Work Area (TTWA) and the TTWAs in PN are removed. This is done by means of a control matrix that is applied during a PFM model run; and
- For PM and PN, all trips other than those internal to the defined TTWAs are removed. This is done by means of a control matrix applied during a PFM model run.
- All intra-zonal trips are removed. This is done by means of a control matrix applied during a PFM model run.

To these ends, Atkins has historically provided the following matrices to feed into PFM.

- PLD matrices with PS and some PM trips removed;
- PS matrices with only internal trips remaining; and
- PM and PN matrices containing all trips.

It is understood that the control matrix within PFM then removed the following trips.

- PLD trips for East Midlands TTWA, as well as the PN TTWAs;
- Selected other trips in PLD;
- Trips that are not internal to the TTWAs in PM and PN; and
- All intra-zonal trips.

Following recent discussions with HS2 Ltd. and the WP1 team, the removing of trips will now be undertaken at the forecasting stage in a single process. Atkins has been provided with definitive control matrices from the WP1 consultants for PLD, PM and PN, so that all trips removed as part of the previous two-stage masking process described above could now be removed from the future year matrices as part of the demand forecasting. The forecasting has been undertaken on the full base year matrices, and then base year matrices with the new control matrices applied, for use by the WP1 consultants as inputs to PFM.

Full base year matrices for PS were not created at the time of the most recent base year update; therefore only matrices with masking applied have been created.

1.6. Other Inputs to PFM

There are a number of other areas within PFM where revisions to forecast economic parameters will require changes to the model or the appraisal spreadsheet. These include:

- VoT growth parameters within PFM;
- The Airport Demand Model;
- Rail fares growth assumptions; and
- VoT growth parameters in the appraisal spreadsheet.

GDP, population and rail fares growth supplied by DfT has been passed on to the WP1 consultants, so that changes to the model and appraisal spreadsheet can be implemented. These data are consistent with the data used to develop the growth forecasts.

1.7. Inputs Not Provided

1.7.1. Revised Economic Parameters Processed for PFM

Revised economic parameters which have been processed for input to PFM have not been provided. The raw GDP, population and fares data has been provided so that so that changes to the model and appraisal spreadsheet can be implemented by the WP1 consultants.

1.7.2. PLD Forecast Rail Fares Matrices

Atkins has not provided any fares matrices, as rail fares matrices are currently uplifted from base year values within the model. As the base year matrices are not affected by this update, new fares matrices are not required.

1.7.3. Car Occupancy Matrices

PLD requires car occupancy matrices to be input to the model. These have not been updated as part of this commission and so revised car occupancy matrices have not been provided.

2. Summary of New Demand Forecasts, PFMv5.1

2.1. Rail Demand Forecasts, PFMv5.1[2]

The following section describes the changes to the rail forecasts for all four PLANET models in PFMv5.1 compared with PFM 4.3, for 2026/27 and the cap year (2040/41). Please note that the demand matrices presented here differ from those summarised in Section 1, so that a like-for-like comparison can be made with the PFM 4.3 matrices. This is because a revised approach has been taken to the masking of demand from the matrices supplied to the WP1 consultants, where the matrix masking and control matrix are combined to into a single process, as described in Section 1.5. The matrices presented here have has the previous masking applied, with the following trips removed:

- PLD matrices with PS and some PM trips removed;
- PS matrices with only internal trips remaining; and
- PM and PN matrices contain all trips.

In addition, the adjustment to the PLD matrices so that Zone 90 (Heathrow) demand is reassigned to Zone 123 (West London) has not been made.

2.1.1. PLANET Long Distance Forecasts

2.1.1.1. Matrix Totals

Table 2-1 summarises the PLD matrix totals for the new rail demand forecasts for 2026/27, and compares these against the demand matrices from PFM 4.3. The table demonstrates that the demand grows at a slower rate in the new forecasts across all trip purposes when compared with PFM4.3. There is a decrease of 14% in total demand between the forecasts in 2026/27.

Table 2-1 PLD Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
Commuting NCA	76,781	63,797	-12,984	-16.9%
Commuting CA from	234,325	195,181	-39,144	-16.7%
Commuting CA to	234,326	195,181	-39,145	-16.7%
Business NCA	-	-	-	-
Business CA from	125,884	113,704	-12,180	-9.7%
Business CA to	93,704	84,919	-8,785	-9.4%
Leisure NCA	117,162	101,600	-15,562	-13.3%
Leisure CA from	284,346	248,113	-36,234	-12.7%
Leisure CA to	208,794	182,571	-26,223	-12.6%
Total	**1,375,321**	**1,185,067**	**-190,254**	**-13.8%**

2.1.1.2. Derivation of the Cap Year

The second forecast year is referred to as the cap year and this represents the year at which long distance rail demand is deemed to reach a saturation point, beyond which no further demand growth occurs. The concept of the cap year is described in WebTAG Unit A5.3, January 2014. Its application for HS2 appraisal has been agreed with DfT. To derive the cap year long distance rail trips over 100 miles (within PLD) are

[2] The rail forecasts used in PFMv5.2 are presented in Chapter 4.

matched to the level originally predicted in the February 2011 HS2 London – West Midlands consultation model which was 290,146 trips.

Table 2-2 shows the level of PLD demand for PFM 4.3 and the new forecasts. The demand is calculated for each forecast year using EDGE forecasts at five year intervals from 2026/27 and linear interpolation for the interim years. The analysis showed that for the new forecasts, the number of trips over 100 miles in 2040/41 (291,286) lies closest to the target figure of 290,146 trips. Therefore, the second model forecast year has been determined to be 2040/41. This is later than PFM 4.3 which forecasts a cap year of 2036/37.

It is also noted that long distance trips over 100 miles represent a greater proportion of total trips in the new forecasts than they do in PFM 4.3. For example, long distance trips represent 19.2% of total demand in the cap year of the new forecasts (2040/41) whilst PFM 4.3 long distance trips represent only 17.5% in the cap year (2036/37). This suggests that the growth rate of short distance regional trips is declining in the new forecasts. As HS2 largely caters for long distance trips which now represent a higher proportion of total demand, this may impact on the HS2 business case.

Table 2-2 Derivation of Cap Year for new forecasts and PFM v4.3 Forecasts

Year	PFM v4.3			New Forecasts, PFM v5.1		
	Total Demand	>100 Miles	% of Total	Total Demand	>100 Miles	% of Total
2026/27	**1,375,321**	**229,350**	**16.7%**	**1,185,067**	**209,417**	**17.7%**
2027/28	1,403,158	235,276	16.8%	1,209,462	215,389	17.8%
2028/29	1,430,994	241,202	16.9%	1,233,857	221,361	17.9%
2029/30	1,458,831	247,128	16.9%	1,258,252	227,333	18.1%
2030/31	1,486,667	253,054	17.0%	1,282,647	233,304	18.2%
2031/32	**1,514,504**	**258,980**	**17.1%**	**1,307,042**	**239,276**	**18.3%**
2032/33	1,541,132	264,878	17.2%	1,332,312	245,634	18.4%
2033/34	1,567,760	270,776	17.3%	1,357,583	251,991	18.6%
2034/35	1,594,388	276,673	17.4%	1,382,854	258,348	18.7%
2035/36	1,621,017	282,571	17.4%	1,408,124	264,706	18.8%
2036/37	**1,647,645**	**288,469**	**17.5%**	**1,433,395**	**271,063**	**18.9%**
2037/38	1,673,661	293,856	17.6%	1,454,419	276,119	19.0%
2038/39	1,699,677	299,242	17.6%	1,475,444	281,174	19.1%
2039/40	1,725,693	304,629	17.7%	1,496,469	286,230	19.1%
2040/41	**1,751,709**	**310,016**	**17.7%**	**1,517,493**	**291,286**	**19.2%**
2041/42	**1,777,725**	**315,402**	**17.7%**	**1,538,518**	**296,341**	**19.3%**
2042/43	1,810,341	322,111	17.8%	1,566,667	302,376	19.3%
2043/44	1,842,956	328,820	17.8%	1,594,817	308,410	19.3%
2044/45	1,875,572	335,529	17.9%	1,622,967	314,444	19.4%
2045/46	1,908,188	342,238	17.9%	1,651,116	320,478	19.4%
2046/47	**1,940,804**	**348,947**	**18.0%**	**1,679,266**	**326,513**	**19.4%**

The PLD rail matrix totals for the cap year are presented in Table 2-3. PFM 4.3 has been compared with the corresponding cap year forecasts for the new forecasts which have been interpolated to 2040/41 from the 2036/37 and 2041/42 forecasts. It can be seen that, in a similar way to the 2026/27 forecasts, the new forecasts have resulted in a slight overall decrease in trips in the PLD matrix with a decrease of 7.9% in the cap year. This decrease in trips is a result of the reduction in commuting and leisure demand especially for the non-car available categories. Business demand is observed to slightly increase in the cap year.

As the overall level of demand in the cap year matrix for the new forecasts is slightly lower, this again shows that short distance demand (<100 miles) has reduced, given that long distance demand (>100 miles) for the cap year is approximately the same (Table 2-2).

Table 2-3 PLD Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
Commuting NCA	83,109	68,024	-15,085	-18.2%
Commuting CA from	279,909	237,905	-42,004	-15.0%
Commuting CA to	279,909	237,905	-42,004	-15.0%
Business NCA	-	-	0	-
Business CA from	155,621	156,058	436	0.3%
Business CA to	116,323	117,040	717	0.6%
Leisure NCA	131,404	120,956	-10,448	-8.0%
Leisure CA from	345,969	332,939	-13,030	-3.8%
Leisure CA to	255,401	246,666	-8,735	-3.4%
Total	**1,647,645**	**1,517,493**	**-130,152**	**-7.9%**

2.1.1.3. Growth in Key Rail Movements

Table 2-4 shows the growth in PLD rail matrices for key rail zone to zone movements for 2026/27 and the cap year in PFM 4.3.Table 2-4 shows the corresponding demand for the new forecasts. These tables show total trips in both direction rounded to the nearest hundred. Note that the PLD zone boundaries do not necessarily correspond exactly with Local Authority boundaries. Any changes in key HS2 movements are likely to have an impact on the HS2 business case.

Table 2-4 PFM v4.3 Forecasts Growth in Total Weekday Trips in PLD (bi-directional)

Key HS2 zone to zone movements	PLD Zone O-D	2010/11 Demand	2026/27 Demand	% Growth 2010/11 – 2026/27	2036/37 Demand	% Growth 2010/11 - 2036/37
Central London - Birmingham	117_5	6,900	10,575	53.27%	13,493	95.55%
Central London - Manchester	117_130	6,600	10,381	57.30%	13,401	103.04%
Central London - Leeds	117_105	4,200	6,449	53.54%	8,604	104.85%
Central London - Glasgow	117_37	1,100	1,761	60.12%	2,192	99.29%
Central London - Liverpool	117_116	2,700	3,880	43.69%	4,855	79.83%
Central London - Newcastle	117_141	2,200	3,271	48.69%	4,174	89.74%
Central London - Edinburgh	117_36	2,100	3,442	63.89%	4,430	110.97%

Table 2-5 New Forecasts Growth in Total Weekday Trips in PLD (bi-directional)

Key HS2 zone to zone movements	PLD Zone O-D	2010/11 Demand	2026/27 Demand	% Growth 2010/11 – 2026/27	2040/41 Demand	% Growth 2010/11 - 2040/41
Central London - Birmingham	117_5	6,900	10,059	45.78%	14,234	106.29%
Central London - Manchester	117_130	6,600	10,051	52.29%	14,414	118.39%
Central London - Leeds	117_105	4,200	6,188	47.34%	9,353	122.69%
Central London - Glasgow	117_37	1,100	1,646	49.63%	2,225	102.28%
Central London - Liverpool	117_116	2,700	3,786	40.23%	5,226	93.54%
Central London - Newcastle	117_141	2,200	3,189	44.94%	4,495	104.30%
Central London - Edinburgh	117_36	2,100	3,221	53.38%	4,540	116.19%

The difference between the two forecasts of demand for key rail zone to zone movements is shown in Table 2-6 below. Consistent with the matrix totals, the 2026/27 demand is lower for all zone pairs in the new forecasts when compared with PFM 4.3. However, in the cap years the key HS2 corridors between London and core UK cities experience an increase in percentage growth from 2010/11 when compared with PFM 4.3. This suggests that demand for non-London long distance flows will be lower since the overall long distance demand is similar in the cap years for PFM 4.3 and the new forecasts.

Table 2-6 Difference between New Forecasts and PFM v4.3 Forecasts

Key HS2 zone to zone movements	PLD Zone O-D	2010/11 Demand	2026/27 Demand	% Growth 2010/11 – 2026/27	Cap Year Demand	% Growth 2010/11 – Cap Year
Central London - Birmingham	117_5	0	-517	-7.49%	741	10.74%
Central London - Manchester	117_130	0	-330	-5.00%	1,013	15.35%
Central London - Leeds	117_105	0	-260	-6.20%	749	17.84%
Central London - Glasgow	117_37	0	-115	-10.49%	33	2.99%
Central London - Liverpool	117_116	0	-94	-3.46%	370	13.71%
Central London - Newcastle	117_141	0	-82	-3.75%	320	14.56%
Central London - Edinburgh	117_36	0	-221	-10.52%	110	5.23%

Table 2-7 presents the comparison of demand growth between PFM 4.3 and the new forecasts for key HS2 corridors between other UK cities. The table illustrates that whilst growth is increasing between London and core UK cities in the cap year, it is actually decreasing between many other UK cities. Exceptions include Birmingham – Leeds, Birmingham – Newcastle and Leeds – Newcastle which are forecast to have a higher cap year growth rate in the new forecasts.

Table 2-7 Difference between New Forecasts and Previous Central Case Forecasts (October 2012) for non-London HS2 flows

Key HS2 zone to zone movements	PLD Zone O-D	2010/11 Demand	2026/27 Demand	% Growth 2010/11 – 2026/27	Cap Year Demand	% Growth 2010/11 – Cap Year
Birmingham - Manchester	5_130	0	-123	-12.35%	-56	-5.59%
Birmingham - Glasgow	5_37	0	-15	-14.53%	-6	-5.82%
Birmingham - Leeds	5_105	0	-31	-7.87%	12	3.10%
Birmingham - Newcastle	5_141	0	-12	-5.95%	8	4.25%
Birmingham - Edinburgh	5_36	0	-26	-12.81%	-8	-4.16%
Manchester - Glasgow	130_37	0	-41	-13.69%	-16	-5.32%
Glasgow - Edinburgh	37_36	0	-2,641	-17.61%	-2,380	-15.86%
Leeds - Newcastle	105_141	0	-45	-6.40%	38	5.38%

2.1.1.4. Regional Variation of Growth

The following section provides more detail on the regional variation of the changes in demand within the PLD matrix resulting from the new forecasts, and identifies the zones with the largest changes in demand. The changes in demand are also summarised at a more aggregated regional level. Figure 2-1 and Figure 2-2[3] illustrate the regional variation of the absolute and relative changes in forecast demand originating in each PLD zone in 2026/27. As expected all of the zones experience a reduction in weekday trips with many of the core cities such as Glasgow, Leeds and Birmingham, along with London experiencing a decrease of more than 500 trips per day. The majority of zones experience a relative decrease in demand of more than 10%.

[3] Please note that Figure 2-1 and Figure 2-2, as well as all subsequent regional plots shown in Section 2 are based on demand matrices derived using a previous assumption of short-term national employment growth. Please see Section 5.2.2 for details of the revised employment assumptions. It should be noted that this will not have a material impact on the distribution of employment growth between individual model zones.

Figure 2-3 and Figure 2-4 illustrate the regional variation of the absolute and relative changes in forecast demand originating in each PLD zone in the cap year (2036/37 for PFM 4.3 and 2040/41 for the new forecasts). Many regions experience a decrease in demand, in particular the North of England, along with many parts of Scotland which experience a decrease in demand of greater than 500 trips per day. Most of these zones also experience a percentage reduction of over 10%. Conversely a number of zones mainly in the South of England, along with the Vale of Glamorgan in Wales, experience an increase in cap year demand especially with London Central and the Vale of Glamorgan experiencing an increase of greater than 500 trips per day in the cap year.

Figure 2-1 Change in Total Demand 2026/27

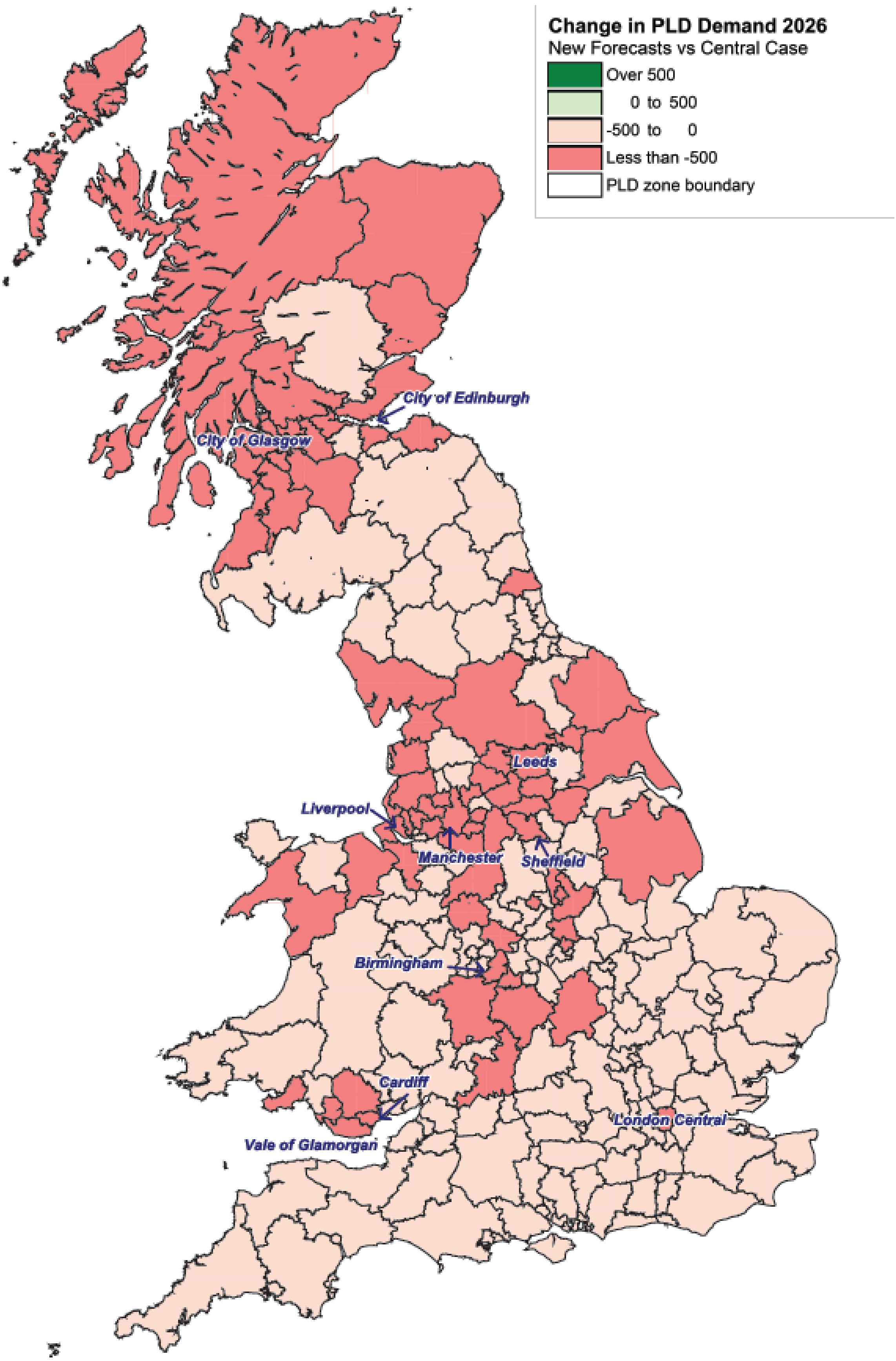


Figure 2-2 Percentage Change in Demand 2026/27

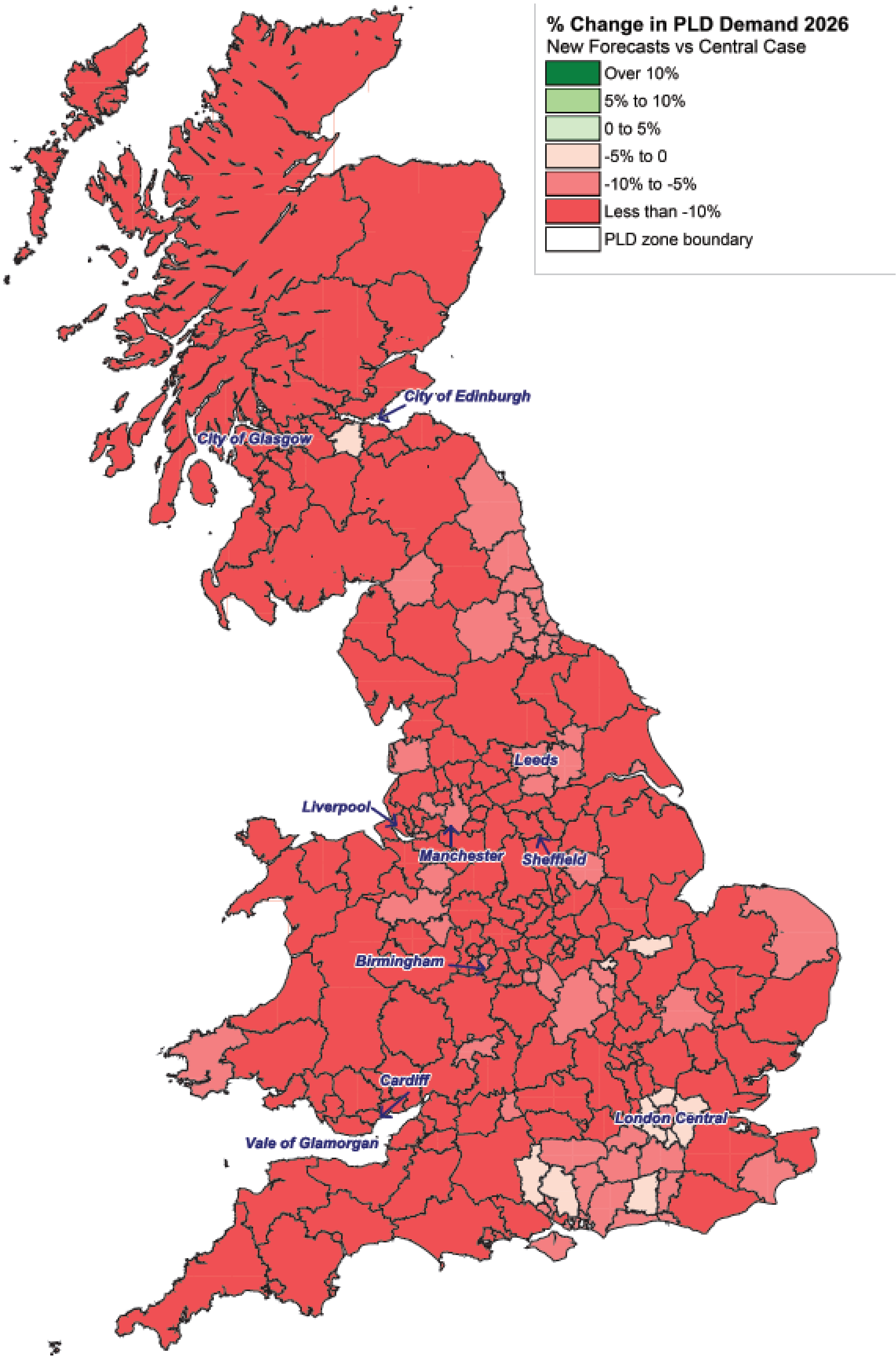


Figure 2-3 Change in Total Demand Cap Year (New Forecasts, 2040/41 vs PFM v4.3, 2036/37)

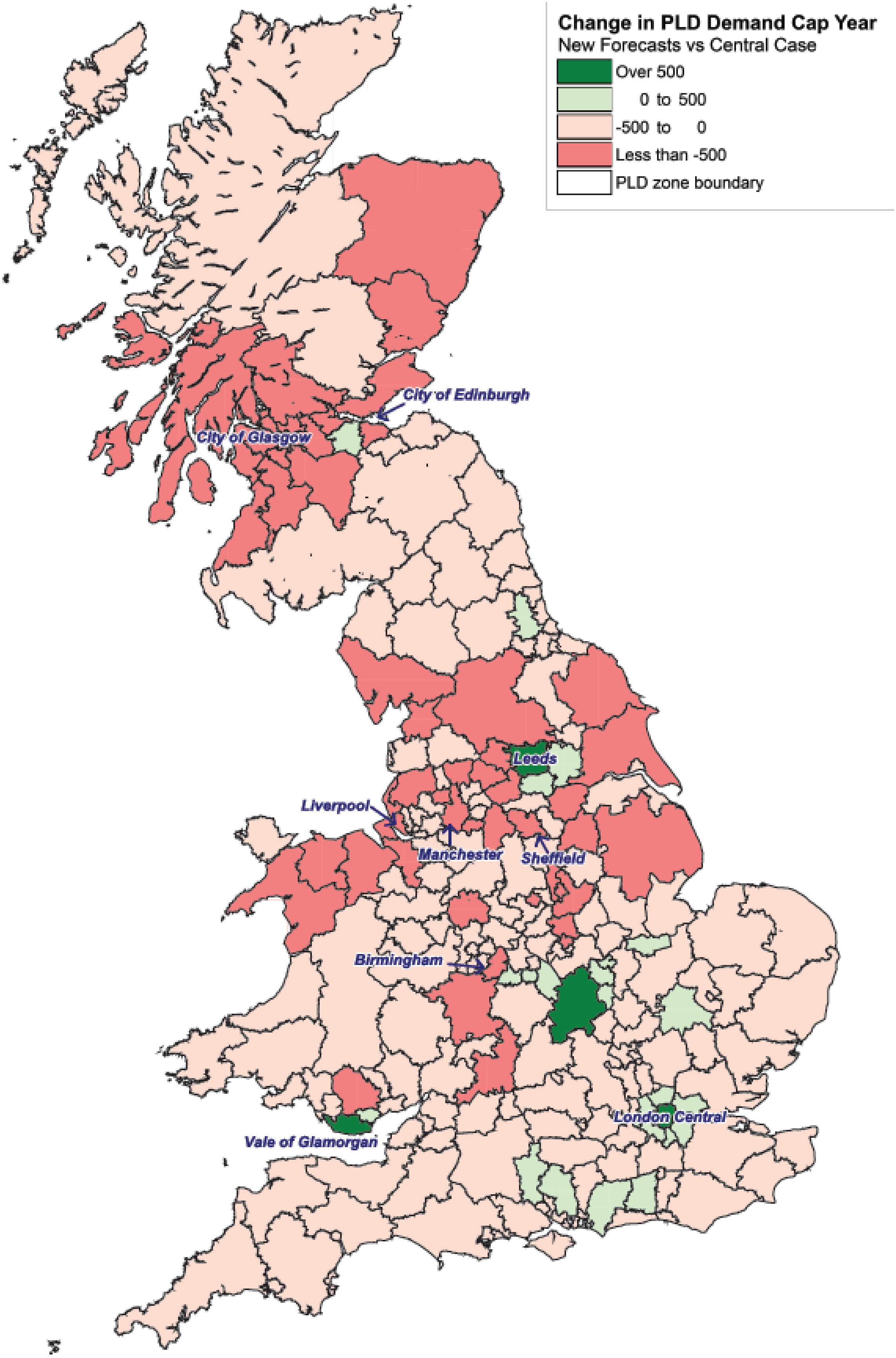


Figure 2-4 Percentage Change in Demand Cap Year (New Forecasts, 2040/41 vs PFM v4.3, 2036/37)

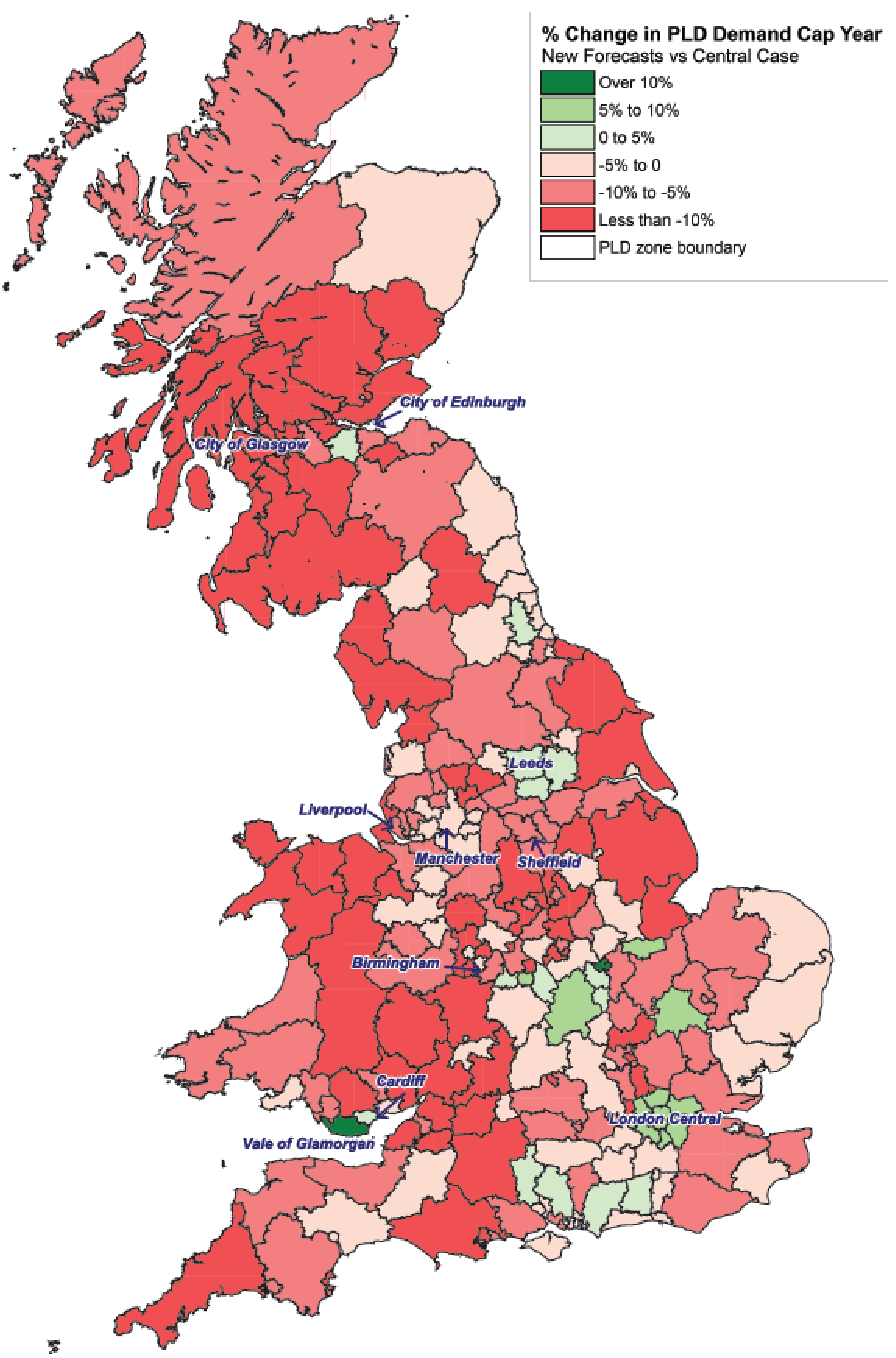


Table 2-8 below shows the 10 PLD zones with the largest absolute changes in demand in 2026/27. The table is dominated by many of the core cities which experience large absolute reductions in demand. Table 2-9 shows the corresponding percentage changes in demand in 2026/27. Many of the largest percentage changes in demand are from a relatively low level of initial demand with the exception of the West of Glasgow which experiences a reduction in demand of 23.1%. As seen in Figure 2-4, zones with a high level of initial demand do experience large relative reductions in demand (>10%); however they are less than 15% in 2026/27.

Table 2-8 Largest Absolute Changes in Demand by PLD Zone Origin (2026/27)

PLD Zone	PLD Zone Name	Total Demand			
		PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
37	City of Glasgow	131,962	111,202	-20,760	-15.7%
130	Manchester including Metrolink area	85,255	74,854	-10,400	-12.2%
116	Liverpool	56,813	48,748	-8,065	-14.2%
105	Leeds	66,981	60,570	-6,410	-9.6%
36	City of Edinburgh	50,230	44,002	-6,228	-12.4%
20	Cardiff	36,685	31,569	-5,117	-13.9%
5	Birmingham	37,388	32,544	-4,845	-13.0%
117	London Central	77,424	72,822	-4,602	-5.9%
229	West of Glasgow	19,090	14,674	-4,416	-23.1%
232	Wirral	22,791	18,661	-4,129	-18.1%

Table 2-9 Largest Percentage Changes in Demand by PLD Zone Origin (2026/27)

PLD Zone	PLD Zone Name	Total Demand			
		PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
124	Luton	182	95	-87	-47.7%
181	Solihull	6,424	3,854	-2,570	-40.0%
214	Vale of Glamorgan	7,654	5,156	-2,498	-32.6%
229	West of Glasgow	19,090	14,674	-4,416	-23.1%
65	East Ayrshire	3,129	2,445	-684	-21.9%
223	West Dunbartonshire	8,019	6,314	-1,705	-21.3%
34	Cheltenham & Cotswold	4,522	3,600	-923	-20.4%
196	South Ayrshire	6,761	5,387	-1,374	-20.3%
66	East Dunbartonshire	9,768	7,850	-1,919	-19.6%
152	Nottinghamshire Bassetlaw	2,452	1,977	-475	-19.4%

Table 2-10 details the largest absolute changes in PLD origin demand in the cap years. Again, many of the core cities experience a large decrease in forecast demand whilst demand originating in Central London increases. Table 2-11 presents the corresponding percentage changes. Similar to 2026/27, many of the largest percentage changes in demand are from areas with relatively low levels of demand with the exception of West of Glasgow which shows a 25.7% reduction in demand in the new forecasts.

Table 2-10 Largest Absolute Changes in Demand by PLD Zone Origin (Cap Year Weekday Trips)

PLD Zone	PLD Zone Name	Total Demand			
		PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
37	City of Glasgow	150,380	131,749	-18,631	-12.4%
117	London Central	99,456	105,965	6,510	6.5%
130	Manchester including Metrolink area	101,121	95,091	-6,030	-6.0%
229	West of Glasgow	22,311	16,573	-5,738	-25.7%
116	Liverpool	64,220	58,757	-5,463	-8.5%
36	City of Edinburgh	61,021	55,991	-5,030	-8.2%
5	Birmingham	46,350	42,163	-4,186	-9.0%
233	Worcestershire	25,602	21,455	-4,147	-16.2%
232	Wirral	25,794	21,764	-4,030	-15.6%
197	South Lanarkshire	22,612	19,204	-3,408	-15.1%

Table 2-11 Largest Percentage Changes in Demand by PLD Zone Origin (Cap Year Weekday Trips)

PLD Zone	PLD Zone Name	Total Demand			
		PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
124	Luton	190	121	-69	-36.3%
229	West of Glasgow	22,311	16,573	-5,738	-25.7%
65	East Ayrshire	3,678	2,841	-837	-22.8%
223	West Dunbartonshire	8,987	7,026	-1,961	-21.8%
196	South Ayrshire	7,871	6,227	-1,644	-20.9%
66	East Dunbartonshire	11,013	8,887	-2,125	-19.3%
34	Cheltenham & Cotswold	5,719	4,617	-1,102	-19.3%
77	Gwynedd	4,347	3,523	-824	-19.0%
174	Renfrewshire	15,707	12,778	-2,928	-18.6%
47	Dudley	2,537	2,066	-471	-18.6%

2.1.1.5. Demand Change by Regional Sector

To allow for further analysis, daily zonal PLD demand was aggregated into regional sectors for PFM 4.3 and the new forecasts. Table 2-12 shows the regional aggregated absolute differences in demand between PFM 4.3 and the new forecasts whilst Table 2-13 presents the corresponding percentage changes in 2026/27. Consistent with previous observations, demand decreases between all regions with the largest absolute and relative decreases (excluding inter-zonals) being observed between West Midlands – London and Wales – Scotland, respectively.

Table 2-14 and Table 2-15 present the aggregated regional daily demand comparison for the cap years. From this aggregation a distinct pattern has emerged; an increase in trips involving London with a corresponding decrease in regional demand. Most notably, trips between the West Midlands – East Midlands and Yorkshire and Humber – North West decrease by over 2000 trips per day. Conversely, demand for rail travel between London and West Midlands increases by over 3000 trips per day. A similar pattern is observed when analysing percentage demand changes with trips between the South West and the South East experiencing a 23% reduction in trips between PFM 4.3 and the new forecasts. Although often higher in absolute terms, the percentage changes involving London trips are lower than regional trips as London trips have a higher level of initial demand.

Table 2-12 Change in the number of daily trips between new forecasts and PFM v4.3 (2026/27)

East Midlands (EM)	EM									
East of England (EE)	-898	EE								
London (LN)	-2052		LN							
North East (NE)	-94	-75	-208	NE						
North West (NW)	-1919	-234	-1213	-225	NW					
Scotland (SC)	-98	-84	-584	-408	-576	SC				
South East (SE)	-621			-55	-353	-76	SE			
South West (SW)	-192	-12	-383	-39	-236	-48	-164	SW		
Wales (WA)	-72	-71	-522	-22	-1171	-44	-242	-1703	WA	
West Midlands (WM)	-3211	-406	-4334	-87	-1983	-141	-1675	-1100	-677	WM
Yorks and Humber (YH)	-2094	-226	-1305	-901	-3510	-302	-188	-154	-56	-446

Table 2-13 Percentage change in daily trips between new forecasts and PFM v4.3 (2026/27)

East Midlands (EM)	EM									
East of England (EE)	-14%	EE								
London (LN)	-5%	-	LN							
North East (NE)	-10%	-7%	-3%	NE						
North West (NW)	-15%	-11%	-4%	-6%	NW					
Scotland (SC)	-11%	-8%	-7%	-7%	-8%	SC				
South East (SE)	-13%	-	-	-6%	-7%	-8%	SE			
South West (SW)	-13%	-16%	-13%	-10%	-10%	-10%	-21%	SW		
Wales (WA)	-11%	-12%	-5%	-15%	-13%	-19%	-9%	-15%	WA	
West Midlands (WM)	-17%	-14%	-10%	-9%	-12%	-11%	-15%	-17%	-13%	WM
Yorks and Humber (YH)	-15%	-7%	-5%	-10%	-12%	-9%	-7%	-10%	-9%	-11%

Table 2-14 Change in the number of daily trips between new forecasts and PFM v4.3 (cap year)

East Midlands (EM)	EM									
East of England (EE)	-773	EE								
London (LN)	4608	0	LN							
North East (NE)	-49	22	746	NE						
North West (NW)	-1945	-97	2984	47	NW					
Scotland (SC)	-53	17	196	-37	-86	SC				
South East (SE)	-564	0	0	9	4	-13	SE			
South West (SW)	-147	-12	-245	-17	-77	-18	-235	SW		
Wales (WA)	-35	-30	669	-25	-914	-57	-78	-1461	WA	
West Midlands (WM)	-2860	-118	3142	24	-1013	-28	-978	-873	-376	WM
Yorks and Humber (YH)	-1814	114	1707	-589	-2905	-35	-12	-20	0	-15

Table 2-15 Percentage change in daily trips between new forecasts and PFM v4.3 (cap year)

East Midlands (EM)	EM									
East of England (EE)	-10%	EE								
London (LN)	9%		LN							
North East (NE)	-4%	2%	7%	NE						
North West (NW)	-13%	-4%	7%	1%	NW					
Scotland (SC)	-5%	1%	2%	-1%	-1%	SC				
South East (SE)	-9%			1%	0%	-1%	SE			
South West (SW)	-8%	-12%	-7%	-3%	-3%	-3%	-24%	SW		
Wales (WA)	-5%	-4%	5%	-13%	-8%	-20%	-2%	-10%	WA	
West Midlands (WM)	-12%	-3%	6%	2%	-5%	-2%	-7%	-11%	-6%	WM

Yorks and Humber (YH)	-10%	3%	5%	-5%	-8%	-1%	0%	-1%	0%	0%

2.1.2. PLANET South Forecasts

2.1.2.1. Matrix Totals

Table 2-16 summarises the PS matrix totals for the new rail demand forecasts for 2026/27, and compares these against the demand matrices from PFM 4.3. Overall demand is almost 14% lower in the new forecasts compared to PFM 4.3. This reduction can mainly be attributed to the large reduction in commuting trips. Leisure and business trips also see a smaller reduction in trips.

Table 2-16 PS Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
2026/27 Business PA	182,823	181,759	-1,064	-0.6%
2026/27 Business AP	11,830	11,626	-204	-1.7%
2026/27 Leisure PA	195,779	186,445	-9,334	-4.8%
2026/27 Leisure AP	22,446	21,252	-1,193	-5.3%
2026/27 Commuting PA	1,873,750	1,571,492	-302,258	-16.1%
2026/27 Commuting AP	38,658	33,144	-5,514	-14.3%
Total 2026/27	**2,325,286**	**2,005,718**	**-319,568**	**-13.7%**

Table 2-17 shows the PS matrix totals for the cap year for PFM 4.3 and the new forecasts and the subsequent divergences between the forecasts for each trip purpose. Business and leisure trips are forecast to increase compared with PFM 4.3 whilst commuting demand is lower. Overall demand is 15% lower than PFM 4.3 due to the high proportion of commuting trips in PS.

Table 2-17 PS Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
CY Business PA	222,915	263,510	263,510	18.2%
CY Business AP	14,468	16,334	16,334	12.9%
CY Leisure PA	239,286	258,037	258,037	7.8%
CY Leisure AP	27,468	28,426	28,426	3.5%
CY Commuting PA	2,197,154	1,730,696	1,730,696	-21.2%
CY Commuting AP	45,097	37,258	37,258	-17.4%
Total CY	**2,746,389**	**2,334,260**	**2,334,260**	**-15.0%**

2.1.2.2. Regional Variation of Growth

Table 2-5 and Figure 2-6 illustrate the regional variation in relative and absolute terms in PS origin demand between PFM 4.3 and the new forecasts in 2026/27. The majority of zones experience a reduction in demand with many of the largest changes concentrated on the periphery of central London where the proportion of commuting is likely to be highest. Some notable increases in origin demand include parts of Surrey, Buckinghamshire and Leicestershire.

Figure 2-7 and Figure 2-8 present the absolute and percentage changes in origin PS demand for the cap year. The pattern emerging is similar to 2026/27 with many zones experiencing a reduction in demand which is especially concentrated in the commuter belt of London.

Figure 2-5 PS Absolute Change in Demand 2026/27

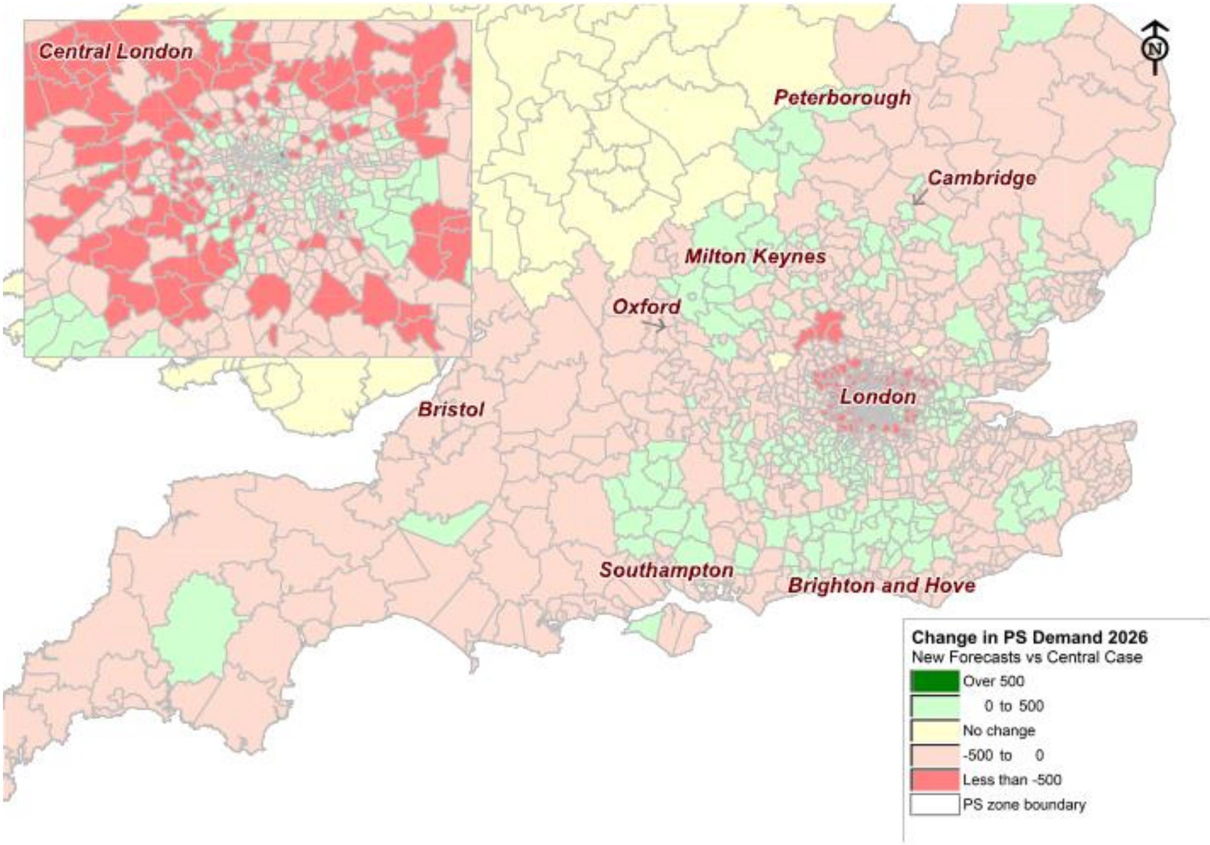


Figure 2-6 PS Percentage Change in Demand 2026/27

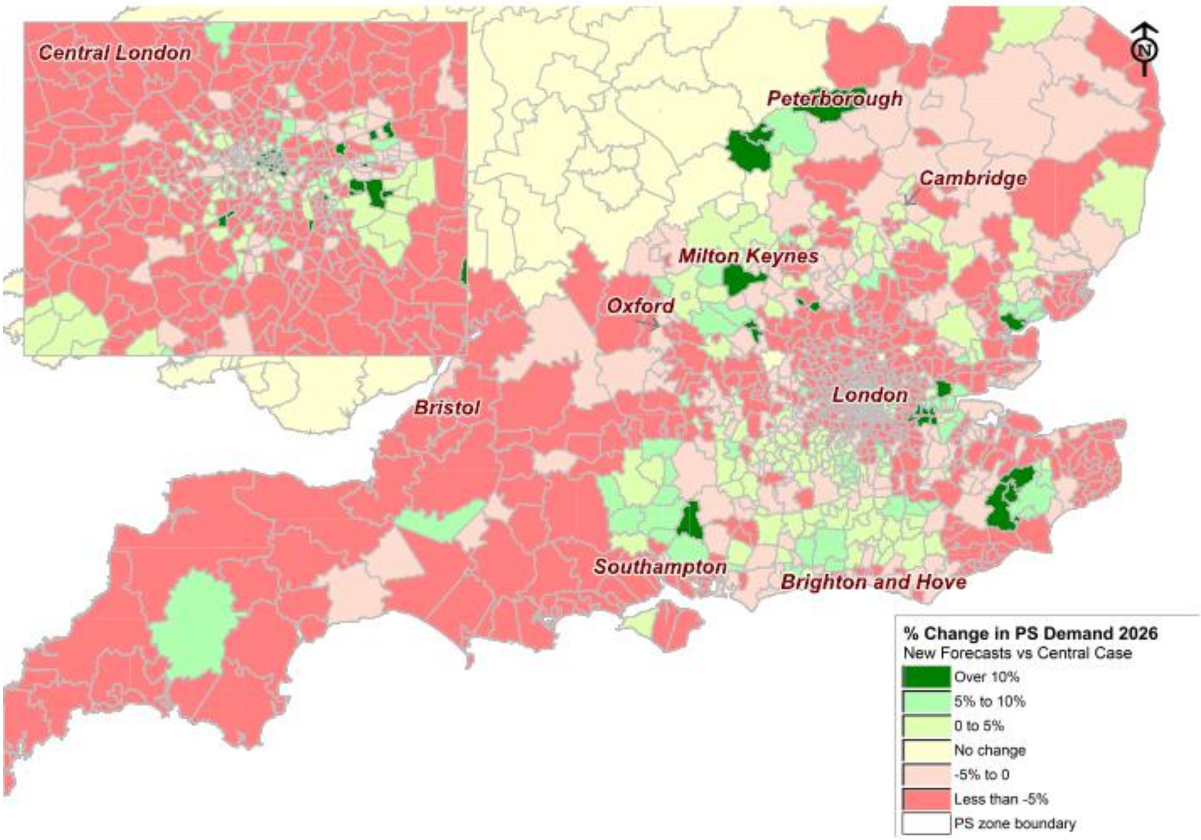


Figure 2-7 PS Absolute Change in Demand in Cap year (new forecast 2040/41 vs PFM4.3 2036/37)

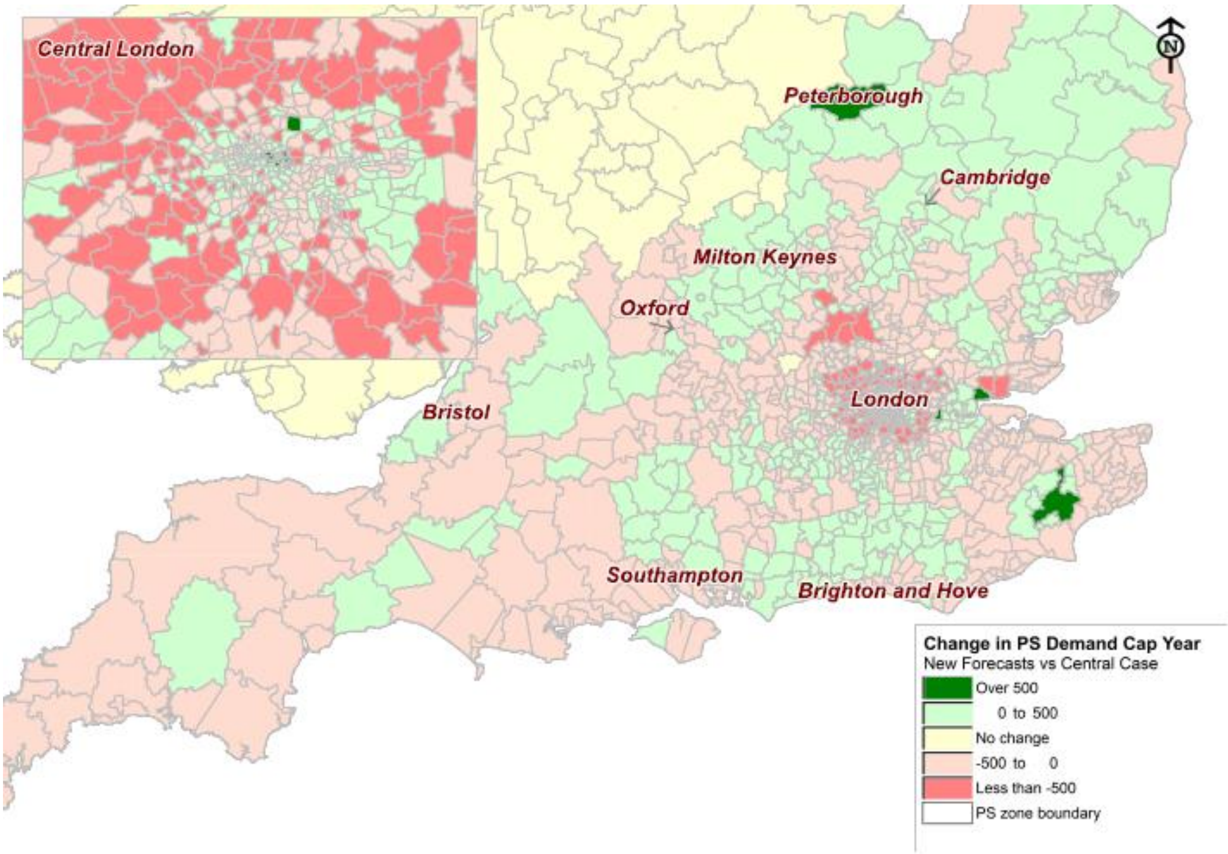


Figure 2-8 PS Percentage Change in Demand in Cap Year (New Forecast vs PFM4.3)

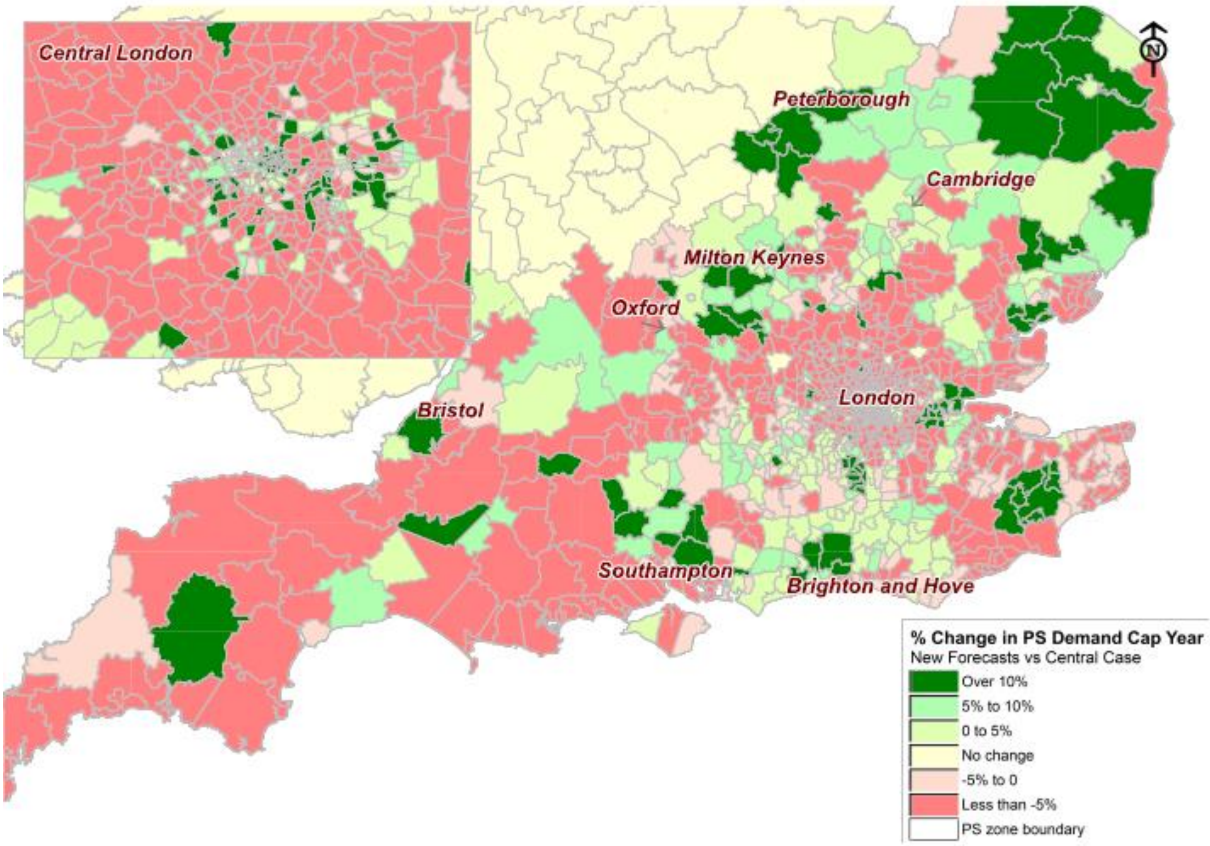


Table 2-18 and Table 2-19 present the largest absolute and relative changes in PS in 2026/27. As many of the PS zones are very small, they have been aggregated to county level for ease of comparison. In 2026/27 all of the largest changes in demand are reductions with Inner and Outer London experiencing a large reduction in demand along with many regions within the commuter belt of London. The majority of the largest percentage changes in demand are from a relatively low level of initial demand with the notable exception of Outer London which decreases by almost 17% in 2026/27.

Table 2-18 Largest Absolute Changes in Demand in PS (2026/27)

County	Total Demand			
	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
Inner London	1,021,566	877,525	-144,041	-14.1%
Outer London	765,761	637,402	-128,360	-16.8%
Essex	87,926	79,067	-8,859	-10.1%
Hertfordshire	52,204	44,111	-8,093	-15.5%
Kent	67,014	61,896	-5,118	-7.6%
Surrey	70,903	67,361	-3,542	-5.0%
Berkshire	36,734	33,340	-3,394	-9.2%
East Sussex	37,721	34,577	-3,143	-8.3%
Hampshire	43,670	40,866	-2,804	-6.4%
Bedfordshire	18,852	16,933	-1,920	-10.2%

Table 2-19 Largest Percentage Changes in Demand in PS (2026/27)

County	Total Demand			
	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
Gloucestershire	178	143	-36	-20.0%
Dorset	8,731	7,057	-1,673	-19.2%
Avon	2,373	1,974	-400	-16.8%
Outer London	765,761	637,402	-128,360	-16.8%
Hertfordshire	52,204	44,111	-8,093	-15.5%
Cornwall	17	14	-3	-15.3%
Devon	2,964	2,541	-424	-14.3%
Inner London	1,021,566	877,525	-144,041	-14.1%
Wiltshire	4,849	4,291	-558	-11.5%
Lincolnshire	125	112	-13	-10.2%

Table 2-20 and Table 2-21 detail the largest absolute and relative changes in demand in PS in the cap year. Again, the PS zones have been aggregated to county level. Similar to 2026/27, many of the largest demand changes are negative and occur in Outer and Inner London along with many London commuter regions. On the other hand, Leicestershire experiences an increase in demand of 38.6% in the cap year.

Table 2-20 Largest Absolute Changes in Demand by PS Zone Origin (Cap Year Weekday Trips)

County	Total Demand			
	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
Outer London	898,814	716,726	-182,088	-20.3%
Inner London	1,217,244	1,036,545	-180,698	-14.8%
Hertfordshire	61,296	49,976	-11,320	-18.5%
Essex	103,306	92,213	-11,093	-10.7%
Kent	78,446	73,300	-5,146	-6.6%
East Sussex	43,678	39,904	-3,774	-8.6%
Surrey	81,331	78,040	-3,291	-4.0%
Berkshire	43,407	40,161	-3,246	-7.5%
Hampshire	50,872	48,307	-2,565	-5.0%
Bedfordshire	22,125	19,955	-2,169	-9.8%

Table 2-21 Largest Percentage Changes in Demand by PS Zone Origin (Cap Year Weekday Trips)

County	Total Demand			
	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
Leicestershire	676	937	261	38.6%
Outer London	898,814	716,726	-182,088	-20.3%
Dorset	10,559	8,425	-2,134	-20.2%
Hertfordshire	61,296	49,976	-11,320	-18.5%
Gloucestershire	230	191	-39	-16.9%
Inner London	1,217,244	1,036,545	-180,698	-14.8%
Cornwall	21	18	-3	-13.7%
Avon	3,044	2,692	-352	-11.6%
Essex	103,306	92,213	-11,093	-10.7%
Bedfordshire	22,125	19,955	-2,169	-9.8%

2.1.3. PLANET Midlands Forecasts

2.1.3.1. Matrix Totals

Table 2-22 and Table 2-23 present the PM rail matrix totals for PFM 4.3 and the new forecasts in 2026/27 and the cap year along with a comparison of forecasts between each trip purpose. When comparing PFM4.3 and the new forecasts, there is a decrease of 14.8% and 11.6% in 2026/27 and the cap year, respectively, with all trip purposes observed to decrease. Similar to PLD, the non-car available trip purposes decrease at a higher rate in the cap year.

Table 2-22 PM Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
2026/27 Business CA	14,208	12,433	-1,775	-12.5%
2026/27 Business NCA	1,828	1,599	-229	-12.5%
2026/27 Leisure CA	12,844	11,115	-1,729	-13.5%
2026/27 Leisure NCA	1,797	1,560	-237	-13.2%
2026/27 Commuting CA	70,130	59,390	-10,740	-15.3%
2026/27 Commuting NCA	11,286	9,362	-1,924	-17.0%
Total 2026/27	**112,093**	**95,459**	**-16,634**	**-14.8%**

Table 2-23 PM Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
CY Business CA	16,780	15,960	-819	-4.9%
CY Business NCA	2,064	1,872	-192	-9.3%
CY Leisure CA	15,236	14,373	-863	-5.7%
CY Leisure NCA	2,022	1,832	-191	-9.4%
CY Commuting CA	83,263	72,485	-10,778	-12.9%
CY Commuting NCA	12,660	10,151	-2,509	-19.8%
Total CY	**132,024**	**116,672**	**-15,352**	**-11.6%**

2.1.3.2. Regional Variation of Growth

Figure 2-9 and Figure 2-10 illustrate the absolute and relative changes in origin zonal demand between PFM 4.3 and the new forecasts in 2026/27. As expected almost all the zones experience a reduction in demand with some zones around Birmingham experiencing reductions in demand of greater than 100 trips per day. Many zones also experience a decrease in trips of greater than 10%. Exceptions include a number of zones in the region of Northamptonshire where demand is forecast to be greater in the new forecasts.

Figure 2-11 and Figure 2-12 present the absolute and percentage changes in origin demand in the cap year. The overall trend is a reduction in demand within the new forecasts. However, a number of zones are observed to increase in demand in the new forecasts, for example zones in the periphery of Birmingham along with a number of zones in Cambridgeshire and Northamptonshire.

Figure 2-9 PM Absolute Change in Demand (2026/27)

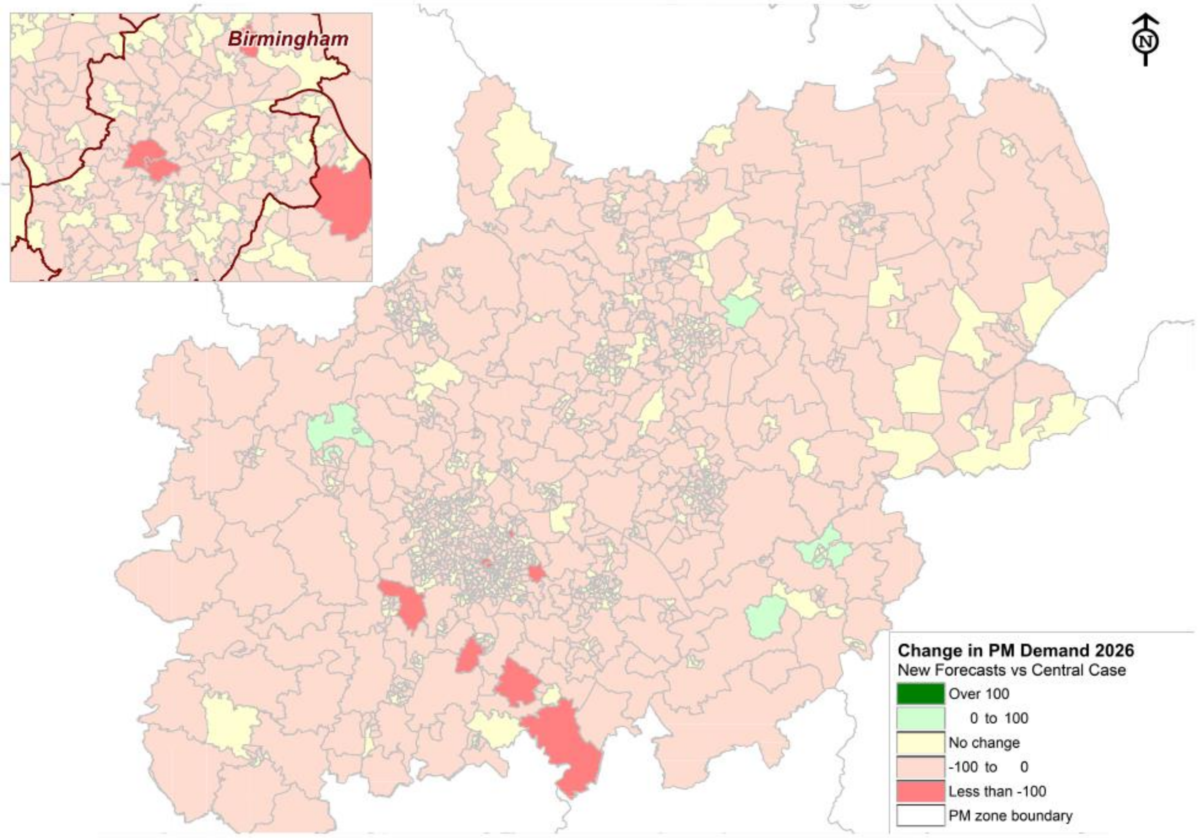


Figure 2-10 PM Percentage Change in Demand (2026/27)

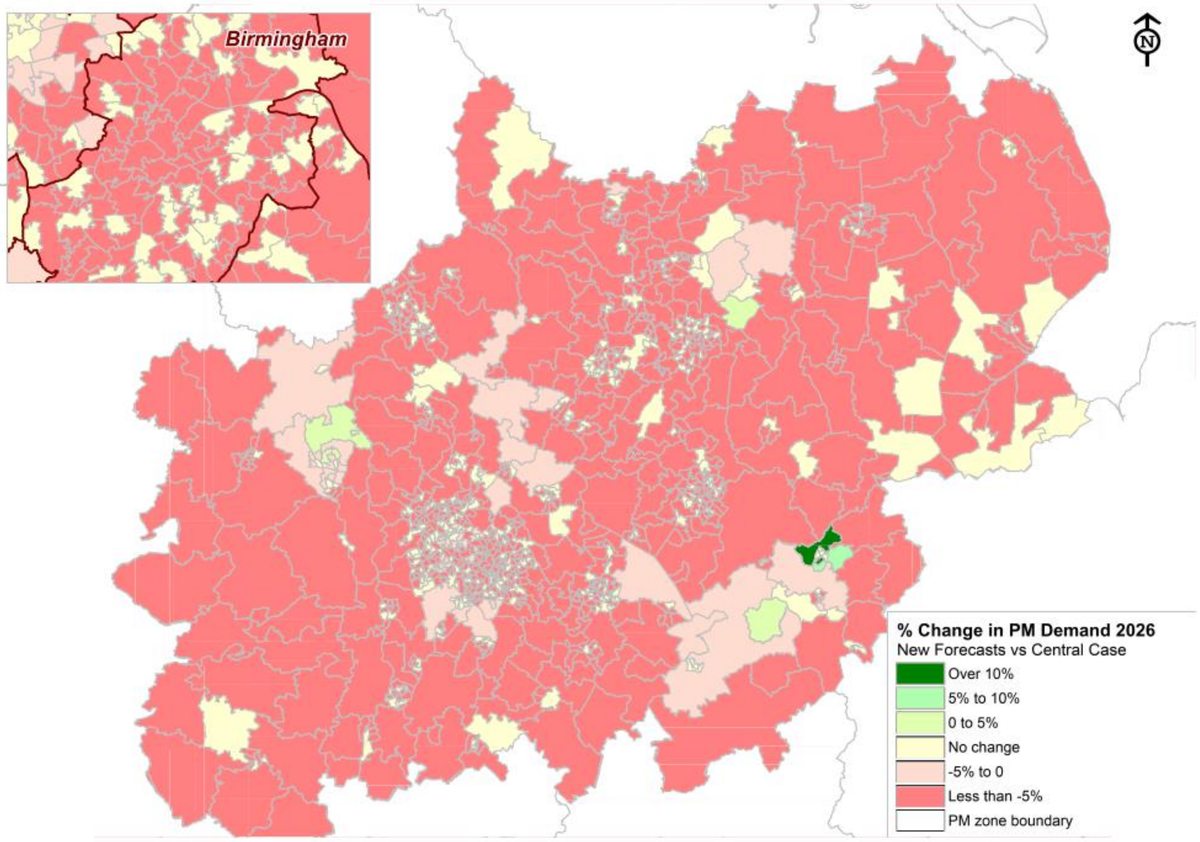


Figure 2-11 PM Absolute Change in Demand in Cap Year (new forecast 2040/41 vs PFM4.3 2036/37)

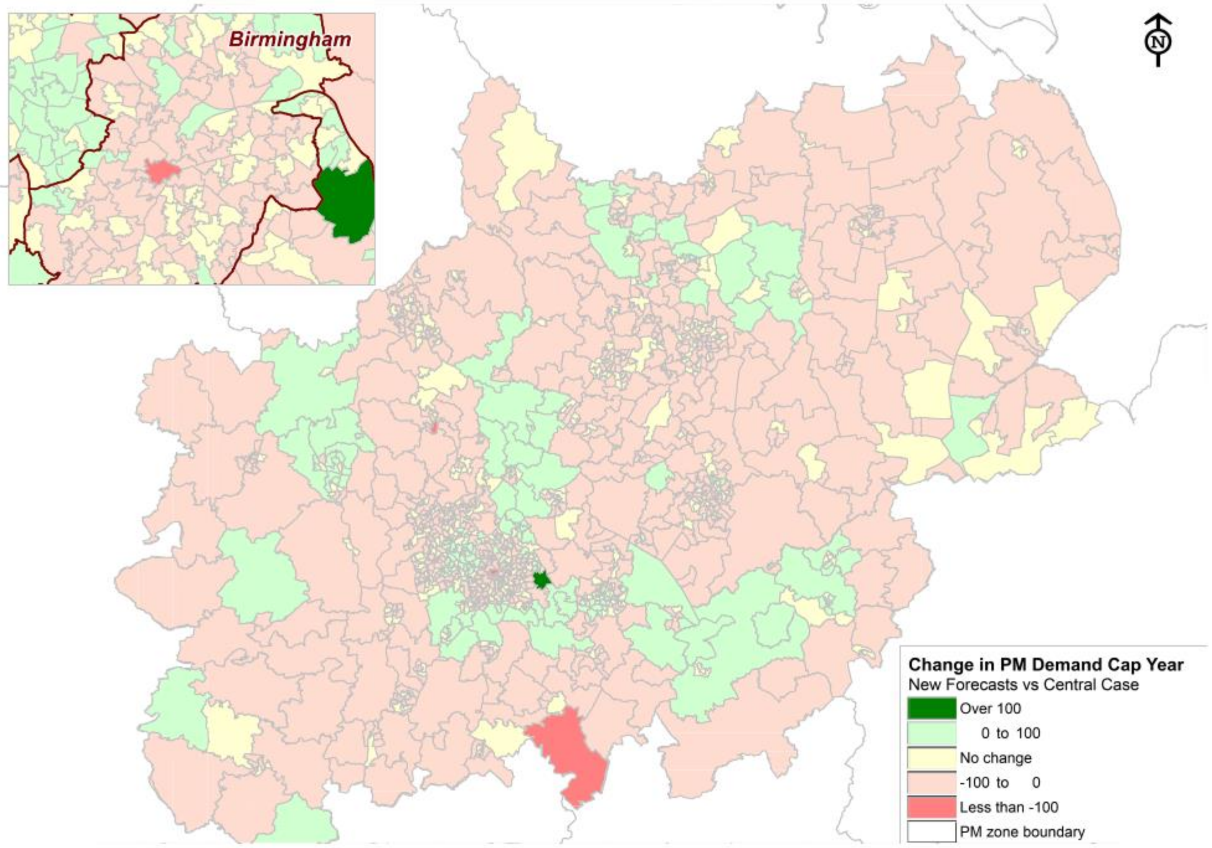


Figure 2-12 PM Percentage Change in Demand in Cap Year (New Forecast vs PFM4.3)

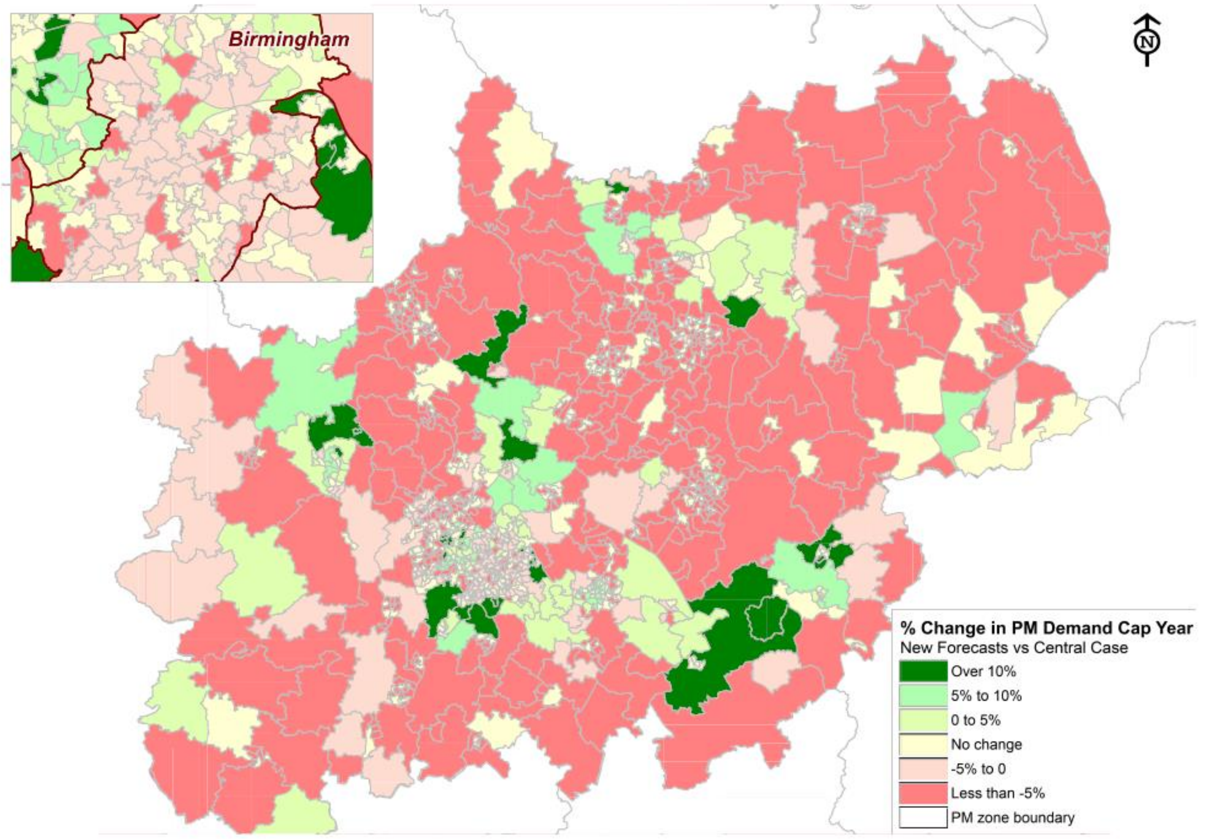


Table 2-24 and Table 2-25 present the largest changes in absolute and relative demand in PM in 2026/27. As the zones in PM are very small they have been aggregated to county level. As expected, all of the largest changes in demand are reductions with some of the largest absolute reductions observed in West Midlands, Staffordshire and Hereford and Worcester.

Table 2-24 Largest Absolute Changes in Demand by PM Zone Origin (2026/27 Weekday Trips)

County	Total Demand			
	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
West Midlands county	48,013	40,971	-7,042	-14.7%
Staffordshire	12,029	10,347	-1,682	-14.0%
Hereford & Worcester	10,456	8,942	-1,514	-14.5%
Warwickshire	7,143	5,912	-1,231	-17.2%
Leicestershire	4,649	3,801	-848	-18.2%
Nottinghamshire	4,697	3,906	-791	-16.8%
Derbyshire	4,238	3,485	-754	-17.8%
Shropshire	4,602	4,062	-540	-11.7%
Lincolnshire	2,368	1,956	-412	-17.4%
Inner London	3,302	2,916	-387	-11.7%

Table 2-25 Largest Percentage Changes in Demand by PM Zone Origin (2026/27 Weekday Trips)

County	Total Demand			
	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
Bedfordshire	170	111	-59	-34.8%
Hertfordshire	194	151	-42	-21.9%
Gloucestershire	507	398	-109	-21.5%
Leicestershire	4,649	3,801	-848	-18.2%
Derbyshire	4,238	3,485	-754	-17.8%
Lincolnshire	2,368	1,956	-412	-17.4%
Warwickshire	7,143	5,912	-1,231	-17.2%
Nottinghamshire	4,697	3,906	-791	-16.8%
Avon	196	163	-33	-16.6%
Essex	23	19	-4	-16.3%

Table 2-26 and Table 2-27 present the largest absolute and relative changes in demand between PFM 4.3 and the new forecasts for the cap year. As in 2026/27, West Midlands County experiences the largest reduction in demand when compared with PFM 4.3. However, its overall relative reduction is quite low at 4.8%. Bedfordshire and Gloucestershire all experience large relative reductions in demand (>15%) albeit from lower levels of initial demand.

Table 2-26 Largest Absolute Changes in Demand by PM Zone Origin (Cap Year Weekday Trips)

County	Total Demand			
	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
West Midlands county	53,440	50,884	-2,557	-4.8%
Staffordshire	13,717	12,704	-1,013	-7.4%
Warwickshire	8,176	7,177	-999	-12.2%
Hereford & Worcester	11,810	10,893	-917	-7.8%
Leicestershire	5,323	4,497	-825	-15.5%
Nottinghamshire	5,383	4,689	-694	-12.9%
Derbyshire	4,892	4,245	-647	-13.2%
Inner London	3,512	3,082	-430	-12.2%
Lincolnshire	2,725	2,311	-414	-15.2%
Shropshire	5,330	4,949	-381	-7.1%

Table 2-27 Largest Percentage Changes in Demand by PM Zone Origin (Cap Year Weekday Trips)

County	Total Demand			
	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
Bedfordshire	189	145	-45	-23.7%
Gloucestershire	602	494	-108	-17.9%
Wiltshire	13	16	2	16.6%
Hertfordshire	231	194	-37	-16.2%
Leicestershire	5,323	4,497	-825	-15.5%
Lincolnshire	2,725	2,311	-414	-15.2%
North Wales	92	79	-13	-14.2%
Derbyshire	4,892	4,245	-647	-13.2%
Nottinghamshire	5,383	4,689	-694	-12.9%
Cumbria	21	18	-3	-12.5%

2.1.4. PLANET North Forecasts

2.1.4.1. Matrix Totals

Table 2-28 and Table 2-29 present the PN matrix totals for PFM 4.3 and the new forecasts in 2026/27 and the cap year. There is a reduction of 13.5% in trips in 2026/27 with reductions observed across all trip purposes. There is a decrease of 9.2% in the cap year with all purposes decreasing with the exception of business car available which increases by 0.2% relative to PFM 4.3.

Table 2-28 PN Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
2026/27 Business CA	32,212	28,866	-3,345	-10.4%
2026/27 Business NCA	5,793	5,166	-627	-10.8%
2026/27 Leisure CA	26,527	23,475	-3,052	-11.5%
2026/27 Leisure NCA	4,915	4,331	-584	-11.9%
2026/27 Commuting CA	98,950	84,169	-14,780	-14.9%
2026/27 Commuting NCA	20,618	17,423	-3,195	-15.5%
Total 2026/27	**189,015**	**163,431**	**-25,584**	**-13.5%**

Table 2-29 PN Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
CY Business CA	39,293	39,355	63	0.2%
CY Business NCA	6,515	6,243	-271	-4.2%
CY Leisure CA	32,633	31,949	-685	-2.1%
CY Leisure NCA	5,576	5,231	-345	-6.2%
CY Commuting CA	117,931	102,428	-15,504	-13.1%
CY Commuting NCA	22,856	19,016	-3,840	-16.8%
Total CY	**224,804**	**204,222**	**-20,582**	**-9.2%**

2.1.4.1.1. Regional Variation of Growth

Figure 2-13 and Figure 2-14 illustrate the regional variation in PN origin demand between PFM 4.3 and the new forecasts in 2026/27. All zones experience a decrease in demand with some zones experiencing a reduction in demand of greater than 100 trips per day. Most of the zones experiencing the largest reductions in demand are outside the core cities. The vast majority of zones also experience a reduction of greater than 5% in demand in 2026/27 relative to PFM 4.3.

Figure 2-15 and Figure 2-16 detail the absolute and relative changes in PN origin demand between PFM 4.3 and the new forecasts for the cap year. Many of the zones which experience large reductions in demand in 2026/27 continue to do so in the cap year; however some zones now increase in demand relative to PFM 4.3. Most notably are a number of zones around Leeds which increase by over 100 trips per day in the new forecasts.

Figure 2-13 PN Absolute Change in Demand in 2026/27

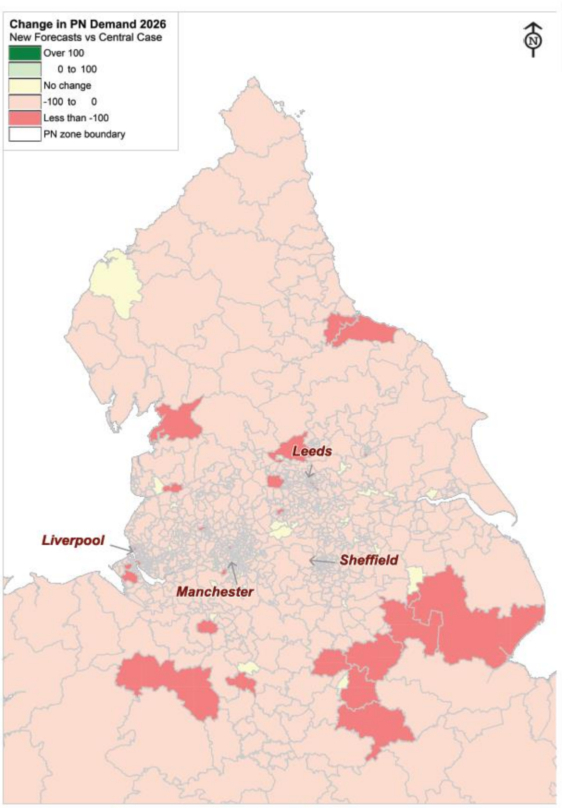


Figure 2-14 PN Percentage Change in Demand in 2026/27

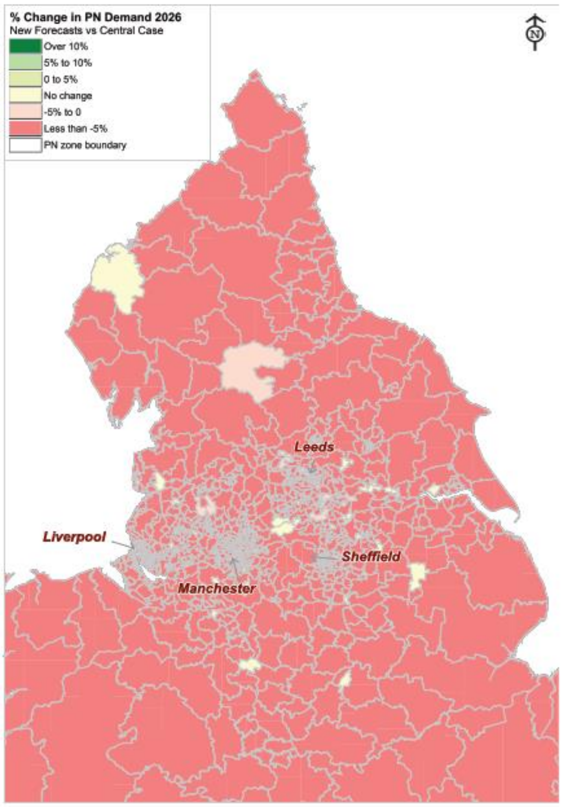


Figure 2-15 PN Absolute Change in Demand in Cap Year (New Forecast 2040/41 vs PFM4.3 2036/37)

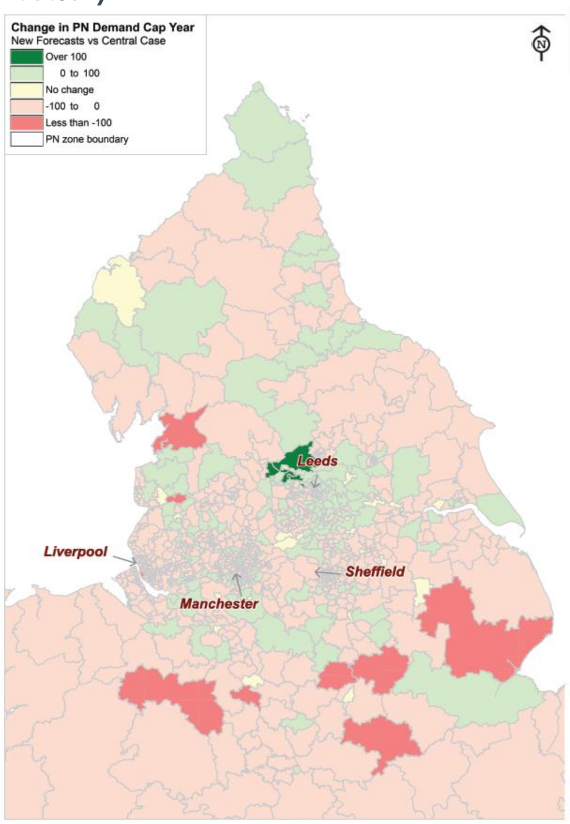


Figure 2-16 PN Percentage Change in Demand in Cap Year (New Forecast 2040/41 vs PFM4.3 2036/37)

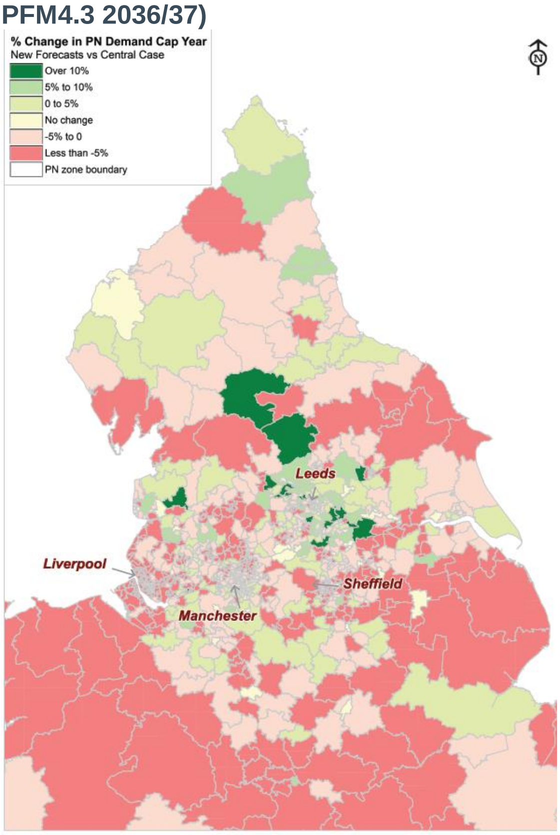


Table 2-30 and Table 2-31 present the largest absolute and relative differences in PN demand between PFM 4.3 and the new forecasts in 2026/27. As in PS and PM, zones have been aggregated to county level for a more meaningful comparison. The highest absolute changes are observed in Leeds, Lancashire and Liverpool which all experience reductions in greater than 1000 trips per day between the two forecasts. All of the largest relative reductions in demand are from low initial levels of demand.

Table 2-30 Largest Absolute Changes in Demand by PN Zone Origin (2026/27 Weekday Trips)

County	Total Demand			
	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
Leeds District	18,036	15,953	-2,083	-11.5%
Lancashire County	11,056	9,499	-1,558	-14.1%
Liverpool District	8,815	7,505	-1,310	-14.9%
Bradford District	9,973	8,763	-1,210	-12.1%
Wirral District	7,036	5,872	-1,164	-16.5%
Manchester District	8,236	7,158	-1,078	-13.1%
Sefton District	5,655	4,655	-1,000	-17.7%
Cheshire County	7,350	6,356	-994	-13.5%
North Yorkshire County	7,482	6,521	-960	-12.8%
Derbyshire County	5,782	4,877	-905	-15.6%

Table 2-31 Largest Percentage Changes in Demand by PN Zone Origin (2026/27 Weekday Trips)

County	Total Demand			
	PFM v4.3 (2026/27)	New Forecasts (2026/27)	Difference	%
Luton	43	23	-20	-47.6%
Medway	1	0	0	-28.9%
Northamptonshire County	109	84	-25	-22.6%
Warwickshire County	16	12	-4	-22.6%
Kent County	364	283	-81	-22.3%
Bedfordshire County	107	83	-24	-22.2%
Hertfordshire County	260	207	-53	-20.3%
West Berkshire	42	34	-8	-19.8%
Wokingham	41	33	-8	-19.7%
Milton Keynes	49	40	-9	-18.7%

Table 2-32 and Table 2-33 present the largest absolute and relative changes in PN demand in the cap year. Again Lancashire County experiences a large reduction in demand. Greater London Authority experiences a 17.5% increase in demand in the cap year; however flows between London and northern regions will likely be masked out at a later stage.

Table 2-32 Largest Absolute Changes in Demand by PN Zone Origin (Cap Year Weekday Trips)

County	Total Demand			
	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
Lancashire County	13,005	11,638	-1,367	-10.5%
Liverpool District	9,876	8,818	-1,058	-10.7%
Leeds District	22,193	21,162	-1,031	-4.6%
Wirral District	7,785	6,758	-1,027	-13.2%
Greater London Authority	5,767	6,778	1,011	17.5%
Manchester District	10,477	9,489	-988	-9.4%
Sefton District	6,176	5,209	-966	-15.6%
Derbyshire County	6,977	6,143	-834	-11.9%
Cheshire County	8,724	7,929	-795	-9.1%
North Yorkshire County	9,119	8,367	-752	-8.2%

Table 2-33 Largest Percentage Changes in Demand by PN Zone Origin (Cap Year Weekday Trips)

County	Total Demand			
	PFM v4.3 (2036/37)	New Forecasts (2040/41)	Difference	%
Luton	45	28	-16	-36.3%
Medway	1	1	0	-35.7%
Northamptonshire County	141	103	-38	-26.9%
Kent County	470	352	-118	-25.1%
Blaenau Gwent	1	1	0	-24.6%
West Berkshire	53	41	-12	-22.7%
Warwickshire County	19	15	-4	-22.4%
Bedfordshire County	139	108	-31	-22.2%
Wokingham	54	42	-11	-21.2%
Hertfordshire County	326	260	-66	-20.2%

2.2. Highway Demand Forecasts

This section details the methodology used to forecast the highway demand matrices for the future years of 2026/27 and 2040/41, for the PLANET Long Distance Model (PLD), as well as to calculate the preloads on the network, which represent short-distance traffic not represented in the PLD matrices.

The PLD highway model covers Great Britain. Its base year is 2010/11 and the highway person demand represents an average weekday for three trip purposes: commuting, business and leisure. The demand is in Origin Destination (OD) format and used in the PLD demand model. For the PLD highway assignment the matrices are converted into hourly demand and adjusted by car occupancy, so as to convert person trips into car trips for assignment.

The methodology applied to this process is consistent with that followed in PFMv4.3.

2.2.1. Demand Matrices

This section describes the methodology carried out to forecast the highway demand matrices for 2026/27 and 2040/41, derived from the base year matrices.

2.2.1.1. Base year

The forecast year highway demand matrices were developed from the PFMv4.3 2010/11 base year matrices. Whilst the PFM model uses OD matrices the forecasting process is undertaken with Production Attraction (PA) matrices with are disaggregated by home and non-home based trip purposes. These purposes are compatible with the purposes presented in DfT’s TEMPRO program:

- Home-based work (HBW) daily person PA matrix;
- Home-based employers’ business (HBEB) daily person PA matrix;
- Home-based other (HBO) daily person PA matrix;
- Non-home-based work (NHBW) daily person PA matrix;
- Non-home -based employers’ business (NHBEB) daily person PA matrix;
- Non-home -based other (NHBO) daily person PA matrix

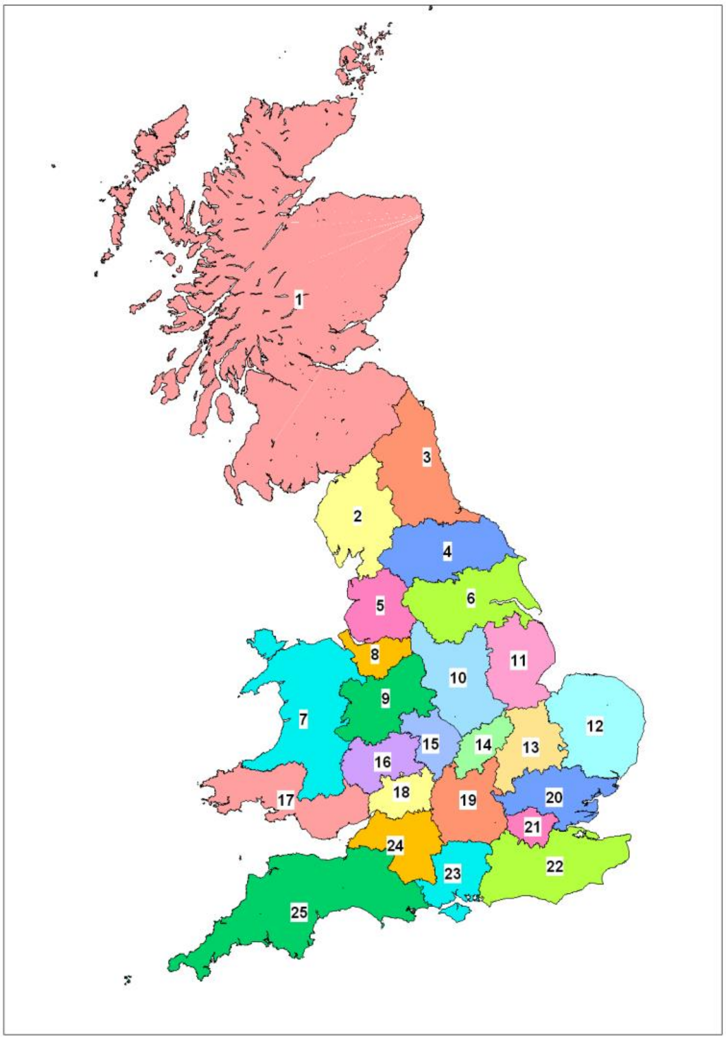
The base year matrices were amended to transfer the highway demand from the Heathrow zones (zone 90) to the West London zone (123). This process is common to highway and rail demand and ensures there is no double counting of demand between the PLD assignment and the Heathrow Access Model (HAM), which already assigns rail and highway demand to/from Heathrow Airport separately. This had previously been undertaken on the forecast highway matrices.

2.2.1.2. Derivation of Furness targets from TEMPRO

The DfT’s TEMPRO program was used to derive factors which were applied to adjust the 2010/11 PA base highway demand matrices to the future years, using the furness matrix balancing process in EMME.

The most up to date version of the TEMPRO dataset (version 6.2) was used to export the trip ends for 2010, 2026 and 2040, for all car passenger and driver trip purposes, for an average weekday. These data were then aggregated from local authority zones to PLD zones and to the twenty five zone sector system which can be seen in Figure 2-17.

Figure 2-17 Twenty Five Sector System for Highway Forecasts



The forecast year aggregated totals were divided by the base year totals to calculate a set of eight (four purposes by Production and Attraction) row and column factors to apply to the base year PA matrix. The non-home based (NHB) factors were used for all disaggregated non-home based matrices (NHBW, NHBEB and NHBO):

- Home-based work (HBW);
- Home-based employers' business (HBEB);
- Home-based other (HBO); and
- Non-home-based (NHB).

Furness targets were obtained by applying the 2010/11 Future Year row and column PA factors to the 2010/11 PA base matrices. The furness calculations were then implemented scaling to origin totals and this step produced PA matrices for the six purposes (HBW, HBEB, HBO, NHBW, NHBEB and NHBW) for each future year.

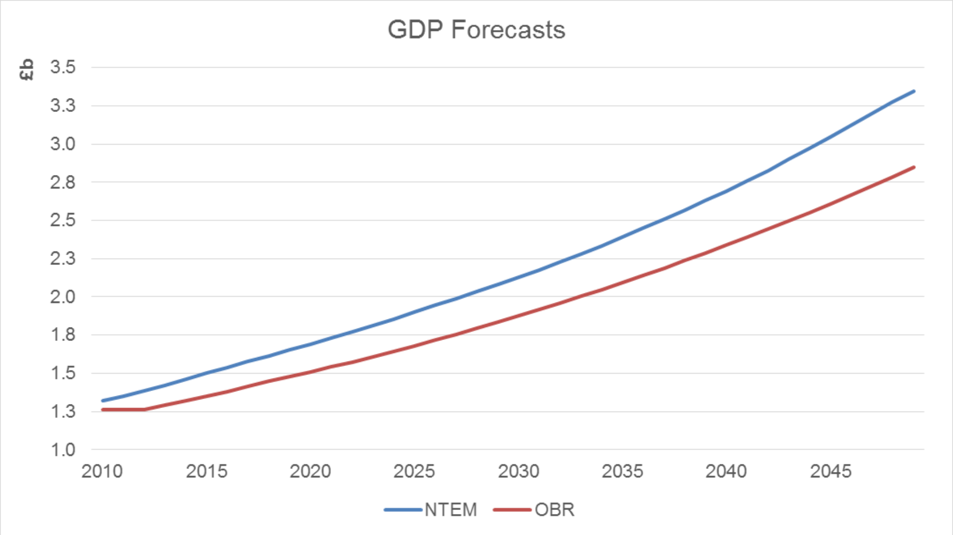
The trips growth forecasted in TEMPRO for the 25 sector system are provided in the Appendix B.1.

2.2.1.3. GDP correction factors calculation

The GDP growth assumptions used in the development of the TEMPROv6.2 forecasts (April 2011) differs from the OBR GDP growth forecasts for March and July 2014 (supplied by the DfT) to be used in the forecasting of rail demand. Therefore, to ensure consistency a correction factor for each trip purpose was applied to the forecast OD matrices. This factor is calculated based on a GDP elasticity, which is a function of demand.

GDP was firstly calculated at an NTEM level and then aggregated at a national level, which was required to calculate the GDP correction factors between the NTEM and OBR forecasts. Figure 2-18 provides the GDP forecasts from NTEM 6.2 and the OBR, to illustrate the differences between both sources.

Figure 2-18 GDP forecast from NTEM 6.2 and OBR



To be consistent with the approach adopted for the development of the PFMv4.3 forecasts the elasticities to be applied to the GDP growth were taken from the report "PLANET Long Distance and Long Distance Model Comparison"[4]. In that report two different sets of highway demand forecasts are presented by a high and standard GDP estimate, using a constant number of households. Table 2-34 shows the demand elasticities with respect to GDP.

Table 2-34 Relative changes in GDP for Standard and High forecasts (constant household)

	GDP growth 2008-2021	
	Standard	High
GDP/household	1.115292046	1.22435421

From these sets of GDP, two sets of highway demand forecast were produced, as shown in Table 2-35 and from these totals the implied arc elasticities were calculated, which are provided in Table 2-36. These elasticities were then applied to the relative growth in GDP which is shown in Table 2-37.

Table 2-35 Daily highway demand totals using standard and high GDP forecasts

	Commuting		Work		Other	
Year	Standard	High	Standard	High	Standard	High
2008	1,335,255	1,335,255	1,344,206	1,344,206	2,108,049	2,108,049
2021	1,436,212	1,447,924	1,461,750	1,482,470	2,335,384	2,367,637

Table 2-36 Implied elasticity of highway demand to GDP

Purpose	Commuting	Work	Other
Implied Elasticity	0.087	0.151	0.147

[4] PLANET Long Distance and Long Distance Model Comparison, Phase Zero Report, High Speed Two Ltd., March 2012

Table 2-37 GDP forecasts from NTEM 6.2 and OBR, with 2010 rebased to 100

Year	NTEM 6.2	OBR
2010	100.00	100.00
2026	147.48	136.05
2040	203.93	185.23

The factors shown in Table 2-38 were calculated from these values and applied globally to the forecast PA matrices to adjust for the differences in GDP. The correspondence used to map these purposes to the six purposes in the model was as follows:

- HBW = Commute
- HBEB = Work
- HBO = Other
- NHBW = Other
- NHBEB = Work
- NHBO = Other

Table 2-38 Global factors to correct for change in GDP forecasts

Year	Commute	Work	Other
2026/27	0.993002	0.987903	0.988210
2040/41	0.991662	0.985595	0.985960

2.2.1.4. OD matrices

The OD matrices were created using PA to OD factors which were consistent with those used in the development of the PFMv4.3 matrices. The OD to PA factors were input to the process at the 25 sector level and mapped to PLD zones. The associated PA to OD factor was then created by calculating the reciprocals and applying these to the home based purposes to convert them into an OD format. As non-home-based matrices PA are identical to OD matrices only home-based purposes were converted.

2.2.1.5. Future year matrices

The future year OD matrices by purpose were created through the aggregation of the six OD purposes as shown below:

- Commuting = HBW
- Business = HBEB + NHBEB
- Leisure = HBO + NHBO + NHBW

2.2.1.6. Regional total analysis and matrix checks

A set of checks are performed to ensure that the expected totals are reflected in the output matrices. The first stage was to verify that the output matrix totals for the six future year furnessed matrices are equal to the origin totals for the furness targets. This is accompanied by an overall sense check that the overall growth level is representative of the purpose and year.

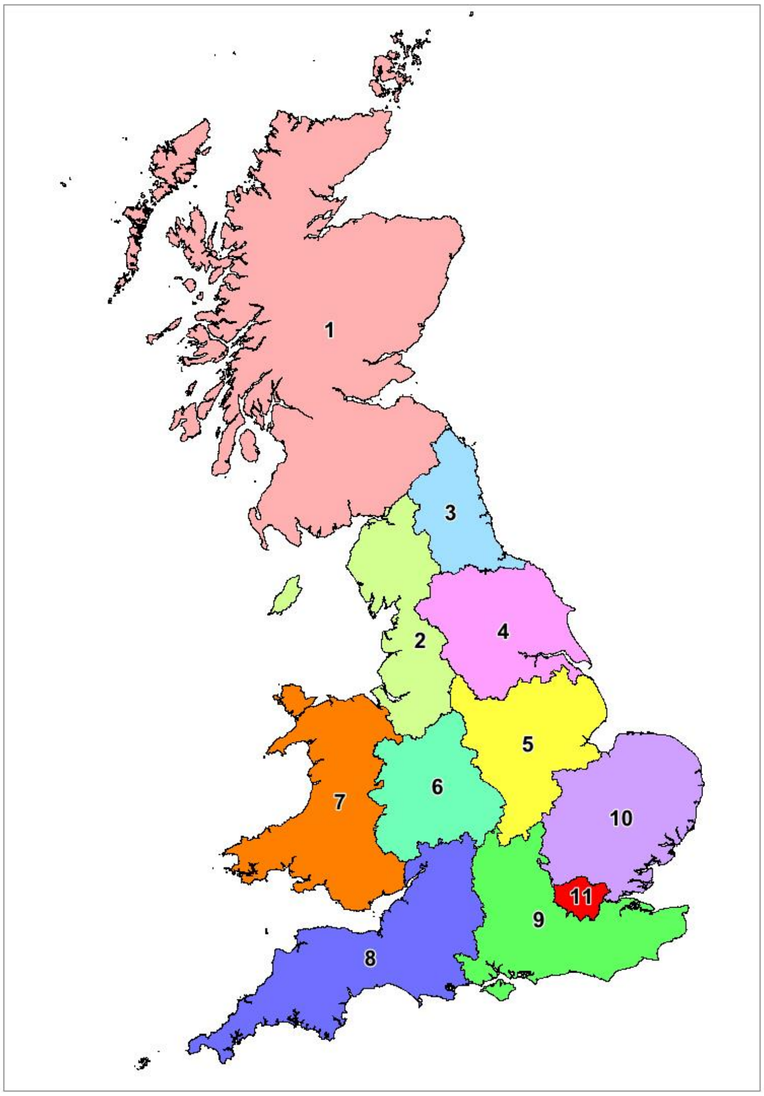
The second stage is to ensure that the conversion from the six OD home and non-home-based purposes to commuting, business and leisure preserved the matrix totals of the base and future year. When this check was completed successfully, the matrix outputs were aggregated to an 11x11 matrix representing Government Office Regions to understand the regional variation in the matrices.

Table 2-39 presents the correspondence between 25 zones and 11 zones systems and Figure 2-19 shows the Government Office Regions.

Table 2-39 Twenty five sector to eleven sector correspondence

25 Sector No.	25 Sector Name	11 Sector No.	11 Sector Name
1	Scotland	1	Scotland
2	Carlisle, Cumbria and Lancaster	2	North West
3	Newcastle, Northumberland and County Durham	3	North East
4	North Yorkshire	4	Yorks & Humber
5	Lancashire, Liverpool and Manchester	2	North West
6	Leeds, Sheffield and York	4	Yorks & Humber
7	North Wales	7	Wales
8	Chester, Crewe and Macclesfield	2	North West
9	Shropshire and Staffordshire	6	West Midlands
10	Derbyshire, Leicestershire and Nottinghamshire	5	East Midlands
11	Lincolnshire	5	East Midlands
12	Norfolk and Suffolk	10	East of England
13	Bedfordshire and Cambridgeshire	10	East of England
14	Northamptonshire	5	East Midlands
15	Birmingham, Rugby and Warwickshire	6	West Midlands
16	Herefordshire and Worcestershire	6	West Midlands
17	South Wales	7	Wales
18	Cheltenham, Gloucester and Tewkesbury	8	South West
19	Berkshire, Buckinghamshire and Oxfordshire	9	South East
20	Essex and Hertfordshire	10	East of England
21	London	11	London
22	Kent, Sussex and Surrey	9	South East
23	Hampshire and Isle of Wight	9	South East
24	Bath, Bristol and Wiltshire	8	South West
25	Cornwall, Devon, Dorset and Somerset	8	South West

Figure 2-19 Government Office Regions



The final output matrices by trip purpose for 2026/27 and 2040/41, aggregated into Government Office Regions, are provided in the Appendix B.2.

2.2.1.7. Masking matrix process

The PFM control matrix was applied to the final forecast matrices for input to PLD. This control matrix was the same as that used in the rail forecasting. Table 2-40 and Table 2-41 show the difference in matrix totals between the full and masked 2026/27 and 2040/41 forecast highway matrices.

Table 2-40 2026/27 highway demand full and masked matrix totals by trip purpose (daily person trips)

	2026/27 Full Matrices	2026/27 Masked Matrices	Difference (Full-Masked)
Commuting	357,423	155,666	201,757
Business	561,739	320,204	241,535
Leisure	1,641,682	884,996	756,686
Total	2,560,844	1,360,866	1,199,978

Table 2-41 Cap year highway demand full and masked matrix totals by trip purpose (daily person trips)

	2040/41 Full Matrices	2040/41 Masked Matrices	Difference (Full-Masked)
Commuting	375,843	164,137	211,706
Business	600,099	343,452	256,647
Leisure	1,784,145	957,464	826,681
Total	2,760,087	1,465,053	1,295,034

2.2.1.8. Comparison with PFMv4.3

The matrices in PFMv4.3 had a masking applied that differs from the control matrix used in the development of the revised forecasts which means that a direct comparison of the matrices input to PLD would be misleading. Therefore, for comparison purposes the PFMv4.3 masking was applied to the revised forecast matrices.

Table 2-42 and Table 2-43 provide a comparison between PFMv4.3 demand and the revised forecasts by trip purpose for 2026/27 and the cap year (2036/37 for PFMv4.3 and 2040/41 for the revised forecasts).

Table 2-42 2026/27 Highway Demand Matrix Totals by trip purpose (daily person trips)

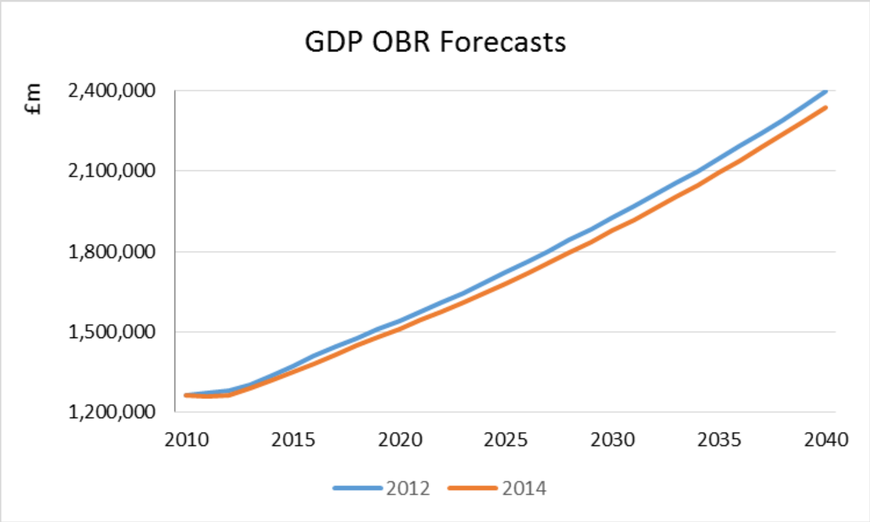
	2026/27 PFMv4.3	2026/27 Revised	Difference	Difference (%)
Commuting	186,593	186,220	-373	-0.2%
Business	360,285	359,039	-1,246	-0.3%
Leisure	1,041,155	1,037,646	-3,509	-0.3%
Total	1,588,033	1,582,905	-5,128	-0.3%

Table 2-43 Cap Year Highway Demand Matrix Totals by trip purpose (daily person trips)

	2036/37 PFMv4.3	2040/41 Revised	Difference	Difference (%)
Commuting	193,432	196,762	3,330	1.7%
Business	377,734	385,569	7,836	2.1%
Leisure	1,097,279	1,117,992	20,713	1.9%
Total	1,668,445	1,700,323	31,878	1.9%

As shown in Table 2-42 the 2026/27 forecast highway demand is slightly lower than to the PFMv4.3 demand. This is due to the fact that the revised GDP forecasts show a lower growth rate as shown in Figure 2-20.

Figure 2-20 GDP OBR forecasts – PFMv4.3 (2012) and Revised Forecasts (2014)



The cap year forecasts are higher in the revised forecasts than in PFMv4.3 as shown in Table 2-43. This fact is due to the difference of four years in the cap year – 2036/37 for PFMv4.3 and 2040/41 for the revised forecasts.

In order to analyse the regional variation between PFMv4.3 and the revised forecasts the matrices were aggregated to Government Office Regions. Table 2-44 shows the absolute differences between the 2026/27 revised forecasts and the PFMv4.3, whilst Table 2-45 shows the percentage differences.

Table 2-44 Comparison of Revised Forecasts and PFMv4.3 Highway Matrices (2026/27 Weekday Trips) – Absolute Differences

East Midlands (EM)	EM									
East of England (EE)	-94	EE								
London (LN)	-25		LN							
North East (NE)	-12	-5	-5	NE						
North West (NW)	-68	-19	-11	-46	NW					
Scotland (SC)	-9	-3	-3	-38	-30	SC				
South East (SE)	-63			-6	-21	-5	SE			
South West (SW)	-10	-5	-7	-2	-18	-4	-17	SW		
Wales (WA)	-18	-17	-25	-4	-64	-6	-15	-79	WA	
West Midlands (WM)	-95	-41	-44	-6	-97	-12	-84	-79	-82	WM
Yorks & Humber (YH)	-105	-23	-13	-67	-137	-22	-27	-9	-14	-31

Table 2-45 Comparison of Revised Forecasts and PFMv4.3 Highway Matrices (2026/27 Weekday Trips) – Percentage Differences

East Midlands (EM)	EM									
East of England (EE)	-0.31%	EE								
London (LN)	-0.33%		LN							
North East (NE)	-0.33%	-0.34%	-0.34%	NE						
North West (NW)	-0.32%	-0.34%	-0.34%	-0.33%	NW					
Scotland (SC)	-0.33%	-0.34%	-0.34%	-0.33%	-0.33%	SC				
South East (SE)	-0.33%			-0.34%	-0.34%	-0.34%	SE			
South West (SW)	-0.33%	-0.32%	-0.31%	-0.34%	-0.34%	-0.34%	-0.32%	SW		
Wales (WA)	-0.33%	-0.33%	-0.33%	-0.34%	-0.33%	-0.34%	-0.33%	-0.33%	WA	
West Midlands (WM)	-0.30%	-0.31%	-0.33%	-0.34%	-0.32%	-0.33%	-0.32%	-0.33%	-0.33%	WM
Yorks & Humber (YH)	-0.32%	-0.33%	-0.33%	-0.33%	-0.32%	-0.33%	-0.33%	-0.34%	-0.34%	-0.33%

Whilst there is a reduction in trips, the corresponding percentage changes for these movements is very small (approximately 0.3%). The largest decrease in absolute values is for movements between Yorkshire and Humberside and the North West and the East Midlands, as well as between East of England and East Midlands.

A comparison was also made for the cap year matrices with Table 2-46 showing the absolute differences between the 2040/41 revised forecasts and the 2036/37 PFMv4.3 highway matrices whilst Table 2-47 shows the percentage differences.

As would be expected there is an increase in trips with the 2040/41 demand which is typically around 2%. The largest percentage changes are Yorkshire and Humberside – East of England and London whilst the smallest percentage increase is between the South West and South East.

Table 2-46 Comparison of Revised Forecasts and PFMv4.3 Highway Matrices for the cap year (2040/41/2036/37) – Absolute Differences

East Midlands (EM)	EM									
East of England (EE)	632	EE								
London (LN)	205		LN							
North East (NE)	64	41	38	NE						
North West (NW)	310	137	71	223	NW					
Scotland (SC)	46	24	18	171	107	SC				
South East (SE)	387			35	88	14	SE			
South West (SW)	66	29	23	12	98	16	46	SW		
Wales (WA)	148	158	233	23	233	17	102	571	WA	
West Midlands (WM)	587	368	343	29	478	55	571	557	572	WM
Yorks & Humber (YH)	878	255	136	480	938	129	220	85	122	285

Table 2-47 Comparison of Revised Forecasts and PFMv4.3 Highway Matrices for the cap year (2040/41/2036/37) – Percentage Differences

East Midlands (EM)	EM									
East of England (EE)	2.0%	EE								
London (LN)	2.5%		LN							
North East (NE)	1.8%	2.7%	2.5%	NE						
North West (NW)	1.4%	2.3%	2.1%	1.6%	NW					
Scotland (SC)	1.6%	2.2%	1.9%	1.5%	1.2%	SC				
South East (SE)	1.9%			1.8%	1.4%	1.0%	SE			
South West (SW)	2.0%	1.8%	1.1%	2.2%	1.7%	1.4%	0.9%	SW		
Wales (WA)	2.5%	2.9%	2.9%	1.7%	1.2%	1.0%	2.2%	2.2%	WA	
West Midlands (WM)	1.8%	2.6%	2.4%	1.6%	1.5%	1.5%	2.1%	2.2%	2.2%	WM
Yorks & Humber (YH)	2.5%	3.4%	3.2%	2.2%	2.1%	1.8%	2.5%	2.8%	2.7%	2.8%

2.2.2. Preload Flows

In PFM short-distance trips and goods vehicles are represented as pre-loaded flows on the network as it is assumed that these trips will not transfer onto the strategic rail network. This ensures that the total modelled link flows in the PLD highway model leads to realistic travel costs for use in the demand model. This section describes the methodology carried out to calculate the preloads for the base year and the derivation of future year preloads.

2.2.2.1. Base year preloads

Base year preloads are calculated using a standalone databank which includes the new PLD highway matrices and PFMv4.3 networks, volume-delay functions and observed traffic counts. The preloads are calculated by subtracting the total assigned volumes for the link from the count value so that the preload represents the remaining volume on the link.

For the revised forecasts the base year preloads were calculated using masked PLD highway matrices. This differs from the approach adopted for PFMv4.3 which used full matrices with no masking applied.

2.2.2.2. Factoring 2010/11 preloads to future years

The methodology to calculate the future year preloads is consistent with that followed for PFMv4.3 which used the Department for Transport's National Transport Model (NTM) traffic forecast component of the Road Transport Forecasts 2011 (RTF11)[5]. The key input assumptions to RTF11 are the following:

- Population and employment data – based on NTEM 5.4;
- GDP Forecasts – 2011-2015 from OBR projections post-Budget 2011, and post 2015 growth from OBR's July 2011 Fiscal Sustainability Report; and
- Fuel Prices – based on DECC's October 2011 fossil fuel price projections.

NTM forecasts traffic levels by region and road type using the DfT's Fitting On of Regional Growth and Elasticities (FORGE) mechanism. FORGE is not a traditional assignment model, as it uses observed data on the level of traffic using each link of the road network from its 2003 base year and then applies elasticities derived from the demand model to forecast future levels of traffic.

The flows for 2010, 2026 and 2040 were derived from Table 4.3 of Road Transport Forecasts 2011 through interpolation, and the tables is shown below in Table 2-48.

Table 2-48 Traffic by Vehicle type and Road type, England

Bn Vehicle Miles	Year	Motorway	Trunk	Principal	Other Roads	All Roads
Cars	2010	39.0	24.2	67.8	77.6	208.6
	2035	55.6	33.9	91.6	104.7	285.8
	Growth	42.6%	40.1%	35.1%	34.9%	37.0%
LGV	2010	6.7	4.1	10.9	14.2	35.9
	2035	12.6	7.7	20.4	26.7	67.3
	Growth	88.1%	87.8%	87.2%	88.0%	87.5%
HGV	2010	6.0	2.8	3.5	1.8	14.1
	2035	8.7	4.0	4.9	2.5	20.1
	Growth	45.0%	42.9%	40.0%	38.9%	42.6%
Bus & Coach	2010	0.2	0.2	0.9	1.4	2.7
	2035	0.2	0.1	0.8	1.3	2.4
	Growth	0.0%	-50.0%	-11.1%	-7.1%	-11.1%
All Traffic	2010	51.9	31.3	83.1	94.9	261.2
	2035	77.1	45.7	117.7	135.1	375.6
	Growth	48.6%	46.0%	41.6%	42.4%	43.8%

Source: Table 4.3 NTM 2011

The link preloads were uplifted using the following assumptions:

- As the projections from the National Transport Model have a broad order of magnitude they possess a significant range of uncertainty. As this uncertainty is likely to be greater for more disaggregate results, a single factor was calculated to be applied globally to all regions;
- The values calculated apply to England only; it is assumed that Wales and Scotland have the same growth factors;
- As the assignment matrices are car only, the car growth factor was used. It should be noted that the preload flow includes both light goods vehicles (LGV) and heavy goods vehicles (HGV), though the proportion of these vehicle types cannot be determined from the observed count data; and

[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4243/road-transport-forecasts-2011-results.pdf

- As the nature of the network modelled is predominantly major roads, the only road types to be considered in the calculation of the growth factors are Motorway, Trunk and Principal.

Table 2-49 provides the factors applied into the model to derive the future year preloads from the base year:

Table 2-49 Factors to derive future year preloads from the base year

Year	Factor
2026/27	1.24476
2040/41	1.45893

2.2.2.3. Comparison with PFMv4.3

There were a number of differences in the inputs used in the revised forecasts compared with those for PFMv4.3. Firstly, different base year highway demand matrices were used with PFMv4.3 using the full PLD highway matrices whilst the revised forecasts using masked PLD highway matrices. Table 2-50 shows the difference in matrix totals for the two sets of matrices.

Table 2-50 Base year full and masked highway demand matrices (daily person trips)

	Masked base year demand	Full base year demand
Commuting	173,403	330,061
Business	328,964	512,201
Leisure	923,376	1,447,158

Furthermore, the 2010/11 demand matrices used in the revised forecasts had been adjusted to transfer demand from the Heathrow zone to the West London Zone.

Additionally, there are small differences between both networks. The revised forecasts used the PFMv4.3 2010/11 base year demand network, whereas the PFMv4.3 preloads had been calculated using an earlier version of the network. Table 2-51 shows the difference in the number of nodes and links between both networks.

Table 2-51 Network Differences

	Base year network	Central case network
Number of nodes	917	916
Number of links	3467	3663

Consequently, the differences resulted in an increase in total traffic of around 3% in the base year preloads. The main reason for this increase is the use of masked demand matrices which requires larger preloads to uplift the assigned flows to the observed link counts.

2.3. Air Demand Forecasts

This section details the methodology for the update to the aviation supply and demand that feeds into the PLANET Framework Model (PFM) for the base year of 2010/11 and forecast years of 2026/27 and 2040/41, to reflect the latest published forecasts from the Department for Transport (DfT). The approach for both the base year and forecast years is to adopt the DfT Aviation Model forecasts of supply and demand. This ensures a completely consistent approach to forecasting domestic air passenger demand and aviation supply between the base and forecast years. The methodology applied to this process is consistent with that followed in PFMv4.3.

2.3.1. DfT Aviation Model

The DfT Aviation Model forecasts the number of passengers passing through UK airports ('terminal passengers') each year and includes UK and foreign residents travelling to, from or within the UK.

Within PFM air is only represented in the PLD model and only includes those trips made exclusively within Great Britain and therefore excludes movements to/from Northern Ireland, Isle of Man etc. It also excludes interlining trips (international movements where, for outbound journeys, the first leg of the trip is within Great Britain but the second and any subsequent legs are international). The internal domestic market sector required for PLD accounts for approximately 15% of the passengers in the DfT Aviation Model.

The DfT's aviation forecasts are primarily prepared to inform long-term strategic aviation policy rather than provide detailed forecasts at every individual airport. The airport and specific market sector level forecasts, such as those used in PLD, are therefore only generated as an intermediate output of the forecasting approach.

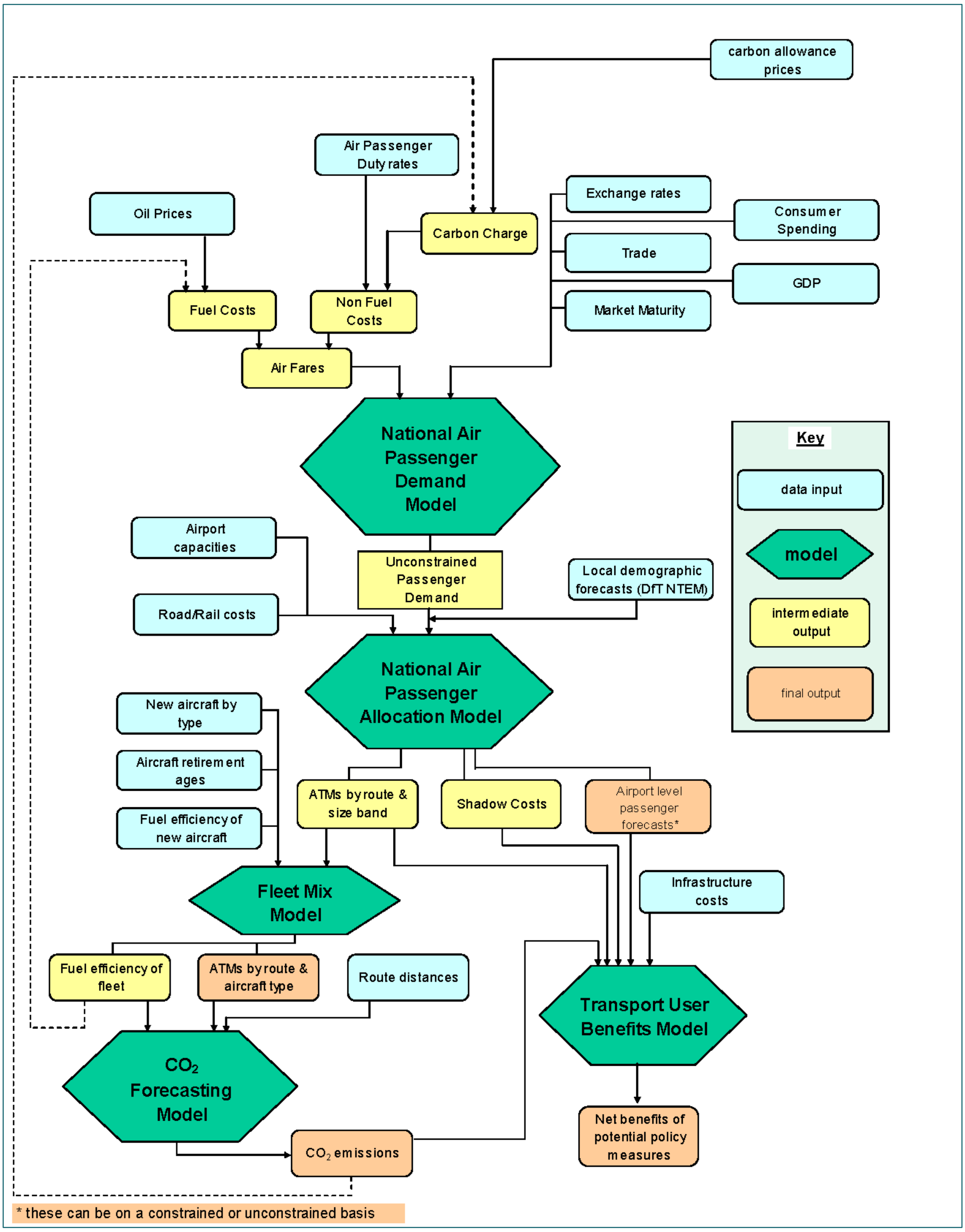
Passenger forecasts are generated for each forecast year in two steps:

- The first step is the unconstrained national air passenger demand forecasts which are generated using the National Air Passenger Demand Model. This combines time-series econometric models with projections of key driving variables, to forecast national air travel demand assuming no UK airport capacity constraints; and
- The second step includes the likely impact of future UK airport capacity constraints, allocation of passengers to airports, and translation of passengers into air transport movements is modelled with the National Air Passenger Allocation Model. Within this step the unconstrained growth rates from NAPDM are applied to the base air matrices to provide forecast matrices for assignment.

To ensure consistency with the other modal forecasts in the PLD model unconstrained air matrices were required. This is achieved by switching off the airport capacity constraints used in the National Air Passenger Allocation Model and are, in contrast, an alternative output to constrained passenger forecasts, showing how UK air passenger numbers would grow if there were no UK airport capacity constraints. It is these unconstrained forecasts that have been used in the PLD model.

Figure 2-21 provides an overview of the framework used by the DfT Aviation Model to produce forecasts of UK air passengers.

Figure 2-21 DfT Aviation Model Forecasting Framework



Source: UK Aviation Forecasts, DfT, January 2013

2.3.1.1. National Air Passenger Demand Model

The National Air Passenger Demand Model is used to forecast the number of UK air passengers assuming no UK airport capacity constraints. It does this by combining a set of time-series econometric models of past UK air travel demand with projections of key driving variables and assumptions about how the relationship between UK air travel and its key drivers change into the future.

The key drivers vary by market sector. In the leisure sector consumer spending and air fares have been identified as the key drivers, whilst in the business sectors GDP and international trade were shown to be the main drivers, with price having a much more limited impact.

Although the National Air Passenger Demand Model is capable of producing forecasts to 2080; it has been used up to 2050 to produce the forecasts presented in this document. The unconstrained demand forecasts from the National Air Passenger Demand Model provide an input to the National Air Passenger Allocation Model.

2.3.1.2. National Air Passenger Allocation Model

The National Air Passenger Allocation Model comprises several sub-models and routines which are used in combination and iteratively:

- The Passenger Airport Choice Model forecasts how passenger demand will split between UK airports;
- The Air Transport Movement (ATM) Demand Model translates the passenger demand forecasts for each airport into air traffic movements; and
- The Demand Allocation Routine accounts for the likely impact of future UK airport capacity constraints on air transport movements (and thus passengers) at UK airports.

The forecasts provided for PLD were derived from the National Air Passenger Allocation Model but were unconstrained forecasts in that they represent the underlying estimates of demand in the absence of airport capacity constraints.

One of the key features of the National Air Passenger Allocation Model is the ability of the ATM Demand Model to project the availability of routes from each modelled airport. The model assumes that, in line with mainstream economic theory, supply will respond to demand as long as the market is commercially viable.

The ATM Demand Model simulates the introduction of new routes by testing in each forecast year whether sufficient demand exists to make new routes viable from each airport. The test is two-way, so routes can be both opened and withdrawn. Also, airports are tested jointly for new routes, allowing them to compete with each other. To ensure consistency between the supply and demand in the PLD model the air supply was updated as the same time as the demand using the aviation model forecasts.

2.3.2. Air Demand Forecasts

This section describes the approach to forecast domestic air passenger demand for the PFM forecast years of 2026/27 and the cap year. The aviation demand forecasts for future years have been updated in the DfT Aviation Model since the development of PFM v4.3. In addition, the cap year, which is determined by long distance rail demand in PLD, has moved from 2036/37 to 2040/41. A spreadsheet was developed to create daily air demand matrices for PLD (the air mode does not appear in the regional models within PFM) based on the forecasts provided by the DfT.

2.3.2.1. Data Sources

The DfT supplied the following data for the aviation demand forecast.

- Latest annual aviation demand forecasts for both 2026/27 and the cap year (2040/41) in an excel spreadsheet. The data in the DfT Aviation Model is in calendar years rather than financial years. The aviation demand matrices were grouped by journey purpose (business and leisure) and distributed to National Air Passenger Allocation Model (NAAM) zone pairs; and
- The correspondences between NAAM zones and Long Distance Model (LDM) zones in an excel spreadsheet.

The annual demand was converted to daily demand using an annualisation factor of 313 which was provided by the DfT

Table 2-52 shows the differences in aviation demand for 2026/27 between the previous and latest forecasts. It can be seen the overall forecasts of demand for 2026/27 are lower for both business and leisure trips, compared with the forecasts used in PFMv4.3.

Table 2-52 DfT aviation matrices 2026/27 forecast comparison

Description	PFMv4.3 Forecast	New Forecast	Change
Business	21,160	19,769	-6.58%
Leisure	16,086	15,082	-6.24%
Combined	**37,246**	**34,851**	**-6.43%**

Table 2-53 shows the differences in aviation demand for the cap year between the previous and latest forecasts. Air demand for the cap year is higher than the forecasts used for PFMv4.3, as there are four additional years of growth.

Table 2-53 DfT aviation matrices cap year forecast comparison

Description	PFMv4.3 Forecast (2036/37)	New Forecast (2040/41)	Change
Business	26,430	26,748	1.20%
Leisure	19,877	20,234	1.80%
Combined	**46,307**	**46,982**	**1.46%**

2.3.2.2. Methodology

To derive the aviation demand matrices for business and leisure journeys, the demand matrices in NAAM zones were converted to matrices in PLD zones which can then be imported into PFM. A standardised spreadsheet was set up to automate the derivation of the aviation demand matrices in PLD zones, so that it can be performed efficiently and consistently for each demand update. In the spreadsheet, the NAAM zones were firstly converted to Long Distance Model (LDM) zones and then from LDM to PLD zones. The annual demand matrices were then divided by the annualisation factor to calculate daily demand matrices suitable for PFM. The following assumptions were made during the process:

- As the DfT Aviation Model matrices represent average annual demand it was assumed that over the course of a year demand will have balanced levels of origin and destination trip totals. Any asymmetry found between origins and destinations was removed by averaging the number of trips in each direction; and
- In the correspondences between LDM and PLD zones, there are several instances where multiple PLD zones correspond within a single LDM zone. In this case, only the PLD zone with the majority weighting was regarded as the corresponding PLD zone for this LDM zone. This assumption has been made as in most situations the majority zone had a weighting greater than 95%.

2.3.2.3. Review of Demand Forecasts

The two tables below show the change in aviation demand for both forecast years in PLD. Table 2-54 shows the matrix totals for 2010/11 to 2026/27 and percentage change in demand whilst Table 2-55 shows the same figures for 2026/27 and 2040/41. It can be seen that between 2026/27 and 2040/41 there is a forecast overall increase in daily air demand of 34.8%, with a 35.3% increase in business demand and a 34.2% increase in leisure demand.

Table 2-54 DfT aviation matrices (per day) 2010/11-2026/27

Description	Business	Leisure	Combined
2010/11 DfT Aviation Model matrix	15,063	12,058	27,121
2026/27 DfT Aviation Model matrix	19,769	15,082	34,851
% change	31.2%	25.1%	28.5%

Table 2-55 DfT aviation matrices (per day) 2026/27-2040/41

Description	Business	Leisure	Combined
2026/27 DfT Aviation Model matrix	19,769	15,082	34,851
2040/41 DfT Aviation Model matrix	26,748	20,234	46,982
% change	35.3%	34.2%	34.8%

The comparison between the forecasts in regional level trip ends (total origin and destination) for PFMv4.3 and the new forecasts in 2026/27 and the cap year are shown from Table 2-56 to Table 2-59. As noted above, the cap year for PFMv4.3 was 2036/37, but it has risen to 2040/41 for the new forecasts.

Demand for travel between Scotland and London shows the largest decrease compared with the PFMv4.3 matrices for 2026/27. The demand between Scotland and other regions like South East, South West and West Midlands also decreases compared with the PFMv4.3 matrices for 2026/27. The decrease in aviation demand for these flows is likely to have a positive impact on HS2, which is assumed to be competing with air on these routes.

Table 2-56 Comparison of New Forecasts and PFMv4.3 Matrices 2026/27 - Absolute Differences

East Midlands (EM)	EM									
East of England (EE)	-1	EE								
London (LN)	0		LN							
North East (NE)	0	14	-10	NE						
North West (NW)	-19	-52	-46		NW					
Scotland (SC)	-45	-82	-320	13	-101	SC				
South East (SE)	0			-22	-32	-107	SE			
South West (SW)	0	0	-5	-28	-77	-82	0	SW		
Wales (WA)	-1	0	-1	-2	0	-27	0	-3	WA	
West Midlands (WM)	-9	-6	0	-1	0	-86	1	-1	0	WM
Yorks & Humber (YH)	-1	-12	-6			-12	-11	-14	0	

Table 2-57 Comparison of New Forecasts and PFMv4.3 Matrices 2026/27 - Percentage Differences

East Midlands (EM)	EM									
East of England (EE)	-67%	EE								
London (LN)	-7%		LN							
North East (NE)	-10%	6%	-4%	NE						
North West (NW)	-100%	-40%	-12%		NW					
Scotland (SC)	-7%	-4%	-6%	12%	-26%	SC				
South East (SE)	5%			-5%	-13%	-3%	SE			
South West (SW)	-17%	1%	-12%	-5%	-32%	-7%	1%	SW		
Wales (WA)	-10%	-16%	-9%	-2%	-22%	-6%	-5%	-16%	WA	
West Midlands (WM)	-100%	-66%	-1%	-4%	-5%	-8%	41%	-21%	-21%	WM
Yorks & Humber (YH)	-100%	-46%	-12%			-5%	-11%	-15%	-12%	

Table 2-58 Comparison of New Forecasts and PFMv4.3 Matrices Cap Year – Absolute Differences

East Midlands (EM)	EM									
East of England (EE)	-2	EE								
London (LN)	0		LN							
North East (NE)	0	-57	32	NE						
North West (NW)	-23	-95	-33		NW					
Scotland (SC)	-105	13	367	38	3	SC				
South East (SE)	0			22	-14	357	SE			
South West (SW)	0	-23	2	55	-29	54	17	SW		
Wales (WA)	0	-2	-6	2	0	39	-1	-3	WA	
West Midlands (WM)	-12	-9	0	0	0	27	0	0	0	WM
Yorks & Humber (YH)	-1	-16	8			18	-2	8	0	

Table 2-59 Comparison of New Forecasts and PFMv4.3 Matrices Cap Year - Percentage Differences

East Midlands (EM)	EM									
East of England (EE)	-56%	EE								
London (LN)	2%		LN							
North East (NE)	-10%	-21%	10%	NE						
North West (NW)	-100%	-60%	-7%		NW					
Scotland (SC)	-12%	0%	5%	29%	1%	SC				
South East (SE)	-10%			4%	-5%	8%	SE			
South West (SW)	3%	-50%	3%	8%	-10%	3%	26%	SW		
Wales (WA)	-3%	-60%	-36%	2%	-5%	7%	-48%	-16%	WA	
West Midlands (WM)	-100%	-79%	39%	-1%	13%	2%	2%	-15%	-25%	WM
Yorks & Humber (YH)	-100%	-52%	13%			6%	-1%	7%	-2%	

2.3.3. Air Passenger Supply Forecasts

This section describes the update to the air passenger supply data in the PLD model for 2026/27 and the cap year (the air mode does not appear in the regional models within PFM). The air passenger supply represents domestic air services wholly within mainland Britain, thus excludes services to Northern Ireland, the Channel Islands, Isle of Man and Scottish Islands.

As with the air passenger forecasts, the aviation supply forecasts for future years have been updated in the DfT Aviation Model since the development for PFMv4.3. A spreadsheet was developed to update the transit line files which were imported into PFM to reflect the latest forecasts from DfT. This ensured that there is a consistent approach to forecasting domestic air passenger demand and aviation supply between the base and forecast years in PLD.

2.3.3.1. Data Source

There are four types of data included in each air transit line file.

- Headway: air headway data were calculated from the aviation supply data which the DfT supplied. The aviation supply matrices included the number of flights per year between each modelled airport in PLD model for each forecast years;
- Business fares: the DfT supplied the air fare matrix for business flights in 2008 prices and values. The fares are for return trips between each modelled airport;
- Leisure fares: the DfT supplied the air fare matrix for leisure flights in 2008 prices and values. The fares are for return trips between each modelled airport; and
- Journey time: as the DfT did not supply the updated journey times, the journey times were assumed to be consistent with which were used in PFMv4.3. Therefore, the journey times were taken from the previous transit line files in PFMv4.3. For those links that did not exist in the previous transit lines in PFMv4.3 journey times obtained from online air timetables.

Table 2-60 provides a definition of the IATA airport codes that are used in the tables that follow.

Table 2-60 IATA Airport codes

Name	Code	Name	Code	Name	Code
Aberdeen Airport	ABZ	Exeter Airport	EXT	Manchester Airport	MAN
Birmingham Airport	BHX	Gatwick Airport	LGW	Newcastle Airport	NCL
Blackpool Airport	BLK	Glasgow Airport	GLA	Newquay Airport	NQY
Bournemouth Airport	BOU	Heathrow Airport	LHR	Norwich Airport	NWI
Bristol Airport	BRS	Humberside Airport	HUY	Plymouth Airport	PLH
Cardiff Airport	CWL	Inverness Airport	INV	Prestwick Airport	PIK
Doncaster-Sheffield Airport	DSA	Leeds/Bradford Airport	LBA	Southampton Airport	SOU
Durham Tees Valley Airport	MME	Liverpool Airport	LPL	Stansted Airport	STN
East Midlands Airport	EMA	London City Airport	LCY		
Edinburgh Airport	EDI	Luton Airport	LTN		

The revised air fare matrices take the base year domestic air fare matrix unadjusted from the DfT Aviation Model which provides air fares between all modelled airports in constant 2008 prices and values. These are adjusted to the 2010/11 base year and the forecast years using the index of changes in real domestic business and leisure fares supplied by the DfT. The fare matrices are based on a distance function which has been developed for each individual airport with domestic flights. The index of changes in real fares is shown in Table 2-61 and this is consistent with the DfT Aviation Model.

Table 2-61 Real Fare Index Factors

Year	Business	Leisure
2010/11	0.962	0.975
2026/27	0.989	1.160
2040/41	1.010	1.233

Table 2-62 and Table 2-63 show the two-way business and leisure fares respectively between each domestic airport in 2008 prices and values**.** The fares were unchanged from those provided by the DfT for use in PFMv4.3.

Table 2-62 Business two-way Fares (2008 Prices and Values)

From/To Airport	ABZ	BHX	BRS	CWL	EMA	EDI	EXT	LGW	GLA	LHR	HUY	INV	LBA	LPL	LCY	LTN	MAN	NCL	NQY	NWI	SOU	STN	MME	BLK	DSA	PIK
ABZ	£0	£239	£168	£244	£238	£328	£197	£180	£273	£239	£235	£291	£233	£196	£239	£160	£287	£227	£246	£260	£215	£175	£230	£234	£195	£214
BHX	£239	£0	£69	£72	£40	£168	£104	£137	£150	£110	£73	£191	£74	£69	£101	£118	£62	£126	£131	£94	£105	£71	£101	£82	£70	£126
BRS	£168	£69	£0	£44	£80	£105	£76	£130	£97	£108	£99	£121	£99	£76	£100	£111	£110	£128	£79	£110	£89	£67	£115	£96	£79	£93
CWL	£244	£72	£44	£0	£92	£161	£70	£142	£154	£123	£124	£203	£122	£89	£115	£123	£124	£171	£82	£143	£97	£81	£148	£117	£103	£142
EMA	£238	£40	£80	£92	£0	£170	£118	£138	£149	£113	£53	£188	£59	£67	£105	£119	£50	£112	£150	£80	£115	£73	£85	£77	£59	£122
EDI	£328	£168	£105	£161	£170	£0	£121	£122	£280	£161	£172	£237	£176	£157	£160	£103	£204	£184	£152	£178	£135	£104	£180	£177	£149	£196
EXT	£197	£104	£76	£70	£118	£121	£0	£147	£122	£134	£140	£158	£140	£102	£127	£128	£164	£174	£80	£153	£107	£90	£159	£134	£107	£127
LGW	£180	£137	£130	£142	£138	£122	£147	£0	£113	£163	£143	£125	£149	£130	£152	£200	£175	£164	£157	£134	£155	£132	£156	£157	£131	£120
GLA	£273	£150	£97	£154	£149	£280	£122	£113	£0	£157	£148	£196	£144	£124	£156	£94	£177	£139	£156	£172	£136	£98	£142	£142	£118	£148
LHR	£239	£110	£108	£123	£113	£161	£134	£163	£157	£0	£127	£197	£142	£125	£96	£144	£166	£182	£164	£106	£117	£76	£161	£152	£117	£161
HUY	£235	£73	£99	£124	£53	£172	£140	£143	£148	£127	£0	£183	£50	£76	£120	£124	£66	£93	£182	£68	£134	£85	£66	£85	£52	£120
INV	£291	£191	£121	£203	£188	£237	£158	£125	£196	£197	£183	£0	£175	£132	£198	£105	£239	£158	£211	£224	£176	£130	£167	£173	£131	£138
LBA	£233	£74	£99	£122	£59	£176	£140	£149	£144	£142	£50	£175	£0	£63	£136	£130	£34	£73	£177	£101	£143	£97	£48	£54	£56	£103
LPL	£196	£69	£76	£89	£67	£157	£102	£130	£124	£125	£76	£132	£63	£0	£118	£111	£36	£86	£119	£106	£114	£79	£75	£53	£73	£83
LCY	£239	£101	£100	£115	£105	£160	£127	£152	£156	£96	£120	£198	£136	£118	£0	£133	£159	£178	£159	£98	£107	£65	£156	£151	£111	£159
LTN	£160	£118	£111	£123	£119	£103	£128	£200	£94	£144	£124	£105	£130	£111	£133	£0	£155	£145	£138	£115	£136	£113	£137	£130	£115	£100
MAN	£287	£62	£110	£124	£50	£204	£164	£175	£177	£166	£66	£239	£34	£36	£159	£155	£0	£101	£203	£135	£169	£121	£69	£38	£56	£132
NCL	£227	£126	£128	£171	£112	£184	£174	£164	£139	£182	£93	£158	£73	£86	£178	£145	£101	£0	£220	£147	£182	£130	£48	£81	£81	£85
NQY	£246	£131	£79	£82	£150	£152	£80	£157	£156	£164	£182	£211	£177	£119	£159	£138	£203	£220	£0	£209	£128	£115	£201	£171	£140	£161
NWI	£260	£94	£110	£143	£80	£178	£153	£134	£172	£106	£68	£224	£101	£106	£98	£115	£135	£147	£209	£0	£126	£67	£118	£145	£84	£167
SOU	£276	£98	£99	£116	£103	£188	£130	£135	£186	£79	£122	£242	£142	£125	£68	£116	£165	£197	£171	£94	£134	£127	£227	£184	£155	£197
STN	£175	£71	£67	£81	£73	£104	£90	£132	£98	£76	£85	£130	£97	£79	£65	£113	£121	£130	£115	£67	£81	£0	£113	£104	£72	£100
MME	£230	£101	£115	£148	£85	£180	£159	£156	£142	£161	£66	£167	£48	£75	£156	£137	£69	£48	£201	£118	£162	£113	£0	£70	£68	£95
BLK	£234	£82	£96	£117	£77	£177	£134	£157	£142	£152	£85	£173	£54	£53	£151	£130	£38	£81	£171	£145	£144	£104	£70	£110	£69	£100
DSA	£195	£70	£79	£103	£59	£149	£107	£131	£118	£117	£52	£131	£56	£73	£111	£115	£56	£81	£140	£84	£111	£72	£68	£72	£0	£88
PIK	£214	£126	£93	£142	£122	£196	£127	£120	£148	£161	£120	£138	£103	£83	£159	£100	£132	£85	£161	£167	£146	£100	£95	£90	£88	£0

Table 2-63 Leisure two-way Fares (2008 Prices and Values)

From/To Airport	ABZ	BHX	BRS	CWL	EMA	EDI	EXT	LGW	GLA	LHR	HUY	INV	LBA	LPL	LCY	LTN	MAN	NCL	NQY	NWI	SOU	STN	MME	BLK	DSA	PIK
ABZ	£0	£111	£105	£128	£129	£121	£132	£101	£124	£127	£130	£117	£135	£112	£123	£104	£131	£120	£126	£129	£146	£100	£131	£114	£130	£122
BHX	£111	£0	£37	£53	£42	£70	£66	£82	£75	£55	£53	£92	£47	£45	£85	£35	£43	£59	£74	£61	£58	£48	£64	£49	£51	£68
BRS	£105	£37	£0	£33	£55	£79	£43	£78	£83	£55	£68	£104	£67	£50	£82	£34	£57	£70	£53	£71	£58	£46	£78	£54	£65	£74
CWL	£128	£53	£33	£0	£72	£98	£58	£95	£102	£74	£86	£125	£84	£66	£100	£53	£73	£89	£67	£91	£78	£65	£96	£71	£85	£92
EMA	£129	£42	£55	£72	£0	£81	£87	£94	£88	£69	£56	£107	£50	£55	£97	£48	£50	£67	£96	£68	£72	£61	£70	£59	£54	£82
EDI	£121	£70	£79	£98	£81	£0	£115	£90	£35	£104	£77	£41	£66	£58	£107	£81	£67	£41	£114	£95	£119	£82	£60	£55	£75	£41
EXT	£132	£66	£43	£58	£87	£115	£0	£99	£118	£82	£101	£143	£105	£78	£106	£61	£92	£104	£62	£103	£87	£71	£112	£83	£99	£106
LGW	£101	£82	£78	£95	£94	£90	£99	£0	£93	£87	£96	£97	£97	£86	£128	£67	£94	£87	£101	£93	£84	£86	£100	£86	£98	£85
GLA	£124	£75	£83	£102	£88	£35	£118	£93	£0	£111	£85	£44	£76	£63	£112	£88	£74	£50	£116	£103	£127	£87	£70	£59	£83	£40
LHR	£127	£55	£55	£74	£69	£104	£82	£87	£111	£0	£76	£132	£83	£72	£84	£24	£79	£89	£95	£66	£40	£42	£94	£76	£77	£101
HUY	£130	£53	£68	£86	£56	£77	£101	£96	£85	£76	£0	£101	£45	£59	£101	£55	£55	£60	£110	£64	£81	£66	£61	£62	£50	£81
INV	£117	£92	£104	£125	£107	£41	£143	£97	£44	£132	£101	£0	£99	£74	£122	£108	£96	£57	£140	£120	£153	£101	£82	£71	£99	£48
LBA	£135	£47	£67	£84	£50	£66	£105	£97	£76	£83	£45	£99	£0	£43	£105	£62	£33	£46	£115	£72	£90	£71	£43	£42	£41	£72
LPL	£112	£45	£50	£66	£55	£58	£78	£86	£63	£72	£59	£74	£43	£0	£93	£51	£37	£52	£80	£72	£79	£60	£59	£45	£56	£59
LCY	£123	£85	£82	£100	£97	£107	£106	£128	£112	£84	£101	£122	£105	£93	£0	£65	£101	£100	£111	£96	£81	£83	£110	£95	£102	£103
LTN	£104	£35	£34	£53	£48	£81	£61	£67	£88	£24	£55	£108	£62	£51	£65	£0	£58	£67	£73	£46	£21	£23	£72	£51	£50	£78
MAN	£131	£43	£57	£73	£50	£67	£92	£94	£74	£79	£55	£96	£33	£37	£101	£58	£0	£54	£99	£76	£85	£68	£55	£42	£48	£70
NCL	£120	£59	£70	£89	£67	£41	£104	£87	£50	£89	£60	£57	£46	£52	£100	£67	£54	£0	£107	£77	£100	£71	£44	£49	£58	£51
NQY	£126	£74	£53	£67	£96	£114	£62	£101	£116	£95	£110	£140	£115	£80	£111	£73	£99	£107	£0	£114	£104	£80	£118	£87	£111	£103
NWI	£129	£61	£71	£91	£68	£95	£103	£93	£103	£66	£64	£120	£72	£72	£96	£46	£76	£77	£114	£0	£69	£59	£82	£77	£72	£96
SOU	£146	£58	£58	£78	£72	£119	£87	£84	£127	£40	£81	£153	£90	£79	£81	£21	£85	£100	£104	£69	£0	£83	£131	£94	£114	£121
STN	£100	£48	£46	£65	£61	£82	£71	£86	£87	£42	£66	£101	£71	£60	£83	£23	£68	£71	£80	£59	£83	£0	£79	£62	£64	£76
MME	£131	£64	£78	£96	£70	£60	£112	£100	£70	£94	£61	£82	£43	£59	£110	£72	£55	£44	£118	£82	£131	£79	£0	£57	£61	£69
BLK	£114	£49	£54	£71	£59	£55	£83	£86	£59	£76	£62	£71	£42	£45	£95	£51	£42	£49	£87	£77	£94	£62	£57	£58	£55	£59
DSA	£130	£51	£65	£85	£54	£75	£99	£98	£83	£77	£50	£99	£41	£56	£102	£50	£48	£58	£111	£72	£114	£64	£61	£57	£0	£79
PIK	£122	£68	£74	£92	£82	£41	£106	£85	£40	£101	£81	£48	£72	£59	£103	£78	£70	£51	£103	£96	£121	£76	£69	£56	£79	£0

2.3.3.2. Methodology

To update the aviation transit line files for the PFM run, the latest air headway, fares and journey time information was required. A standardised spreadsheet was set up to display the required information for each airport-airport flow, to simplify the manual process for updating the transit line file. The previous transit line files for the two years, 2026/27 and the cap year (2040/41) were then updated to incorporate the new forecasts.

The flight per year matrix supplied by DfT was converted to a flight per day matrix by applying an annualisation factor. The headway for each airport-airport flow was calculated by the following formula: headway = minutes per day / flights per day.

The revised networks for the new forecasts take the base year domestic air fare matrix unadjusted from the DfT Aviation Model which provides air fares between all modelled airports in constant 2008 prices and values. As the fare matrices supplied were the fares for return trips, they were divided by two before being applied in the transit line files.

The following assumptions were made in the updates to the aviation supply.

- The annualisation factor was assumed to be 313, as per the demand update;
- The number of minutes per day was assumed to be 960;
- Any airport-airport flows with a headway larger than 1200 minutes, i.e. less than one flight a day, were not included in PLD;
- As the journey time matrix was obtained from the previous transit line file, journey times for flights between new airport pairs were estimated based on the following principles:
  - Every flight has the same journey time as its reverse flight;
  - Each airport in London has the same journey time to/from other airports outside of London;
  - Journey times for Inverness to/from Bristol, and Inverness to/from Edinburgh are based on the online flight timetable.
- The transit line between Exeter and Stansted did not previously exist so a new link was added into the base network file for PFM.

2.3.3.3. Modifications to Air Services

Forecasts for 2026/27

In the new forecast for 2026/27, there were some new flights which were added into the transit line file compared with the previous forecast. Also, some flights represented in the previous transit line file no longer exist in the new forecast. Details of the transit line change are shown in Table 2-64.

Table 2-64 Changes between New and PFMv4.3 Transit Lines (2026/27)

New transit lines	Removed transit lines
Aberdeen – Gatwick	Aberdeen – London City
Exeter – Stansted	Aberdeen – Durham Tees Valley
Glasgow – Stansted	Edinburgh – Manchester
Inverness – Bristol	Edinburgh – Stansted
Inverness – Edinburgh	Exeter – Edinburgh
Inverness – London City	Glasgow – Southampton
London City – Edinburgh	Aberdeen
London City – Inverness	Gatwick – Edinburgh
Gatwick – Aberdeen	Luton – Inverness
Gatwick – Manchester	Luton – Manchester
Manchester– Gatwick	Manchester – Bristol
Stansted – Exeter	Manchester – Edinburgh
Stansted – Glasgow	Manchester – Luton

Stansted – Newcastle	Manchester – Norwich
	Durham Tees Valley – Aberdeen
	Newquay – Manchester
	Stansted – Edinburgh
	Stansted – Newcastle

For some of the transit lines which existed in both the previous and new forecasts, headways and fares were changed based on the new forecasts. However, because the business fares have changed very slightly (under 1%), they are not shown in the tables below.

Table 2-65 shows the top five headway increases and decreases for transit lines compared with the previous forecasts. Note that an increase in headway means a decrease in the number of flights per year which are also shown in Table 2-65.

Table 2-65 Headway and annual flight comparison between previous and new forecast 2026/27

Air Routes	PFMv4.3	New Forecast	Change	PFMv4.3	New Forecast	Change
	Headway Increase			**Flight per year Decrease**		
Exeter – Glasgow	368	642	274	817	468	-348
Bristol – Glasgow	733	960	227	410	308	-102
Edinburgh – Exeter	755	960	205	398	313	-85
Glasgow – Bristol	780	960	180	385	303	-82
Exeter – Newcastle	470	648	178	639	464	-176
	Headway Decrease			**Flight per year Increase**		
Luton – Edinburgh	543	87	-456	553	3454	2900
Inverness – Birmingham	712	424	-288	422	709	287
Edinburgh – Luton	634	493	-141	474	609	136
Glasgow – Gatwick	427	305	-122	704	985	281
Glasgow – Birmingham	545	448	-97	551	671	119

Forecasts for 2040/41

Details of the transit line changes for 2040/41, compared with the 2036/37 forecasts for PFMv4.3, are shown in Table 2-66.

Table 2-66 Changes between new and previous transit lines (2040/41 vs 2036/37)

New transit lines	Removed transit lines
Aberdeen – Exeter	Aberdeen – London City
Aberdeen – Gatwick	Aberdeen – Durham Tees Valley
Exeter – Stansted	Edinburgh – Manchester
Glasgow – Leeds/Bradford	Exeter – Edinburgh
Inverness – Stansted	Glasgow – Southampton
London City – Edinburgh	Leeds/Bradford – Prestwick
Newquay – Manchester	London City – Aberdeen
Southampton – Glasgow	Luton – Manchester
Stansted – Exeter	Manchester – Edinburgh
Stansted – Inverness	Manchester – Luton
	Norwich – Newquay
	Stansted – Edinburgh

	Durham Tees Valley– Aberdeen
	Prestwick – Leeds/Bradford

Table 2-67 shows the top five headway increases and decreases for transit lines compare with the previous forecasts, as well as the flight per year change.

Table 2-67 Headway and flight per year comparison between the previous and new forecast (2040/41 vs 2036/37)

Air Routes	PFMv4.3	New Forecast	Change	PFMv4.3	New Forecast	Change
	Headway Increase			**Flight per year Increase**		
Manchester – Norwich	577	951	374	521	316	-205
Exeter – Aberdeen	601	960	359	500	306	-194
Manchester – Bristol	668	960	292	450	299	-151
Bristol – Glasgow	671	960	289	448	276	-172
Glasgow – Bristol	637	832	196	472	361	-111
	Headway Decrease			**Flight per year Decrease**		
Luton – Edinburgh	606	110	-496	496	2741	2245
Inverness – Edinburgh	960	508	-452	313	591	278
Edinburgh – Luton	609	244	-366	493	1232	739
Inverness – Birmingham	523	265	-258	574	1132	558
Aberdeen – Cardiff	960	746	-214	313	403	90

3. Summary of Rail Step Through

The following section provides a summary of the various updates to the rail demand forecasts which were undertaken as part of WP2. Each change to the inputs or methodology was tested and reported as a separate increment so that the impact of each update could be independently understood and verified. A more detailed description of the methodology and results for each update is provided in Appendix A.

3.1. Automation of Existing Process

3.1.1. Justification

The first update undertaken was to produce an automated interface between EDGE and PFM. The rationale for this was to improve the robustness, transparency and inherent assurance in updating the exogenous forecasts, as well as reducing the elapsed time for the process. None of the updates to the interface were designed to alter the resultant forecast rail demand matrices.

3.1.2. Methodology

A number of distinct tools were developed as part of the new automated interface. These have been combined into an automated ‘shell’ such that the user can produce a set of demand forecasts with minimal manual intervention. The process has been fully quality assured, meaning that the need for manual quality assurance at each step of the process has been vastly reduced. The overall forecasting process can now be summarised in the following steps. Each step has a bespoke tool associated with it, with specific details on the operation and function of each of the tools described in a separate user guide.

1. Review demand driver inputs from DfT and compare with the previous forecasts;
2. Format demand driver inputs for EDGE;
3. Run EDGE to produce growth uplifts for each forecast year;
4. Check that EDGE has performed the correct calculations by reviewing log file;
5. Convert EDGE outputs from ticket type to journey purpose;
6. Prepare growth factor matrices for input to EMME;
7. Automated process to calculate forecast year demand matrices in EMME using macros;
8. Adjust PS matrices to account for air passenger growth;
9. Calculate the cap year using the demand matrices in PLD and produce demand matrices for the cap year if required.

3.1.3. Impact on Forecasts

In order to provide assurance that the automated interface tools did not introduce a change to the rail forecasts, an exercise was undertaken to replicate the existing central case forecast demand matrices for each of the four constituent PLANET models.

The results indicated the following:

PLANET Long Distance, PLANET South & PLANET North

The forecast rail demand matrices were replicated exactly using the automated interface tools.

PLANET Midlands

The PFMv4.3 central case matrices could not be replicated, with the matrices larger when produced using the automated interface tools compared with the central case. Attempts to isolate the source of divergence from the central case forecasts pointed to the fact that the growth factors produced by EDGE were different for the two approaches.

As the audit trail for the PFMv4.3 central case matrices is incomplete, i.e. EDGE log files have not been retained due to their excessive file size, attempts were made to replicate the central case matrices using the previous method. These were also unsuccessful, with the forecasts exactly matching those produced using the automated interface. It was therefore concluded that there was an issue with the PFMv4.3 PLANET Midlands central case forecast matrices.

Table 3-1 and Table 3-2 below show the PM matrix totals for 2026/27 and 2036/37, comparing the central case matrices with those produced by the automated interface.

Table 3-1 PM matrix totals (daily trips) – 2026/27

Matrix	Demand - Central Case	Demand - Automated Interface	Difference (Abs.)	Difference (Rel.)
2026/27 Business CA	14,208	14,424	216	1.5%
2026/27 Business NCA	1,828	1,868	40	2.2%
2026/27 Leisure CA	12,844	13,088	243	1.9%
2026/27 Leisure NCA	1,797	1,842	45	2.5%
2026/27 Commuting CA	70,130	71,771	1,641	2.3%
2026/27 Commuting NCA	11,286	11,566	279	2.5%
Total 2026/27	**112,093**	**114,558**	**2,466**	**2.2%**

Table 3-2 PM matrix totals (daily trips) – 2036/37

Matrix	Demand - Central Case	Demand - Automated Interface	Difference (Abs.)	Difference (Rel.)
2036/37 Business CA	16,780	17,138	358	2.1%
2036/37 Business NCA	2,064	2,126	62	3.0%
2036/37 Leisure CA	15,236	15,641	405	2.7%
2036/37 Leisure NCA	2,022	2,091	69	3.4%
2036/37 Commuting CA	83,263	85,888	2,625	3.2%
2036/37 Commuting NCA	12,660	13,075	415	3.3%
Total 2036/37	**132,024**	**135,958**	**3,934**	**3.0%**

3.2. Migration to EDGE 1.5

3.2.1. Justification

EDGE v1.5.0.0 has replaced v1.4.0.3 as the standard version of the software, and DfT therefore recommend that HS2 Ltd. migrates to this version. The delivery of EDGE v1.5.0.0 represents an opportunity to refresh and “clean up” the EDGE folder structure and ensure it is consistent for all users. DfT have confirmed that there is no difference between the results produced by v1.5.0.0 and v1.4.0.3; the only difference is the format of some of the inputs to the EDGE process. For example, the National Rail fares driver is now required to use cumulative rather than year-on-year growth, in line with the other inputs. However, it is important that the process is checked using the new software to ensure that there are no unintended impacts on the matrices produced.

3.2.2. Methodology

Atkins ran the new EDGE software with the central case inputs from PFMv4.3 to produce forecast year matrices (for PLD only) using the existing process in EMME. The following changes were made to the inputs to EDGE so that they were compatible with the new version.

PDFH Flow Category Labelling

A number of the demand driver inputs to EDGE are supplied in PDFH flow category format. Previously, a correspondence was needed to convert these drivers from PDFH flow category format to the case study zoning system, i.e. the PLANET models. In EDGE 1.5.0.0 this is no longer the case, as the elasticities are applied in the 'native' format, i.e. the PDFH flow categories. This affects the following demand drivers:

- Fuel price and car journey times
- Bus fares, headway and journey times
- Air passengers, fares and frequency
- London Underground fares

The resultant factor is subsequently converted to the output zoning system; also the PLANET model. Previously a conversion was made from PDFH flow category to the case study zoning system before the elasticities were applied. The implication of this change is that the labelling of flow categories in both the demand driver and elasticity files must be entirely consistent for EDGE to function correctly.

National Rail Fares Inputs

In EDGE 1.5.0.0 the convention has changed so that the format of the National Rail fares driver is an index, as opposed to year-on-year growth, in order to be consistent with the other demand drivers. Therefore the National Rail fares driver has been adapted so that the values are indexed from 2010/11/11.

Car Ownership Inputs

The car ownership driver is unique in that, as supplied, it contains two sets of values for each year: the number of households and the number of households without a car. Previously this file was converted so that one value is specified as the input to EDGE: the proportion of households without a car. In EDGE 1.5.0.0 the convention has changed so that if the car ownership driver is not supplied in the case study zoning system, then the driver must be input to EDGE in the format as supplied.

3.2.3. Impact on Forecasts

Table 3-3 summarises the PLD matrix totals for the new rail demand forecasts for 2026/27, developed using the EDGE 1.5 run described above, and compares these against the demand matrices used in PFMv4.3, based on EDGE 1.4.0.3.

Table 3-3 PLD matrix totals comparison, EDGE 1.4.0.3 v 1.5.0.0 (2026/27)

Matrix	EDGE 1.4.0.3 Forecast	EDGE 1.5.0.0 Forecast	Change	%
Commuting NCA	76,781	76,811	30	0.0%
Commuting CA from	234,325	234,372	46	0.0%
Commuting CA to	234,326	234,372	46	0.0%
Business NCA	-	-	-	-
Business CA from	125,884	125,955	71	0.1%
Business CA to	93,704	93,760	57	0.1%
Leisure NCA	117,162	117,218	57	0.0%
Leisure CA from	284,346	284,410	64	0.0%
Leisure CA to	208,794	208,840	46	0.0%
Total	**1,375,321**	**1,375,738**	**417**	**0.0%**

The forecast matrices have been produced from the underlying base year demand matrices used in PFMv4.3. There is a slight increase in demand of less than 0.1% as a result of the use of EDGE 1.5.0.0.

As a change to the size of the PLD demand matrix was unexpected, Atkins has analysed the EDGE log file and confirmed that the cause of the difference is the way in which the impact of the car ownership driver is calculated within EDGE, specifically the point at which the demand driver values are converted from the input zoning system (RIFF) to the case study zoning system (PLD). In EDGE 1.4.0.3 the proportion of households without a car is calculated prior to the EDGE process, where the resultant values are converted to the PLD zoning system. In EDGE 1.5.0.0 both the number of households and the number of households without a car are both converted from RIFF to PLD, prior to the calculation of the proportion of households without a car. This results in slightly different values.

The rail demand forecast matrix totals for the cap year of 2036/37, which is unchanged, are presented in Table 3-4. These have been compared with the corresponding cap year forecasts from PFMv4.3. Again, there is a slight increase in demand as a result of the use of EDGE 1.5.0.0, correspondingly higher than that for 2026/27.

Table 3-4 PLD matrix totals comparison, EDGE 1.4.0.3 v 1.5.0.0 (2036/37)

Matrix	EDGE 1.4.0.3 Forecast	EDGE 1.5.0.0 Forecast	Change	%
Commuting NCA	83,109	83,155	46	0.1%
Commuting CA from	279,909	279,989	79	0.0%
Commuting CA to	279,909	279,988	79	0.0%
Business NCA	-	-	-	-
Business CA from	55,621	155,748	126	0.1%
Business CA to	16,323	116,424	100	0.1%
Leisure NCA	131,404	131,499	95	0.1%
Leisure CA from	345,969	346,089	120	0.0%
Leisure CA to	255,401	255,489	88	0.0%
Total	**1,647,645**	**1,648,380**	**735**	**0.0%**

3.3. NTEM Case Study

3.3.1. Justification

There are separate EDGE case studies for each of the PLANET models within the PLANET Framework Model (PFM) and the forecasts are undertaken using two different zoning structures:

- The PLANET Long Distance (PLD), PLANET South (PS) and PLANET Midlands (PM) EDGE case studies are based on the Rail Industry Forecasting Framework (RIFF) zoning system (69 zones); and
- The PLANET North (PN) EDGE case study is based on the DfT's National Trip End Model (NTEM) zoning system (2496 zones).

Converting the three current RIFF based case studies to ones based on NTEM provides a more robust EDGE study, for the following reasons:

- The RIFF zones mirror the rail train operating companies and so do not easily map to data provided at a geographic level;
- The current mapping between NTEM and RIFF contains assumptions provided by others and has a limited audit trail;
- It ensures that rail forecasting is undertaken at the most disaggregate spatial level; and
- It removes the need to aggregate certain driver data to RIFF zone level, therefore removing an extra layer of complexity from the process.

The update is expected to have an impact on the values in the final demand matrices, due to the revised zoning for the population, employment and car availability inputs. The GDP per capita data is uniform across each Government Office Region (GOR), so the use of NTEM or RIFF zoning should not impact on the forecasts of GDP per capita for each PLANET zone. The regional distribution of rail demand growth is expected to change as the use of more detailed zoning will bring out local variations of population, employment and car ownership growth, which were previously dampened by using a uniform growth rate for each RIFF zone. However, the scale of this impact, and the resulting change to the overall level of demand, cannot be fully anticipated prior to carrying out the case study.

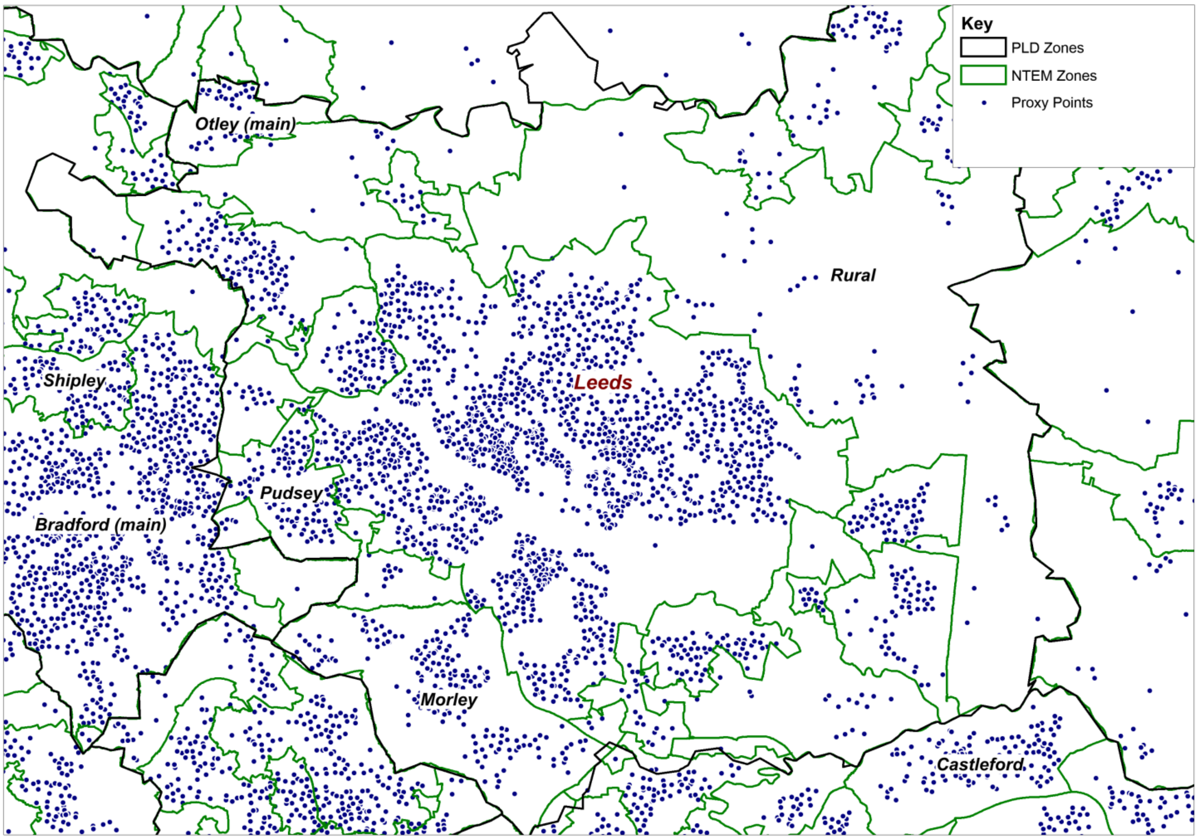
3.3.2. Methodology

The methodology was consistent with that used to develop the PN EDGE case study and the steps followed are described below:

- Mapping of the PLD zoning system to NTEM zones in GIS;
- Assign weightings from NTEM to PLD zones;
- Run EDGE with revised NTEM zoning system applied to previous inputs; and
- Compare NTEM case study matrices to those from PFMv4.3.

When creating a correspondence between two zoning systems, it is common for a zone from one system to only be a proportion of a zone from another system. Instances like this are treated by adopting the 'population proxy point' distribution method. This means that the proportion of a zone is weighted by the number of settlements or in other words – by population. The 'population proxy points' are centroids of Census Output Areas (OA) from the Office of National Statistics. Figure 3-1 below illustrates the representation of OA centroids and the two zoning systems in the Leeds area.

Figure 3-1 Mapping of PLD and NTEM Zones, with Population Centroids



A correspondence is created between the 'proxy points' table and the NTEM zones, so that each point has an NTEM zone code assigned. An equivalent correspondence is created between the 'proxy point' table and the PLD zones, so that each point also has a PLD zone code assigned. The two correspondences are exported to Excel so that they can be processed into the final NTEM to PLD correspondence, which defines the proportion of the PLD zone within each NTEM zone, represents the zone correspondence used in EDGE.

3.3.3. Impact on Forecasts

PLANET Long Distance

Table 3-5 below summarises the PLD matrix totals for the new rail demand forecasts for 2026/27, developed using the updated NTEM-based inputs described above, and compares these against the demand matrices from PFMv4.3.

Table 3-5 PLD Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday Trips)

Journey Purpose	PFMv4.3	NTEM Case Study	Difference	%
Commuting NCA	76,781	76,921	141	0.2%
Commuting CA from	234,325	235,096	771	0.3%
Commuting CA to	234,326	235,096	770	0.3%
Business NCA	-	-	-	0.0%
Business CA from	125,884	126,448	564	0.4%
Business CA to	93,704	94,166	462	0.5%
Leisure NCA	117,162	117,329	167	0.1%
Leisure CA from	284,346	284,492	146	0.1%
Leisure CA to	208,794	208,936	142	0.1%
Total	**1,375,321**	**1,378,484**	**3,163**	**0.2%**

The table demonstrates that the number of forecasts trips in PLD is slightly higher than the PFMv4.3 matrices with the increase in commuting and business demand being greater than the increase in leisure demand.

The rail demand forecast matrix totals for the cap year of 2036/37, which remains unchanged, are presented in Table 3-6. These have been compared with the corresponding cap year forecasts from PFMv4.3.

Table 3-6 PLD Rail Matrix Totals for the Cap Year (2036/37) by Journey Purpose (Weekday Trips)

Journey Purpose	PFMv4.3	NTEM Case Study	Difference	%
Commuting NCA	83,109	83,325	216	0.3%
Commuting CA from	279,909	281,140	1,231	0.4%
Commuting CA to	279,909	281,140	1,231	0.4%
Business NCA	-	-	-	0.0%
Business CA from	155,621	156,593	971	0.6%
Business CA to	116,323	117,123	800	0.7%
Leisure NCA	131,404	131,681	277	0.2%
Leisure CA from	345,969	346,116	147	0.0%
Leisure CA to	255,401	255,562	16	0.1%
Total	**1,647,645**	**1,652,680**	**5,035**	**0.3%**

It can be seen that, in a similar way to the 2026/27 forecasts, the NTEM-based case study has resulted in a slight overall increase in trips within the PLD demand matrices, in particular commuting and business trips.

Regional Variation

Table 3-7 below summarises the ten PLD zones with the largest absolute changes in demand resulting from the NTEM-based case study compared with PFMv4.3, and the corresponding percentage change. The table shows there is increased demand for trips originating from Leeds, southern Scotland, Manchester and around Rugby and Northampton, while demand for trips originating from the Liverpool and Merseyside area has reduced. Overall, it can be seen that the most affected areas, whether positive or negative, are generally relevant to the current HS2 scheme proposals and will likely have an impact on the existing business case. It should also be noted that for several of these areas the change in demand is from a high base level of demand, with a relatively small percentage change.

Table 3-7 Largest Absolute Changes in Demand by PLD Zone Origin (2036/37 Weekday Trips)

PLD Zone	PLD Zone Name	Total Demand			
		PFMv4.3	NTEM	Difference	%
105	Leeds	80,983	83,719	2,736	3.40%
197	South Lanarkshire	22,612	24,099	1,487	6.60%
148	Northamptonshire (West Coast Main Line)	13,307	14,429	1,122	8.40%
37	City of Glasgow	150,380	151,436	1,055	0.70%
117	London Central	99,456	100,377	922	0.90%
36	City of Edinburgh	61,021	61,933	912	1.50%
130	Manchester including Metrolink area	101,121	102,010	889	0.90%
177	Sefton	20,104	19,291	-813	-4.00%
100	Kirklees	17,249	16,261	-989	-5.70%
232	Wirral	25,794	24,761	-1,034	-4.00%

Regional Models

The forecast PS matrix totals for the cap year of 2036/37 (which was derived from the PLD NTEM-based case study) are presented in Table 3-8. These have been compared with the corresponding 2036/37 cap year forecasts from PFMv4.3.

Table 3-8 PS Rail Matrix Totals for Cap Year (2036/37) by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFMv4.3	NTEM Case Study	Difference	%
2036/37 Business PA	222,915	227,042	4,127	1.9%
2036/37 Business AP	14,468	15,010	542	3.7%
2036/37 Leisure PA	239,286	241,957	2,670	1.1%
2036/37 Leisure AP	27,468	27,843	374	1.4%
2036/37 Commuting PA	2,197,154	2,236,658	39,504	1.8%
2036/37 Commuting AP	45,097	46,322	1,226	2.7%
Total 2036/37	**2,746,389**	**2,794,832**	**48,443**	**1.8%**

The increase in demand in both absolute numbers and percentage are higher than that for PLD with business trips have seen the highest percentage increase in demand.

The forecast PM matrix totals for the cap year of 2036/37 are presented in Table 3-9.

Table 3-9 PM Rail Matrix Totals for the Cap Year (2036/37) by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	PFM v4.3	NTEM Case Study	Difference	%
Business CA	16,780	16,863	84	0.5%
Business NCA	2,064	2,094	30	1.5%
Leisure CA	15,236	15,317	81	0.5%
Leisure NCA	2,022	2,048	26	1.3%
Commuting CA	83,263	83,884	621	0.7%
Commuting NCA	12,660	12,762	102	0.8%
Total 2036/37	**132,024**	**132,968**	**944**	**0.7%**

It can be seen that the NTEM-based case study has resulted in an overall increase in trips within the PM demand matrices, in particular business and leisure trips in relative terms. In absolute terms, commuting trips see the largest increase, though this is due to commuting trips being the largest journey purpose.

Impact on Business Case

Overall, the update to NTEM zones has not materially impacted on the HS2 business case with a BCR of 1.42 for Phase 1 and 1.83 for Phase 2 compared to 1.44 and 1.84 for PFMv4.3. On an aggregate level, the impact of the update to NTEM is a small increase in rail demand. The cap year demand forecasts have marginally increased with PLD forecasts increasing by only 0.3%. However, on a disaggregate level, the divergences in forecasts are more apparent because the NTEM zoning system provides more detailed regional variation than the RIFF-based zoning system.

Although the input rail demand matrices are slightly larger overall, the model outputs show the difference between Do Minimum and Do Something demand is slightly lower than for PFMv4.3, which is causing the overall benefits to be marginally lower. For example, the Do Minimum rail demand for Phase 2 in 2026/27 increases by 360 trips per day, while the Do Something demand reduces by 1,242 trips. Therefore, the change in rail demand as a result of the Do Something has reduced by 1,602 trips.

3.4. WebTAG 2014 Updates

3.4.1. Justification

The central case forecasts for PFM 4.3 were developed using PDFH 5.0 market segmentation and demand driver elasticities (with the exception of PDFH 4.0 for fares), as defined in the latest WebTAG forecasting guidance at the time of model development. In order to update the HS2 demand forecasting in line with the latest guidance, it was necessary to run EDGE using the revised parameters recommended in WebTAG 2014, which was published in draft form in June 2014.

3.4.2. Methodology

The draft version of the latest WebTAG guidance (June 2014) relating to PDFH Recommended Forecasting Parameters (TAG Unit M4) has been consulted to determine the PDFH version to use for each demand forecasting parameter, shown in Table 3-10. It can be seen that ticket type to journey purpose conversions are unchanged from the previous forecasts, as are the car cost and rail fares parameters. The parameters for the remaining inter-modal competition and external environment have been updated from PDFH 5.0 to 5.1. This affects changes to both the market segmentation and demand driver elasticities to be used in EDGE.

Table 3-10 PDFH Recommended Forecasting Parameters

Parameter	PDFH Version	Chapter	Tables
Ticket Type to Journey Purpose Conversions	5.0	B0	B0.1 – B0.10
External Environment	5.1	B1	B1.1 – B1.7
Inter-modal competition – excluding car cost	5.1	B2	B2.1 – B2.6
Inter-modal competition – car cost only	5.0	B2	B2.7
Fares	4.0	B2	B2.1 – B2.7

Market Segmentation

PDFH 5.1 introduces new non-London segmentation for the external environment demand drivers (GDP per capita, population and employment). There is a move from two non-London flows; inter-urban (>20 miles) and urban (<20 miles) to core, major and other cities. Inter-modal competition elasticities are still categorised as inter-urban and urban for the non-London flows as in PDFH 5.0. This requires the following adjustments to the EDGE inputs:

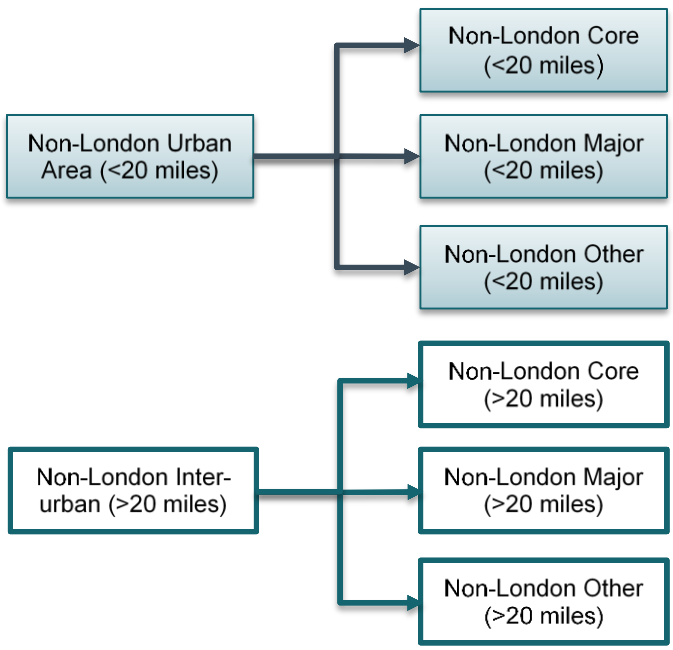
- Demand drivers: as the inter-modal competition elasticities are expressed in PDFH flow groups, it was necessary to convert the non-London demand drivers to correspond with the new flow groups. This was based on weightings supplied by DfT, summarised in Table 3-11 below.

Table 3-11 Inter-modal competition elasticities for non-London flows

Journey Split	PDFH 5.1 flows		
PDFH 5.0 flows	**Non-London Core**	**Non-London Major**	**Non-London Other**
Non-London inter-urban	51%	90%	74%
Urban areas	49%	10%	26%
Grand Total	100%	100%	100%

- Elasticities: The elasticities for the inter-modal competition parameters are still characterised by distance but allocated to the new non-London segmentation using the distance functionality in EDGE, as shown in Figure 3-2.

Figure 3-2 Conversion of non-London segmentation for intermodal competition drivers in PDFH 5.1



- PLANET – PDFH correspondence: revised zone correspondences mapping PLANET zone-zone pairs to PDFH categories have been created so that non-London flows are characterised as "core", "major" or "other". All PLANET zones that contain a proportion of a core or major city local authority zone are labelled "core" or "major". The proportion of local authority zone within a PLANET zone is defined using the NTEM to PLANET weightings. If under 5% of a PLANET zone is mapped to a core or major city, the zone is labelled as "other".

- Ticket type (TT) to journey purpose conversion: PDFH 5.0 ticket-type to journey purpose conversion files, adjusted for the new PDFH 5.1 non-London segmentation, were used within EDGE and also in the post processing executable HS2GrowthFactors.exe. In order for consistency with DfT EDGE forecasting, the revised mapping was supplied directly from DfT.

Parameter changes between PDFH 5.0 and PDFH 5.1

Updates were required to external environment and intermodal competition elasticities due to the update from PDFH 5.0 and PDFH 5.1.

- External environment: some changes to elasticities have been necessitated by the new flow categories in PDFH 5.1 for non-London flows. The changes are summarised in Table 3-12. It is apparent that non-London inter-urban flows (>20 miles) have changed from being driven by GDP per capita at the origin to employment at the destination of the trip, which is consistent with the treatment of season tickets within other PDFH categories. This is expected to have an impact on commuting demand as long term GDP growth is substantially higher than employment growth, and employment growth elasticities are also lower. It should also be noted that long term elasticities, which the guidance recommends are applied from 2023/24 onwards, have been used for the entire forecast period, as the current version of EDGE cannot easily account for variable elasticities.

Table 3-12 Changes to External Environment Elasticities for non – London flows

Flow	TT	GDP	Employment	Population	Flow	TT	GDP	Employment	Population
PDFH 5.0		**5.0**	**5.0**	**5.0**	**PDFH 5.1**		**5.0**	**5.0**	**5.0**
Inter-urban	F	1.1	0	1	Core	F	1.2	0	1
Inter-urban	R	1.1	0	1	Core	R	1.2	0	1
Inter-urban	S	1.5	0	1	Core	S	0	1.3	0
Urban	F	0.85	0	1	Major	F	1.2	0	1
Urban	R	0.85	0	1	Major	R	1.2	0	1
Urban	S	0	1	0	Major	S	0	1.2	0
					Other	F	0.85	0	1
					Other	R	0.85	0	1
					Other	S	0	1.3	0

- Intermodal competition: WebTAG recommends that PDFH 5.1 elasticities should be used from Tables B2.1 – 2.6 (distinguished by ticket type) with the exception of car cost, as opposed to elasticities distinguished by journey purpose (PDFH 5.0 Table B2.7), which were used in PFMv4.3. This is expected to lead to an increase in business demand at the expense of leisure demand. In addition, Table 3-13 describes the changes to the elasticity values and the expected impact on the forecasts. It can been seen that elasticities have increased, which will lead to higher rail demand growth, as these demand drivers will increase with time. Removing air cost and headway is also expected to lead to higher rail growth, as these demand drivers decrease with time. It is expected that the greatest impact will be for business and leisure trips, as season ticket elasticities, which generally influence commuting demand, only change for car time.

Table 3-13 Changes to Inter-modal Competition Elasticities

Variable	Flow Group	PDFH 5.0	PDFH 5.1	Expected Impact
Car Time	ROC – LT, LT – ROC	0.3	0.7	Increase forecasts (all purposes)
	Non London-inter-urban	0.3	0.6	Increase forecasts (all purposes)
Bus Fares (non-seasons)	ROC – LT, LT – ROC	0.18	0.2	Increase forecasts (especially business and leisure trips)
	Non London-inter-urban	0.17	0.2	Increase forecasts (especially business and leisure trips)
Bus Time (non-seasons)	ROC – LT, LT – ROC	0.18	0.4	Increase forecasts (especially business and leisure trips)
	Non London-inter-urban	0.17	0.4	Increase forecasts (especially business and leisure trips)
Air Fares (non-seasons)	Various	Various	Removed	Increase forecasts (especially business and leisure trips)
Air Headway (non-seasons)	Various	Various	Removed	Increase forecasts (especially business and leisure trips)

Expected Impact
It is expected that overall demand will increase as a result of the move to WebTAG 2014 guidance, driven by an increase in business and leisure trips. Full and reduced ticket elasticities have increased for several intermodal competition drivers, whilst season ticket elasticities have stayed the same, with the exception of car time. Looking specifically at the external environment factors, the move from non-London seasons trips over 20 miles being driven by GDP per capita at the origin to employment at the destination will have a reducing effect on non-London seasons growth. This is because the long term growth in GDP is substantially higher than the growth in employment.

As season trips generally contain a very high proportion of commuting demand, it is anticipated that although overall demand may increase, commuting trips will see a reduction in demand. For this reason, it is expected that demand in the PS model will decrease, in contrast to the three other models, as PS contains a much higher proportion of commuting demand.

3.4.3. Impact on Forecasts

PLANET Long Distance
Table 3-14 below summarises the PLD matrix totals for the new rail demand forecasts for 2026/27, developed using the updated PDFH 5.1 elasticities and segmentation described above, but with no changes to the demand driver values, and compares these against the demand matrices from the NTEM case study.

Table 3-14 PLD Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday Trips)

Journey Purpose	NTEM Case Study	WebTAG 2014 Guidance	Difference	%
Commuting NCA	76,921	76,614	-307	-0.4%
Commuting CA from	235,096	232,128	-2,968	-1.3%
Commuting CA to	235,096	232,128	-2,968	-1.3%
Business NCA	-	-	-	-
Business CA from	126,448	133,462	7,014	5.5%
Business CA to	94,166	99,311	5,145	5.5%
Leisure NCA	117,329	123,934	6,605	5.6%
Leisure CA from	284,492	300,811	16,319	5.7%
Leisure CA to	208,936	220,879	11,943	5.7%
Total	**1,378,484**	**1,419,267**	**40,783**	**3.0%**

The table demonstrates that the number of forecast trips in PLD is 3.0% higher than the for the NTEM case study matrices with commuting seeing a decrease in demand whilst demand for business and leisure purposes seeing an increase. One of the reasons for the decrease in commuting demand can be attributed to the change in GDP/employment seasons elasticities for non-London trips.

For the update to WebTAG 2014 matrices, the number of trips over 100 miles in 2033/34 (290,313) lies closest to the target figure of 290,146 trips. Therefore, the second model forecast year has been determined to be 2033/34. This is earlier than the NTEM case study, and indeed PFM 4.3, which forecast a cap year of 2036/37. The rail demand forecast matrix totals for the cap year are presented in Table 3-15. The NTEM case study forecasts have been compared with the corresponding cap year forecasts for the WebTAG 2014-based matrices, interpolated to 2033/34 from the 2036/37 forecasts.

Table 3-15 PLD Rail Matrix Totals for the Cap Year by Journey Purpose (Weekday Trips)

Journey Purpose	NTEM Case Study (2036/37)	WebTAG 2014 Guidance (2033/34)	Difference	%
Commuting NCA	83,325	81,520	-1,805	-2.2%
Commuting CA from	281,140	262,979	-18,161	-6.5%
Commuting CA to	281,140	262,979	-18,161	-6.5%
Business NCA	-	-	-	-
Business CA from	156,593	159,991	3,398	2.2%
Business CA to	117,123	119,307	2,184	1.9%
Leisure NCA	131,681	139,424	7,743	5.9%
Leisure CA from	346,116	357,651	11,535	3.3%
Leisure CA to	255,562	263,575	8,013	3.1%
Total Cap Year	**1,652,680**	**1,647,426**	**-5,254**	**-0.3%**

It can be seen that, in a similar way to the 2026/27 forecasts, the update to WebTAG 2014 guidance has resulted in a slight overall decrease in trips in the PLD matrix with commuting trips decreasing in demand whilst business and leisure demand increases. As the overall level of demand in the cap year matrix for the WebTAG 2014 update is slightly lower, this shows that short distance demand (<100 miles) has reduced, given that long distance demand (>100 miles) for the cap year should be approximately the same.

Table 3-16 below show the demand change by regional sector in absolute and percentage terms. The largest increase in both absolute and relative terms is between London and East Midlands. Other notable increases include London – North West and London – West Midlands. Decreases in demand are observed between West Midlands and East Midlands, North West and East Midlands and North West and Yorkshire and Humber. It is apparent that the main increases in demand involve trips to/from London whilst regional trips often experience decreases.

Table 3-16 Comparison of WebTAG 2014 and NTEM Matrices (Cap Year Weekday Trips) – Absolute Differences

East Midlands (EM)	EM									
East of England (EE)	-520	EE								
London (LN)	1949		LN							
North East (NE)	5	14	86	NE						
North West (NW)	-1453	1	638	128	NW					
Scotland (SC)	11	21	23	163	285	SC				
South East (SE)	-406			13	22	13	SE			
South West (SW)	-13	-3	123	6	71	19	-114	SW		
Wales (WA)	2	-11	69	-16	34	-34	-61	-864	WA	
West Midlands (WM)	-1593	-3	652	44	-168	38	-833	-349	-106	WM
Yorks and Humber (YH)	-387	73	61	-289	-1398	99	-24	54	14	77

Regional Models

The forecast PS matrix totals for the cap years of 2033/34 and 2036/37, for the NTEM case study and the WebTAG 2014 updates respectively, are presented in Table 3-17.

Table 3-17 PS Rail Matrix Totals for the Cap Year by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	NTEM Case Study (2036/37)	WebTAG 2014 Guidance (2033/34)	Difference	%
Business PA	227,042	235,939	8,897	3.9%
Business AP	15,010	15,263	252	1.7%
Leisure PA	241,957	237,699	-4,258	-1.8%
Leisure AP	27,843	27,218	-625	-2.2%
Commuting PA	2,236,658	2,094,744	-141,915	-6.3%
Commuting AP	46,322	44,026	-2,296	-5.0%
Total Cap Year	**2,794,832**	**2,654,888**	**-139,944**	**-5.0%**

The absolute difference between the two forecasts indicates an overall reduction of 5% in the PS model, and the only journey purpose category with does not decrease is business trips. PLANET South has a very high proportion of short distance commuting trips. As the seasons elasticities have experienced a decrease for many of the parameters, this result is as expected. The increase in business demand at the expense of leisure demand is understood to be driven by the move from intermodal competition elasticities to vary by ticket type as opposed to journey purpose. The elasticities for bus fares, headway and journey time, and car journey time are lower for leisure trips, which reducing leisure demand for rail travel.

Table 3-18 below summarises the PM matrix totals for the new rail demand forecasts for the cap years of 2033/34 and 2036/37, for the NTEM case study and the WebTAG 2014 updates respectively.

Table 3-18 PM Rail Matrix Totals for the Cap Year by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	NTEM Case Study (2036/37)	WebTAG 2014 Guidance (2033/34)	Difference	%
Business CA	39,293	41,443	2,150	5.5%
Business NCA	6,515	6,986	471	7.2%
Leisure CA	32,633	34,218	1,584	4.9%
Leisure NCA	5,576	5,950	374	6.7%
Commuting CA	117,931	112,598	-5,333	-4.5%
Commuting NCA	22,856	22,214	-642	-2.8%
Total Cap Year	**224,804**	**223,409**	**-1,395**	**-0.6%**

It can be seen that the results for the respective cap years of 2036/37 for the NTEM case study and 2033/34 for WebTAG updates highlight an increase in the number of trips within business and leisure travel with contrary results observed for commuting trips. Overall the level of demand in the cap year matrix is slightly lower.

Table 3-19 below summarises the PN matrix totals for the cap years of 2033/34 and 2036/37, for the NTEM case study and the WebTAG 2014 updates respectively.

Table 3-19 PM Rail Matrix Totals for the Cap Year by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	NTEM Case Study (2036/37)	WebTAG 2014 Guidance (2033/34)	Difference	%
Business CA	39,293	41,443	2,150	5.5%
Business NCA	6,515	6,986	471	7.2%
Leisure CA	32,633	34,218	1,584	4.9%
Leisure NCA	5,576	5,950	374	6.7%
Commuting CA	117,931	112,598	-5,333	-4.5%
Commuting NCA	22,856	22,214	-642	-2.8%
Total Cap Year	**224,804**	**223,409**	**-1,395**	**-0.6%**

Again, there is a small decrease in the number of trips between the cap years of 2033/34 and 2036/37, with a decrease in the number of commuting trips, while business and leisure travel increase. This is a similar observation to the PLD and PM models.

Impact on Business Case

The following impacts on the HS2 Business Case can be observed as a result of the WebTAG updates:

- A higher rate of demand growth in long distance trips leads to an earlier cap year of 2033/34 where previously it was 2036/37. This is due to the overall higher elasticities especially within the inter-modal competition parameters.
- Demand growth is concentrated within business and leisure trips whilst commuting trips grow at a lower rate than the NTEM case study. This can be attributed to:
  - Seasons trips for non-London travel being driven by employment at the destination where previously it was GDP at the origin. GDP grows at a substantially higher rate than employment
  - The increases in inter-modal competition parameters are only applicable to full and reduced tickets
  - Seasons tickets tend to have a high proportion of commuting demand
- Demand growth is mainly concentrated in trips to/from London whilst many regional trips experience a slower rate of demand growth than previously. Again, this can mainly be attributed to an increase in inter-modal competition elasticities for Rest of Country – London flows and the move to employment driven seasons demand for non-London trips.

- The fact that the overall cap year demand in all four PLANET models is lower in the update to WebTAG 2014 compared to the NTEM case study suggests that while long distance trips are increasing, shorter distance regional demand is increasing at a slower rate.
- The BCR increases for Phase 1 compared to NTEM (1.44 versus 1.42) and decreases for Phase 2 (1.81 versus 1.83). One main reason for this is the concentration of demand growth within the Rest of Country – London flows and a reduction in regional trips.

3.5. Amendments to Existing Process

3.5.1. Justification

A number of amendments have been identified during the audit of PFMv4.3 and added to the Development Opportunities Log (DOL), or during the present update of the forecasting process. The work to update the rail demand forecasting process presents an opportunity to amend a number of these legacy issues. The amendments are expected to have a small impact on PLD, PM and PN. However, it is expected that there may be a more significant impact on PS matrices.

Six separate amendments are required which are summarised as follows:

1. New distance matrix for PLANET Long Distance (PLD);
2. PLANET South (PS) relative population driver and elasticities;
3. PS airport growth adjustment (DOL ID 117);
4. Car availability redistribution factors adjustment;
5. Rename PS zone 5013 in EDGE processing (DOL ID 95);
6. Review of fares elasticities used in EDGE.

In addition, a further amendment was made to the PDFH-PLANET correspondences following the audit of the previous step, incorporating the WebTAG updates.

3.5.2. Methodology

PLD Distance Matrix

Systra has provided Atkins with a new distance matrix for PLD, weighted using the current PLD base year demand for 2010/11/11. There are two applications of the PLD distance matrix in the demand forecasting process, which have both been updated as follows:

1. **Base data for PLD EDGE run**: a distance matrix is used in the EDGE run to determine which elasticity should be applied to each O-D flow, as some elasticities vary by trip distance. The distance matrix input has been updated to reflect the new distance matrix provided by Systra.
2. **Cap year calculation**: as the cap year is calculated based on the number of trips over 100 miles in the PLD demand matrix, the cap year spreadsheet developed in Task 8 has been updated with the new distance matrix.

PS Relative Population

During the update work for PFMv4.3 the population elasticity was erroneously changed to 1 for South East to London commuting trips, and therefore the population of the origin zone and the relative population was included as a driver of rail demand. Therefore the population and relative population elasticities needed to be updated so that there was no double counting of population growth, and that only relative population growth was applied to commuting trips. It is anticipated that this amendment may have a material impact on PS demand. This is due to the high proportion of commuting demand which was previously been uplifted by both population and relative population.

The relative population growth approach was also incorporated into the demand forecasting for all four PLANET models as part of this update, as PDFH recommends that relative population growth at the origin is a driver of commuting demand for non-London trips. This was achieved by adjusting the relative population elasticity for non-London commuting trips to 1 and expanding the relative population growth driver to include all NTEM zones.

PS Airport Growth (DOL ID 117)

The PLANET South model contains point zones (with no spatial representation), with the purpose of representing rail demand accessing airports. A review of this process used in the matrix development for PFMv4.3 revealed that the growth factors for the PLANET South airport zones were not updated with the latest air passenger forecasts supplied in autumn 2012 for use in EDGE, so there was an inconsistency between the EDGE forecasts and the airport adjustments. The growth factors have been updated to incorporate the air passenger forecasts for autumn 2012.

CA Redistribution Factors

To reflect increased car availability in future years, demand has to be redistributed from the non-car available (NCA) to the car available (CA) matrix. It has been found that the car availability factors for forecast years had been based on a base year of 2011 calendar year, as opposed to 2010/11, so one year of growth had not been included. Therefore the car availability factors have been updated so that a base year of 2010/11 is used instead of 2011.

PS Zone 5013 (DOL ID 95)

The following inputs to EDGE have been updated so that all references to zone 5013 are renamed "905013": This corrects an issue with the PFMv4.3 forecasts, where no growth factor was applied to zone 905013.

- PS base demand matrix
- PS distance matrix
- PS – NTEM correspondence
- PS – PDFH correspondence.

Fares Elasticities

The fares elasticities used previously in EDGE have been reviewed and compared with those used by DfT. Where there are differences, the fares elasticities have been changed to match the DfT values, unless there was clear evidence to the contrary. The differences between the elasticities used by Atkins and DfT, as well as the subsequent changes made by Atkins, are summarised in Table 3-20 below.

Table 3-20 Summary of Changes to Fares Elasticities

Driver	Flow Category	Ticket Type / Journey Purpose	Elasticity Used			PDFH Ref.	Comments
			Atkins	DfT	Change?		
Population	LT - LT	Commuting	1	0	No: retain 1	PDFH v5.1, Table B1.1	Elasticity of 1 applied to relative population only
Population	South East	Seasons	1	0	No: retain 1	PDFH v5.1, Table B1.2	Elasticity of 1 applied to relative population only
Car Cost	Airports	Commuting	0	0.25	No: retain 0	PDFH v5.0, Table B2.7	No commuting elasticity shown in PDFH
NR Fares	LT – ROC (< 20 miles)	F/R/S	-0.7	-0.6/-1/-0.6	Yes: Change to -0.6/-1/-0.6	No guidance	DfT has used (>20 mile) values from Table B2.3. Flow is redundant as would be within south east.
NR Fares	ROC – LT (< 20 miles)	F/R/S	-0.7	-0.66/-0.66/-0.3	Yes: Change to -0.66/-0.66/-0.3	No guidance	DfT has used ROSE – LT values. Flow is redundant as would be within south east.

NR Fares	ROC to/from LT (> 20 miles)	F/R	Cross-elasticities by distance	Conditional elasticities by distance	Yes	PDFH v4.0, Table B2.3	Same result expected as fares demand driver is uniform across the county
NR Fares	ROC to/from LT (> 20 miles)	Seasons	-0.7 (both directions)	-0.6 from London, -0.3 to London	Yes: Change to -0.6 from London, -0.3 to London	No guidance	DfT has used ROSE value, Atkins had used WebTAG 3.15.4 (April 2009) Annex A Table 3
NR Fares	Non-London Urban (< 20 miles)	Full	-0.4/-0.4/-0.6	-0.35	Yes: Change to -0.35	PDFH v4.0, Table B2.6	Atkins had used WebTAG 3.15.4 (April 2009) Annex A Table 3 to split by journey purpose
NR Fares	Non-London Urban (< 20 miles)	Reduced	-0.4/-0.4/-0.6	-0.9	Yes: Change to -0.9	PDFH v4.0, Table B2.6	Atkins had used WebTAG 3.15.4 (April 2009) Annex A Table 3
NR Fares	Non-London Urban (< 20 miles)	Seasons	-0.4	-0.6	Yes: Change to -0.6	PDFH v4.0, Table B2.6	Atkins had used conditional elasticity suggested below Table B2.6
NR Fares	Non-London Interurban (> 20 miles)	F/R/S	-0.9	-0.85	Yes: Change to -0.85	PDFH v4.0, Table B2.4/B2.5	DfT has used B2.5 (assumes proportion of first & full tickets >10%), Atkins had used B2.4 (assumes <10%)

PDFH – PLANET Correspondence

The zone correspondences for PLD and PN have been updated so that zones representing the Kirklees local authority area are re-labelled from “other” to “major”. This was an omission from the original correspondence, where the major city of Huddersfield was not matched to the local authority of Kirklees.

3.5.3. Impact on Forecasts

PLANET Long Distance

Table 3-21 below summarises the PLD matrix totals for the new rail demand forecasts for 2026/27, developed including the Amendments to previous approach described above, and compares these against the demand matrices from the update to WebTAG 2014 guidance. The table demonstrates that the amendments to previous approach step has a slight reducing impact on PLD rail demand with decrease of 1.2% of trips.

Table 3-21 PLD Rail Matrix Totals for 2026/27 (Weekday Trips)

Journey Purpose	WebTAG 2014	Amendments	Difference	%
Commuting NCA	76,614	75,188	-1,426	-1.9%
Commuting CA from	232,128	229,461	-2,667	-1.1%
Commuting CA to	232,128	229,461	-2,667	-1.1%
Business NCA	-	-	-	-
Business CA from	133,462	133,360	-102	-0.1%

Business CA to	99,311	99,316	5	0.0%
Leisure NCA	123,934	121,010	-2,924	-2.4%
Leisure CA from	300,811	296,464	-4,347	-1.4%
Leisure CA to	220,879	217,956	-2,923	-1.3%
Total	**1,419,267**	**1,402,217**	**-17,050**	**-1.2%**

The cap year remains at 2033/34 with the number of long-distance trips remaining similar between the two updates. Table 3-22 below details the level of demand in PLD for the WebTAG update and the amendments to previous approach step in the 2033/34. It can be seen that, in a similar way to the 2026/27 forecasts, the amendments to previous approach has resulted in a slight decrease of 1.7% of trips in the PLD matrix. All trip purposes have reduced in demand.

Table 3-22 PLD Rail Matrix Totals for the Cap Year (Weekday Trips)

Journey Purpose	WebTAG 2014	Amendments	Difference	%
Commuting NCA	81,520	79,570	-1,949	-2.4%
Commuting CA from	262,979	258,824	-4,155	-1.6%
Commuting CA to	262,979	258,824	-4,156	-1.6%
Business NCA	-	-	-	-
Business CA from	159,991	159,786	-205	-0.1%
Business CA to	119,307	119,291	-16	0.0%
Leisure NCA	139,424	135,176	-4,248	-3.0%
Leisure CA from	357,651	350,004	-7,647	-2.1%
Leisure CA to	263,575	258,328	-5,247	-2.0%
Total	**1,647,426**	**1,619,803**	**-27,623**	**-1.7%**

Regional Models

Table 3-23 below summarise the PS matrix totals for the new rail demand forecasts for the cap year, developed including the amendments to previous approach described above, and compares these against the demand matrices from the update to WebTAG 2014 guidance. Contrary to the results observed in PLD, the amendments to previous approach step has a material impact on the PS demand matrices with the number of weekday trips decreasing by 13.1%. This result is as anticipated due to the high proportion of London commuting demand within PLANET South. The table below shows that commuting demand experiences a significant reduction in demand with business and leisure purposes only showing a small reduction as expected.

Table 3-23 PS Rail Matrix Totals for the Cap Year (Weekday Trips)

Journey Purpose	WebTAG 2014	Amendments	Difference	%
Business PA	235,939	233,920	-2,019	-0.9%
Business AP	15,263	14,984	-279	-1.8%
Leisure PA	237,699	235,633	-2,066	-0.9%
Leisure AP	27,218	26,738	-480	-1.8%
Commuting PA	2,094,744	1,757,580	-337,163	-16.1%
Commuting AP	44,026	37,919	-6,107	-13.9%
Total	**2,654,888**	**2,306,774**	**-348,114**	**-13.1%**

Table 3-24 below summarises the PM matrix totals for the new rail demand forecasts for the cap year, developed using the amendments to previous approach and compared to the WebTAG 2014 update. Similar to PLD, the amendments do not have a material impact on the matrix totals with a reduction of 2%.

Table 3-24 PM Rail Matrix Totals for the Cap Year (Weekday Trips)

Journey Purpose	WebTAG 2014	Amendments	Difference	%
Business CA	17,334	17,188	-147	-0.8%
Business NCA	2,142	2,116	-26	-1.2%
Leisure CA	15,944	15,504	-440	-2.8%
Leisure NCA	2,144	2,079	-65	-3.0%
Commuting CA	80,204	78,653	-1,551	-1.9%
Commuting NCA	12,053	11,728	-325	-2.7%
Total	**129,822**	**127,268**	**-2,554**	**-2.0%**

Table 3-25 summarises the PN matrix totals for the cap year, developed using the amendments to previous process. In a similar way to PLD and PM, the amendments do not have a material impact on the matrix totals with a reduction of 1.5%.

Table 3-25 PN Rail Matrix Totals for the Cap Year (Weekday Trips)

Journey Purpose	WebTAG 2014	Amendments	Difference	%
Business CA	41,443	40,988	-455	-1.1%
Business NCA	6,986	6,929	-57	-0.8%
Leisure CA	34,218	33,262	-956	-2.8%
Leisure NCA	5,950	5,801	-149	-2.5%
Commuting CA	112,598	111,121	-1,477	-1.3%
Commuting NCA	22,214	21,889	-325	-1.5%
Total	**223,409**	**219,990**	**-3,419**	**-1.5%**

Impact on Business Case

The amendments to previous process reduce the BCR from 1.44 to 1.41 in Phase 1 whilst it remains unchanged at 1.81 in Phase 2 when compared with the update to WebTAG 2014 guidance. This reduction in Phase 1 BCR can largely be attributed to the reduction in PS demand as a result of the correction to population and relative population elasticities.

3.6. Revised Economic Forecasts

3.6.1. Justification

In HS2 Ltd received updated demand driver input data from the Department for Transport (DfT) for use in the High Speed Two (HS2) business case. Atkins was required to produce updated future year rail demand matrices for use in the PLANET Framework Model (PFM) suite, based on the latest input data, and in line with the latest WebTAG guidance.

3.6.2. Methodology

The exogenous assumptions documentation supplied by DfT alongside both the October 2014 and October 2012 forecasts has been consulted and a list of the changes in driver forecasting methodology/sources is provided in Table 3-26 below.

Table 3-26 Change in demand growth drivers between October 2012 and October 2014

Demand Driver	October 2012 Assumption	October 2014 Assumption	Change	Comments
Population	ONS national (Oct 11, 2010/11 base), CEBR regional shares (July 12)	ONS national (Nov 13, 2012 base), CEBR regional shares (Aug 14)	Yes	
GDP per Capita	OBR national GDP (Mar 12 short term, July 12 long term), CEBR regional shares (July 12)	OBR national (Mar 14 short term, July 14 long term), CEBR regional shares (Aug 14)	Yes	
Employment	OBR national (Mar 12 short term, July 11 long term), OEF regional shares (Mar 12)	OBR national (Mar 14 short term, July 14 long term), CEBR regional shares (Aug 14)	Yes	Smoothing of short term employment growth rates has been applied for compatibility with long term forecasts
Car Ownership	TEMPRO 6.2	TEMPRO 6.2	No	
Car Time	NTM runs, no growth from 2035/36	NTM runs, no growth from 2034/35	Yes	Demand cap consistent with WebTAG 2014
Car Cost	WebTAG 2012, no growth from 2035/36	WebTAG 2014, no growth from 2034/35	Yes	Now car cost rather than just fuel cost, as stipulated in WebTAG 2014, revised demand cap
Air Cost	DfT Aviation Model (2011)	Not used	Yes	Parameters are no longer defined in PDFH 5.1 – it was agreed with DfT to exclude these drivers
Air Headway	DfT Aviation Model (2011)	Not used	Yes	
Air Passengers	DfT Aviation Model (2011)	DfT Aviation Model (2013)	Yes	
Bus Time	NTM runs, no growth from 2035/36	NTM runs, no growth from 2034/35	Yes	Demand cap consistent with WebTAG 2014
Bus Cost	Extrapolation of past trends, no growth from 2035/36	Extrapolation of past trends, no growth from 2034/35	Yes	Demand cap consistent with WebTAG 2014
Bus Headway			Yes	
LUL Fares & NR Fares	RPI+1 for all years	RPI+1 except RPI+0 in 2014 & 2015	Yes	New simplified methodology, no longer deflating by RPI within year

The following sections present the demand growth for each of the drivers received from the DfT and compare these with the previous drivers received in October 2012. Note the charts show data for October 2012 and October 2014 (labelled Sep-14).

Population

Figure 3-3 Population Growth – UK

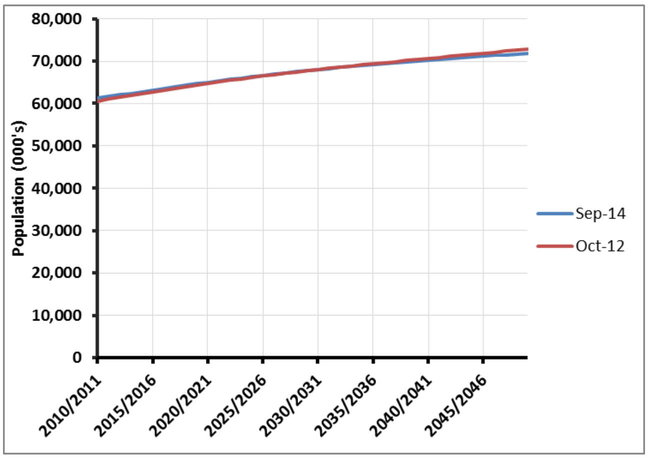
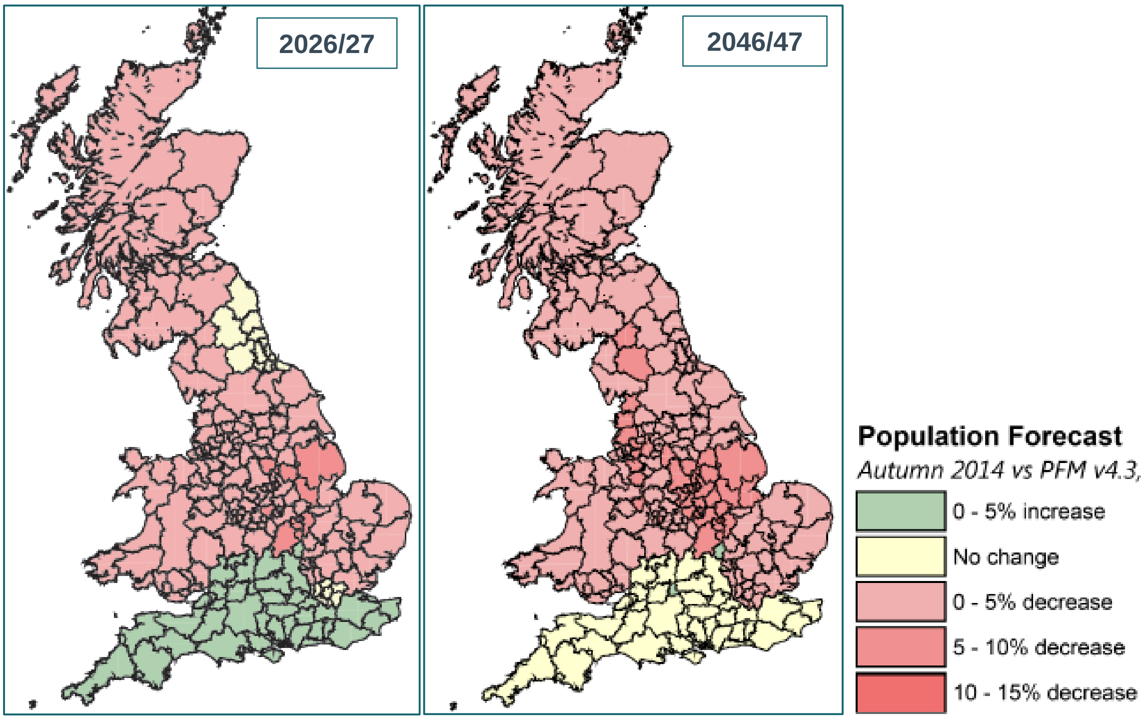


Figure 3-3 presents the UK population to the year 2049/50 from the ONS low migration projection (OBR GDP forecasts are also based on the low migration projection). For the October 2014 forecasts, the population is projected to grow from a higher base at a slower rate, but remains higher than the October 2012 estimations until the year 2042 due to increased base levels of population from the 2011 census. The long term UK population size in 2049/50 is lower than previously estimated.

Figure 3-4 illustrates the regional variation in the change in population forecasts for 2026/27 and 2046/47, based on CEBR forecasts. The data have been aggregated to PLANET Long Distance (PLD) zones for clarity. The figure demonstrates that population forecasts are generally higher in the south of England and lower in the rest of the country, although there are several exceptions to this trend.

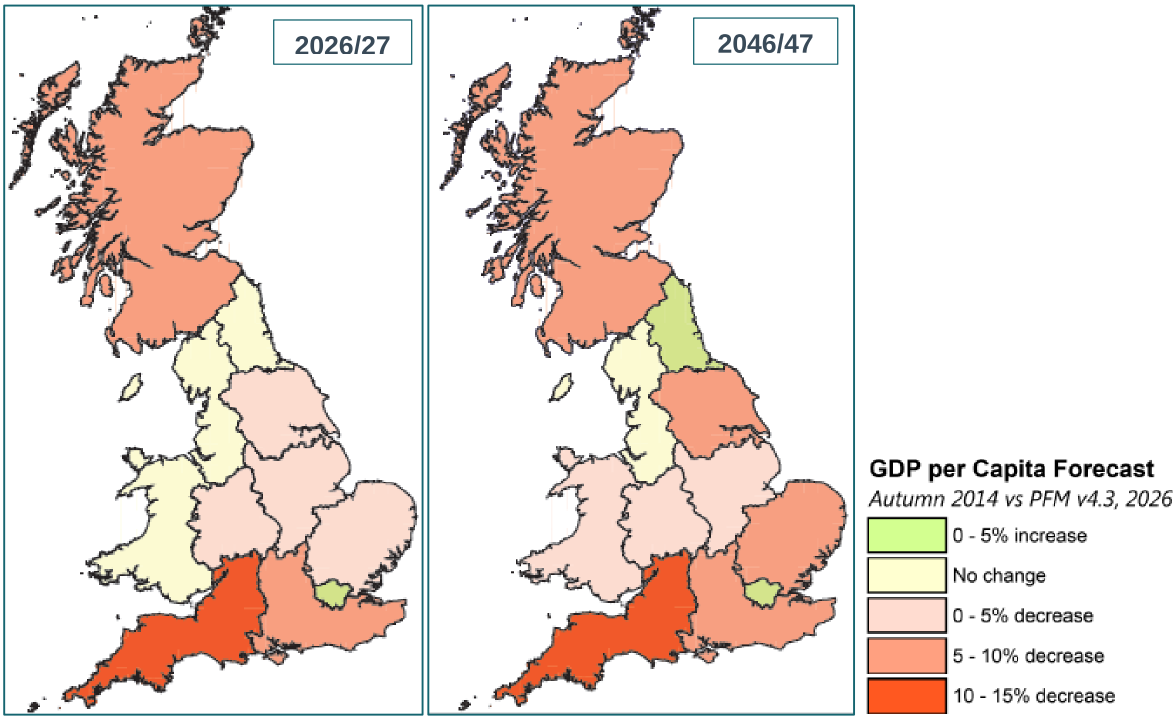
Figure 3-4 Population – Regional variation vs October 2012 (2026/27 & 2046/47)



GDP per Capita

Figure 3-5 presents the regional forecasts of GDP per capita for 2026/27 and 2046/47 compared with the previous forecasts from October 2012. The GDP per capita forecasts are supplied as an average for each Government Office Region. It can be seen that for the majority of regions to be served by HS2, GDP per Capita is forecast to be lower, with the exception of London and the North East of England.

Figure 3-5 GDP per capita – Regional variation vs October 2012 (2026/27 & 2046/47)



Employment

Figure 3-6 Employment Growth – UK

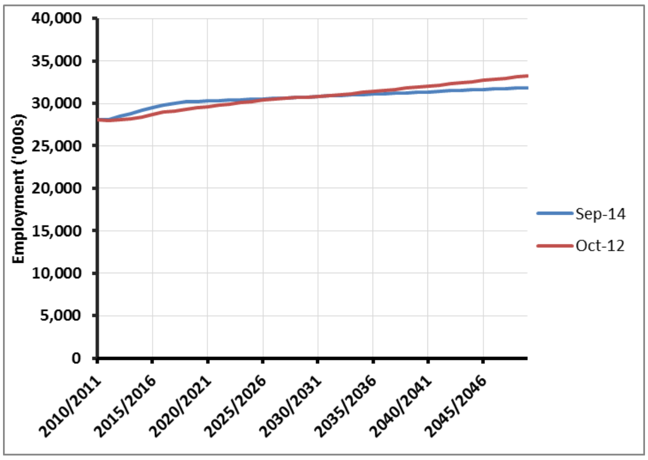
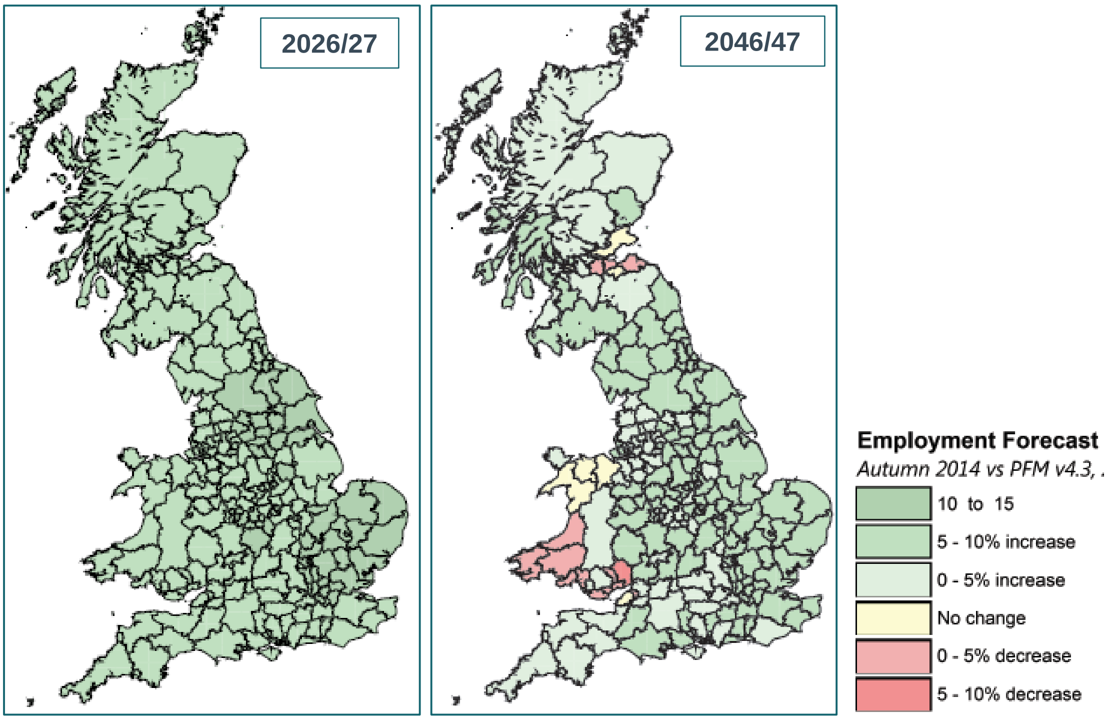


Figure 3-6 presents the UK employment growth forecasts to the year 2049/50 from the OBR data sources. For the October 2014 forecasts, employment is predicted to grow at a slightly higher rate initially, before slowing from 2018/19 onwards, so that the number employed becomes lower than the October 2012 estimations by approximately 2035/36.

The slight kink observed in the October 2014 employment curve arises from the use of different sources for short-term (to 2018/19) and long-term (to 2060/61) forecasts. As the December 2013 OBR Economic and Fiscal Outlook estimations predict faster-rising short-term employment levels than the previously published long-term OBR Fiscal Sustainability Report forecasts from July 2013, the growth rate has been "smoothed" after 2018/19 in order to reach the same long-term forecast level in year 2060/61 as the long-term forecasts.

Figure 3-7 illustrates the regional variation in the change in employment forecasts for 2026/27 and 2046/47, which are based on CEBR forecasts, again aggregated to PLANET Long Distance (PLD) zones. The figure demonstrates that employment forecasts are generally higher across the country, although there are a few exceptions to this trend, in parts of Wales and Lothian.

Figure 3-7 Employment – Regional variation vs October 2012 (2026/27 & 2046/47)[6]



Car Ownership

The October 2014 forecasts of the proportion of households without a car are unchanged from the previous forecasts.

Car Journey Time

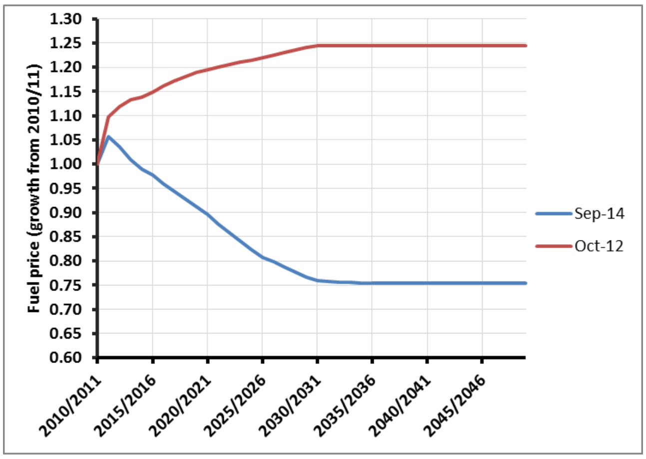
Although the growth rates are unchanged, a slight difference is observed between the October 2012 and October 2014 forecasts, due to capping growth a year earlier in 2034/35 for consistency with the latest WebTAG databook.

Car Cost

Figure 3-8 presents the forecasts of car cost for travel between London and the rest of Britain. October 2014 forecasts are based on WebTAG (2013), and take into account additional elements of car cost including fuel efficiency. It supersedes the previous indicator of car cost form October 2012, which included only fuel prices (based upon DECC's Energy price forecasts and assumed Treasury Taxation policy). As a result there is a substantial divergence between the forecasts, with the October 2014 forecasts significantly lower than the previous forecasts. Both forecasts are capped from 2031/32 onwards.

[6] Please note that Figure 3-7 is based on the previous assumption of short-term national employment growth. Please see Section 4.2.2 for details of the revised employment assumptions. It should be noted that this will not have a material impact on the distribution of employment growth between individual NTEM zones.

Figure 3-8 Car Costs – between ROC and LT



Air Cost & Headway

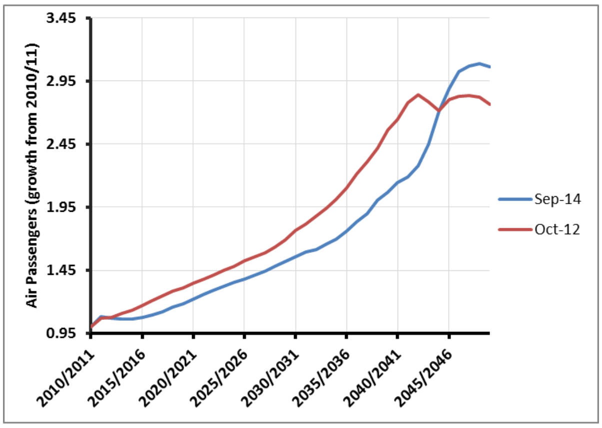
The forecasts for air cost and headway remain unchanged since October 2012. In general, costs steadily decrease in the long term. Note that air costs are no longer required as an input to rail forecasting as specified in PDFH 5.1. Therefore the removal of the decline in air costs is anticipated to have a positive impact on forecasts of rail demand.

Air Passengers

Forecasts of domestic air passenger growth for the key airports that are relevant to demand for the future HS2 network are presented in Figure 3-9 to Figure 3-13. Manchester Airport forecasts follow a similar upward trend to the October 2012 forecasts, however the growth in air passengers in Manchester are lower than previously estimated until 2044/45. Similarly to Manchester, Birmingham Airport has lower forecasts of air passenger demand initially, but forecasts are now anticipated to continue increasing steadily beyond 2037/38 so that by 2049/50 forecasts are substantially higher.

Forecasts for London’s airports introduce dissimilar changes in growth across the different airports. Heathrow Airport growth is expected to follow a similar general trend than for the October 2012 forecasts, but with lower growth. The October 2014 data indicates that Gatwick Airport will not experience substantial growth over the period, which compares dramatically with the October 2012 forecasts, which predicted growth of almost 300% by 2035/36. Stansted is the only London airport to have an increase in demand growth compared with the previous forecasts. Demand for Stansted Airport is estimated to grow faster during the period 2013/14 to 2030/31, before levelling off in a similar fashion to the October 2012 forecasts.

Figure 3-9 Air Forecasts – Manchester



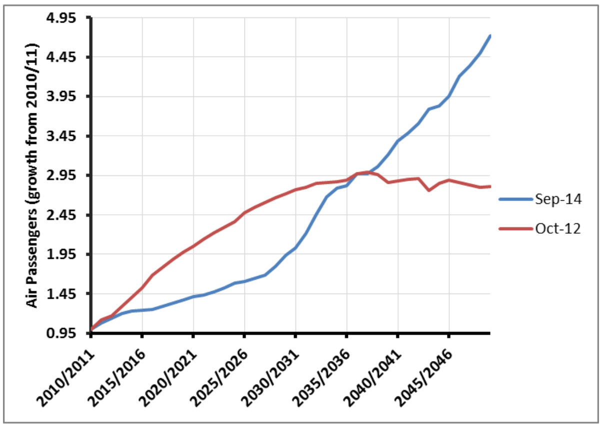


Figure 3-10 Air Forecasts – Birmingham

Figure 3-11 Air Forecasts – Gatwick

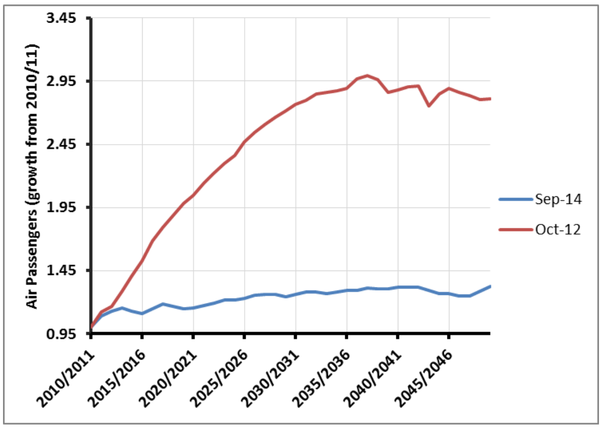


Figure 3-13 Air Forecasts – Heathrow

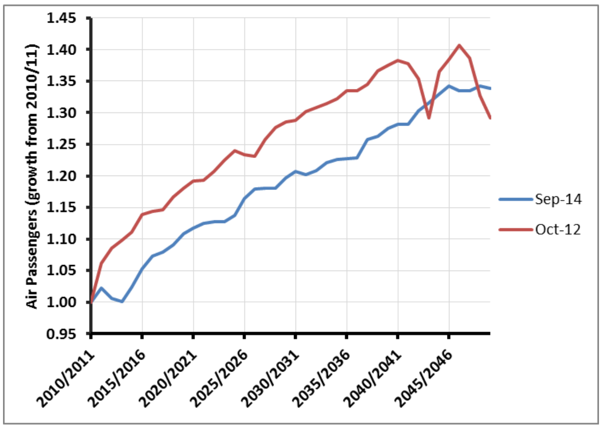
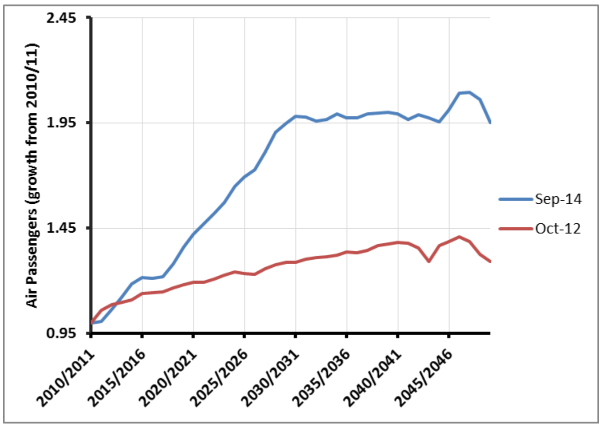


Figure 3-12 Air Forecasts – Stansted



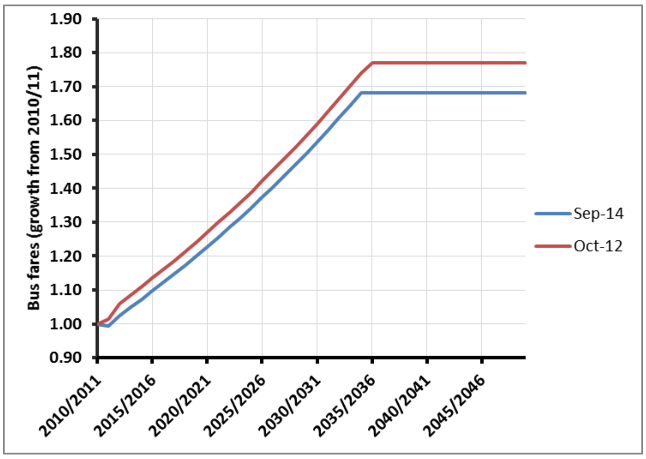
Bus Journey Time

Bus journey time growth rates are unchanged from the October 2012 forecasts. As with car journey time, a slight difference is observed between the October 2012 and October 2014 forecasts, due to capping growth a year earlier in 2034/35 for consistency with the latest WebTAG databook.

Bus Cost

Figure 3-14 presents the bus fares forecast for travel between London and the rest of Britain. The forecasts for October 2014 show a similar trend to those of October 2012, with steady growth initially then remaining at the same growth value for the remaining years. However, the October 2014 forecasts are lower than the previous forecasts and are capped in 2034/35, rather than in 2035/36, for consistency with WebTAG 2014.

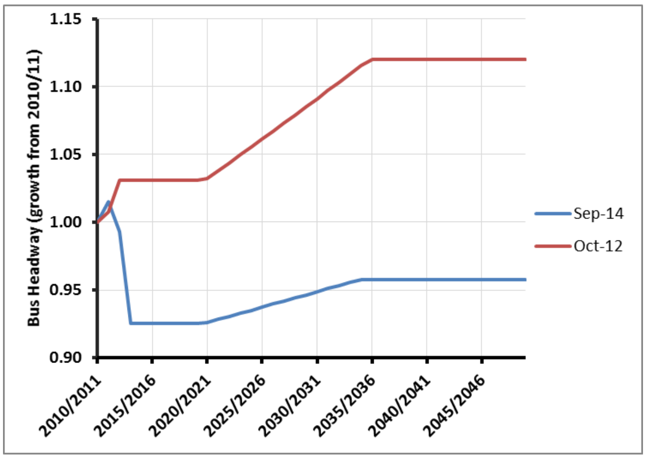
Figure 3-14 Bus Cost – between ROC and LT



Bus Headway

Figure 3-15 shows the forecasts for bus headway between London and the rest of Great Britain. The graph reveals substantial changes in the growth in bus headway between the October 2014 and October 2012 forecasts. While the October 2012 data predicted an overall growth in headway, the October 2014 data exhibits an overall decrease. Bus headway is anticipated to peak in 2011/12 and then decrease sharply to the year 2013/14 in current forecasts. The DfT have confirmed that this change to the forecast is due to changes in bus subsidies, following a request for clarification. Headway remains at the same level until 2020/21 before growing gradually to the demand cap in 2034/35. Note that the demand cap is a year earlier for consistency with WebTAG 2014.

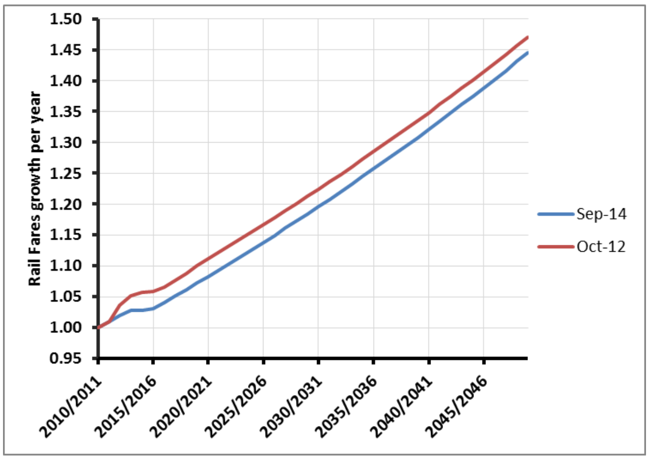
Figure 3-15 Bus Headway – between ROC and LT



National Rail & London Underground Fares

Figure 3-16 shows the expected growth in national rail fares. The forecasts of the fares growth are lower in October 2014 than those of October 2012, though the growth is identical from 2015/16 onwards. This can be directly linked to the government policy to freeze rail fares growth to RPI+0% during the 2014 and 2015 calendar years, lower than the previous cap of RPI+1% which was assumed in the October 2012 data. The growth in London Underground fares is identical to the forecast of National Rail fares growth.

Figure 3-16 National Rail Fares



Expected Impact

Table 3-27 summarises the changes which arise from the updated forecasts of October 2014 in comparison to the previous data of October 2012. According to the forecast trends for each driver, overall rail demand growth is anticipated to be slightly lower than previous forecasts. This is due to reduced car and bus cost forecasts, as well as reduced GDP and population forecasts for the north, although these will be offset to some extent by reduced rail fares forecast for 2014 and 2015 and the increase in short term employment forecasts.

Table 3-27 Summary of the Demand Drivers and their Expected Impacts

Demand Driver	Comparison with October 2012 forecasts	Expected impact on HS2 demand growth
Population	The UK population forecasts are similar overall, with lower forecasts for cities served by HS2 in the north and an increase for London	▼There will be lower rail demand to London and between cities in the north, although there will be higher demand from London to these cities
Employment	Overall the short term employment forecasts are higher across the UK and the HS2 cities	▲Rail demand is expected to be higher as employment rises
GDP per Capita	GDP forecasts are similar overall, with lower forecasts for HS2 cities in the north, except Manchester, and an increase for London	▼Reduced demand into London and between cities in the north, except Manchester, and increased demand from London
Car Ownership	No change	-
Car Journey Time	Growth cap one year earlier	▼A slight reduction in rail demand is expected
Car Cost	Forecasts of car cost are lower, due to accounting for improved fuel efficiency	▼A reduction in car costs would induce a reduction in long distance rail demand
Air Cost	No longer used	▲Rail demand is expected to be higher as the forecast reduction in air cost is no longer incorporated in the demand forecasting
Air Headway	No longer used	▲ Rail demand is expected to be higher as the forecast reduction in air headway is no longer incorporated in the demand forecasting
Air Passengers	Overall there is a long term increase in non-London airport growth, while the growth in London airports is lower	■Overall impact expected to be negligible due to low elasticities for key HS2 flows
Bus Journey Time	Growth cap one year earlier	▼A slight reduction in rail demand is expected
Bus Cost	The bus cost forecasts are lower	▼Reduction in rail demand, as bus fares become cheaper
Bus Headway	The bus headway forecasts are lower	▼Reduction in rail demand, due to the increased frequency of long distance bus services
National Rail Fares	Rail fares growth for 2014 and 2015 has fallen by 1% per year	▲Reduced rail fares will lead to an increase in rail demand
LUL Fares	The LUL fares forecasts indicate lower fares than previously	■A decrease in LUL fares would be expected to result in a small reduction in rail demand within the Greater London area, although the impact on long distance flows relevant to HS2 will be negligible

3.6.3. Impact on Forecasts

PLANET Long Distance

Table 3-28 below summarises the PLD matrix totals for the new rail demand forecast for 2026/27, developed using the updated October 2014 forecasts for the demand drivers described above, and compares these against the demand matrices from the amendments increment.

It is shown that the number of forecast trips in PLD is substantially lower for 2026/27 than the matrices obtained from the amendments to previous process step: there is on overall decrease of over 15% observed regardless of the journey purpose. The lower demand forecasts are driven by lower growth in GDP per capita and population for all regions except London, as well as lower car and bus costs. For the October 2014 forecasts, the number of trips over 100 miles in 2040/41 (291,286) lies closest to the target figure of 290,146 trips. Therefore, the second model forecast year has been determined to be 2040/41. This is seven years later than the previous amendments step, which forecast a cap year of 2033/34.

Table 3-28 PLD Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	Amendments (2026/27)	Sept 14 Forecasts (2026/27)	Difference	%
Commuting NCA	75,188	63,797	-11,391	-15.2%
Commuting CA from	229,461	195,181	-34,280	-14.9%
Commuting CA to	229,461	195,181	-34,280	-14.9%
Business NCA	-	0	0	-
Business CA from	133,360	113,704	-19,656	-14.7%
Business CA to	99,316	84,919	-14,397	-14.5%
Leisure NCA	121,010	101,600	-19,410	-16.0%
Leisure CA from	296,464	248,113	-48,352	-16.3%
Leisure CA to	217,956	182,571	-35,385	-16.2%
Total	**1,402,217**	**1,185,067**	**-217,150**	**-15.5%**

The rail demand forecast matrix totals for the cap year are presented in Table 3-29. An overall decrease in demand can be seen from the revision to October 2014 forecasts, especially for the two ‘non-car availability’ categories.’ This larger relative reduction in non-car available demand is a result of the post-EDGE car availability adjustment. By 2040/41 non-car ownership rates will have decreased compared with 2033/34; therefore smaller proportions of demand are assigned to the non-car available matrices in the October 2014 cap year compared with the amendments cap year.

Table 3-29 PLD Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	Amendments (2033/34)	Sept 14 Forecasts (2040/41)	Difference	%
Commuting NCA	79,570	68,024	-11,546	-14.5%
Commuting CA from	258,824	237,905	-20,918	-8.1%
Commuting CA to	258,824	237,905	-20,918	-8.1%
Business NCA	-	0	0	-
Business CA from	159,786	156,058	-3,728	-2.3%
Business CA to	119,291	117,040	-2,251	-1.9%
Leisure NCA	135,176	120,956	-14,220	-10.5%
Leisure CA from	350,004	332,939	-17,065	-4.9%
Leisure CA to	258,328	246,666	-11,662	-4.5%
Total	**1,619,803**	**1,517,493**	**-102,309**	**-6.3%**

As the number of long distance trips over 100 miles in the cap year for the two forecasts is broadly similar, the overall decrease in cap year demand for the October 2014 highlights a decline in the number of short distance trips. This is attributable to the substantial decline in car cost forecasts, as well as lower growth in bus fares and headway. As elasticities for bus fares have increased as part of the 2014 WebTAG update, this will also increase the impact of lower bus fares growth.

Table 3-30 shows the regional aggregated absolute differences between the October 2014 forecasts and the amendments step. The tables illustrate that the largest increases in demand are for trips involving London with most regional trips forecast to decrease. Notable decreases include trips from Yorkshire and Humber to North West and West Midlands to East Midlands.

Table 3-30 Change in the number of daily trips between October 14 Forecasts and Amendments (Cap Years, Sept 14 2040/41, Amendments 2033/34)

East Midlands (EM)	EM									
East of England (EE)	-474	EE								
London (LN)	868		LN							
North East (NE)	-56	-34	651	NE						
North West (NW)	-1280	-110	2003	-116	NW					
Scotland (SC)	-81	-68	59	-284	-533	SC				
South East (SE)	-456			-33	-253	-67	SE			
South West (SW)	-138	-6	-82	-23	-171	-41	-67	SW		
Wales (WA)	-38	-20	702	-5	-509	-16	-97	-515	WA	
West Midlands (WM)	-1422	-120	2133	-26	-902	-87	-515	-470	-268	WM
Yorks & Humber (YH)	-1256	-133	1122	-353	-1631	-239	-125	-110	-21	-175

Regional Models

Table 3-31 and Table 3-32 present the PS matrix totals for 2026/27 and the cap years (2033/34 for amendments to previous process and 2040/41 for October 2014 demand drivers). PS demand is forecast to be 4.7% lower in 2026/27 but 1.2% higher in 2026/27the cap year. 2026/27In the cap year, demand is higher for business and leisure trips as there are 7 more years of growth. The proportion of commuting demand in the cap year matrix is lower than for 2026/27 due to the smoothing of the employment forecasts for consistency with long term employment growth estimates.

Table 3-31 PS Rail Matrix Totals for 2026/27 by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	Amendments (2026/27)	Sept 14 Forecasts (2026/27)	Difference	%
2026/27 Business PA	192,135	181,759	-10,376	-5.4%
2026/27 Business AP	12,405	11,626	-778	-6.3%
2026/27 Leisure PA	196,480	186,445	-10,034	-5.1%
2026/27 Leisure AP	22,664	21,252	-1,412	-6.2%
2026/27 Commuting PA	1,645,967	1,571,492	-74,475	-4.5%
2026/27 Commuting AP	35,109	33,144	-1965	-5.6%
Total 2026/27	**2,104,759**	**2,005,718**	**-99,041**	**-4.7%**

Table 3-32 PS Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	Amendments (2033/34)2026/27	Sept 14 Forecasts (2040/41)2026/27	Difference	%
CY Business PA	233,920	263,510	29,590	12.6%
CY Business AP	14,984	16,334	1,349	9.0%
CY Leisure PA	235,633	258,037	22,404	9.5%
CY Leisure AP	26,738	28,426	1,688	6.3%
CY Commuting PA	1,757,580	1,730,696	-26,884	-1.5%
CY Commuting AP	37,919	37,258	-661	-1.7%
Total CY	**2,306,774**	**2,334,260**	**27,486**	**1.2%**

Table 3-33 below presents the PM demand matrix totals of the October 2012 (amendments step) and October 2014 drivers for the respective cap years (2033/34 for amendments and 2040/41 for October 2014). The October 2014 demand forecasts result in an 8.3% decrease in trips with the non-car available categories being the most affected for the same reasons as the PLD matrices described earlier.

Table 3-33 PM Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	Amendments (2033/34)	Sept 14 Forecasts (2040/41)	Difference	%
Business CA	17,188	15,960	-1,227	-7.1%
Business NCA	2,116	1,872	-245	-11.6%
Leisure CA	15,504	14,373	-1,131	-7.3%
Leisure NCA	2,079	1,832	-248	-11.9%
Commuting CA	78,653	72,485	-6,168	-7.8%
Commuting NCA	11,728	10,151	-1,577	-13.4%
Total	**127,268**	**116,672**	**-10,596**	**-8.3%**

Table 3-34 presents the PN matrix totals for the October 2012 drivers (amendments step) and the October 2014 drivers for the respective cap years (2033/34 for amendments and 2040/41 for October 2014). The October 2014 demand forecasts are just under 7.2% lower in the cap year than the October 2012 drivers, with all trip purposes decreasing in demand, most notably the non-car available category in the cap year, as with the PLD and PM forecasts.

Table 3-34 PN Rail Matrix Totals for the Cap years by Journey Purpose (Weekday AM Peak Trips)

Journey Purpose	Amendments (2033/34)	Sept 14 Forecasts (2040/41)	Difference	%
Business CA	40,988	39,355	-1,633	-4.0%
Business NCA	6,929	6,243	-686	-9.9%
Leisure CA	33,262	31,949	-1,313	-3.9%
Leisure NCA	5,801	5,231	-570	-9.8%
Commuting CA	111,121	102,428	-8,694	-7.8%
Commuting NCA	21,889	19,016	-2,873	-13.1%
Total	**219,990**	**204,222**	**-15,768**	**-7.2%**

4. Rail Forecasts PFMv5.2: Revised Fares Test

4.1. Justification

In May 2015, HS2 Ltd. requested that Atkins revise the demand matrices for PFM to reflect the indication in the Conservative Party manifesto that fares will rise at a rate of RPI+0% for the duration of the new Parliament (until 2020). This has now been agreed to form the central case demand scenario going forward, and will be known as PFMv5.2.

4.2. Methodology

The rail demand matrices reported elsewhere in this document assume a rail fares (and LUL fares) growth scenario of RPI+1 from 2016 onwards; the new scenario assumes RPI+0 from 2016/17 to 2020/21 financial years, followed by RPI+1. The change in fares assumptions will affect the rate of demand growth on the rail network, and could also change the year in which the demand cap occurs.

Table 4-1 below summaries the fares growth index above RPI from 2010/11 through to 2026/27 for the two scenarios (rounded to the nearest 1%).

Table 4-1 Summary of Fares Index for each Scenario

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Previous Fares Scenario	1.00	1.01	1.02	1.03	1.03	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.12	1.13	1.14	1.15
Revised Fares Scenario	1.00	1.01	1.02	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.05	1.06	1.07	1.08	1.09

4.3. Impact on Forecasts

Table 4-2 below summarises the masked PLD matrix totals for the rail demand forecasts in 2026/27. For context, these are compared against the PFMv5.1 demand matrices.

Table 4-2 Rail Matrix Totals for 2026/27/27 by Journey Purpose for Each Scenario

Journey purpose	PFMv5.1 Reference Case	PFMv5.2 Fares Scenario	Difference	%
Commuting NCA	63,797	65,834	2,037	3.2%
Commuting CA from	195,181	201,614	6,433	3.3%
Commuting CA to	195,181	201,614	6,433	3.3%
Business NCA	-	-	-	-
Business CA from	113,704	118,406	4,701	4.1%
Business CA to	84,919	88,507	3,588	4.2%
Leisure NCA	101,600	105,826	4,226	4.2%
Leisure CA from	248,113	258,374	10,261	4.1%
Leisure CA to	182,571	190,154	7,583	4.2%
Total	**1,185,067**	**1,230,328**	**45,262**	**3.8%**

The demand in 2026/27 increases as fares growth decreases, due to the rail fares demand driver being subjected to a negative demand elasticity. Business travel is more sensitive to changes in fares, with commuting demand being the least sensitive.

Regional Comparison

Table 4-3 shows a comparison of the total demand change in daily trips for each of the Government Office Regions compared with the reference case in in 2026/27. Note that this corresponds to the masked demand.

The figure below suggest that the change in fares has an almost homogenous impact on all regions throughout Great Britain, except for the London area which is more sensitive to a change in fares. The central fares scenario shows an increase in demand of 3-6% compared with the reference case.

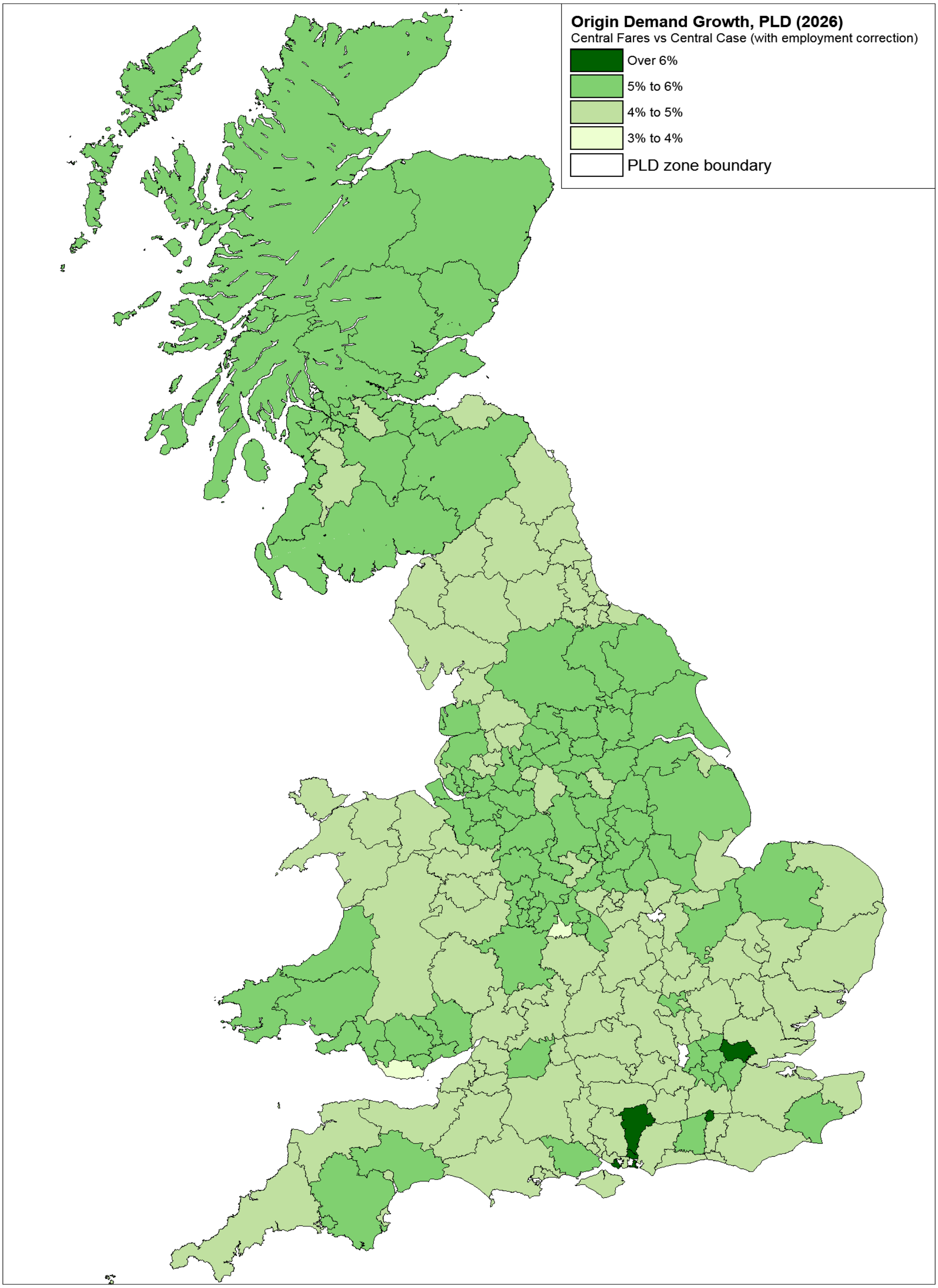
Table 4-3 2026/27 Change in Daily Trips: New Fares Scenario vs Reference Case

	EM	EE	LN	NE	NW	SC	SE	SW	WA	WM	YH
East Midlands (EM)	4%										
East of England (EE)	4%										
London (LN)	5%										
North East (NE)	4%	4%	5%	3%							
North West (NW)	4%	4%	5%	4%	4%						
Scotland (SC)	4%	4%	6%	4%	4%						
South East (SE)	4%			4%	4%	4%					
South West (SW)	4%	4%	5%	4%	4%	4%	4%	4%			
Wales (WA)	4%	4%	5%	4%	4%	4%	4%	4%	4%		
West Midlands (WM)	4%	4%	5%	4%	4%	4%	4%	4%	4%	3%	
Yorks & Humber (YH)	4%	4%	5%	4%	4%	4%	4%	4%	4%	4%	4%

Origin Based Comparison

Figure 4-1 below shows the variation of change in forecast demand in PLD zones in 2026/27, with green areas indicating an increase and red indicating a reduction. The figure demonstrates that there is some variation in demand growth across the country, however this variation is small. This result is expected, given that fares policy is uniform across the country. The variation is due to different journeys being subjected to different elasticities depending upon trip type, ticket type, distance and PDFH flow group. Whilst there can be a large difference in these elasticities (from -0.3 to -1), the reality is that each PLD zone contains a wide variety of trips, meaning the overall change in demand is similar across all zones.

Figure 4-1 Change in Origin Demand – Fares Update: Central Fares, 2026/27



Derivation of Cap Year

The second forecast year is referred to as the cap year, and is defined by HS2 Ltd as the year at which long distance rail trips (over 100 miles) within the PLD rail matrix reaches a certain level: 290,146. Beyond this no further demand growth occurs.

Table 4-4 shows the cap year analysis for the central fares scenario, which has indicated that the number of trips over 100 miles in 2037/38 lies the closest to the target figure of 290,146 trips. Therefore additional matrices have been produced for the year 2037/38 by interpolating between the 2036/37 and 2041/42 matrices.

Table 4-4 Derivation of Cap Year for PFMv5.2

Central Fares	Total Demand	Demand >100miles	% of Total
2010/11	**1,034,766**	**161,640**	**55.7%**
2026/27	**1,230,328**	**219,390**	**75.6%**
2027/28	1,255,675	225,648	77.8%
2028/29	1,281,022	231,907	79.9%
2029/30	1,306,369	238,166	82.1%
2030/31	1,331,715	244,425	84.2%
2031/32	**1,357,062**	**250,684**	**86.4%**
2032/33	1,383,317	257,346	88.7%
2033/34	1,409,573	264,008	91.0%
2034/35	1,435,828	270,671	93.3%
2035/36	1,462,083	277,333	95.6%
2036/37	**1,488,338**	**283,995**	**97.9%**
2037/38	**1,510,150**	**289,293**	**99.7%**
2038/39	1,531,961	294,590	101.5%
2039/40	1,553,772	299,888	103.4%
2040/41	1,575,583	305,185	105.2%
2041/42	**1,597,395**	**310,482**	**107.0%**
2042/43	1,626,567	316,802	109.2%
2043/44	1,655,740	323,121	111.4%
2044/45	1,684,912	329,440	113.5%
2045/46	1,714,085	335,759	115.7%
2046/47	**1,743,258**	**342,079**	**117.9%**

Table 4-5 shows the forecast masked PLD matrix totals for the new fares scenario, compared with the cap year forecasts of the PFMv5.1 reference case.

Table 4-5 Cap Year Rail Matrix Totals by Journey Purpose

Journey purpose	PFMv5.1 Reference Case (2040/41)	PFMv5.2 New Fares (2037/38)	Difference	%
Commuting NCA	68,024	69,972	1,948	2.9%
Commuting CA from	237,905	237,607	-298	-0.1%
Commuting CA to	237,905	237,607	-298	-0.1%
Business NCA	-	-	-	-
Business CA from	156,058	154,023	-2,035	-1.3%
Business CA to	117,040	115,588	-1,452	-1.2%
Leisure NCA	120,956	122,951	1,995	1.6%
Leisure CA from	332,939	328,897	-4,042	-1.2%
Leisure CA to	246,666	243,504	-3,162	-1.3%
Total	**1,517,493**	**1,510,150**	**-7,344**	**-0.5%**

Growth in Key Rail Movements

Table 4-6 below shows the growth in trips in the PLD rail matrices for key rail movements in the three scenarios compared to the reference case. These show total trips in both directions (note that the zone boundaries do not necessarily correspond with Local Authority boundaries). The Edinburgh to London flow is most sensitive to the change in fares growth.

Table 4-6 Growth in Total Weekday Trips for Selected OD Movements (bi-directional)

Key HS2 zone to zone movements	% Growth 2010/11 – 2026/27 – Reference Case, PFMv5.1	% Growth 2010/11 – 2026/27 – New Fares Scenario, PFMv5.2
Birmingham - Central London	45.8%	53.2%
Manchester - Central London	52.3%	60.2%
Leeds - Central London	47.3%	55.0%
Glasgow - Central London	49.6%	57.9%
Liverpool - Central London	40.2%	47.5%
Newcastle - Central London	44.9%	52.8%
Edinburgh - Central London	53.4%	61.9%

Regional Model Forecasts

Table 4-7 to Table 4-9 below summarise the matrix totals for the regional models, PLANET South, PLANET Midlands and PLANET North, for each of the fares scenarios. These matrices have been masked with the latest masking matrix provided by HS2. Each scenario is compared against the demand matrices used in the previous central case.

Table 4-7 PLANET South Rail Matrix Totals for 2026/27 by Journey Purpose

Journey purpose	PFMv5.1 Reference Case	PFMv5.2 New Fares Scenario	Difference	%
Business PA	181,759	184,945	3,186	1.8%
Business AP	11,626	11,922	297	2.6%
Leisure PA	186,445	193,555	7,110	3.8%
Leisure AP	21,252	21,940	688	3.2%
Commuting PA	1,571,492	1,593,772	22,280	1.4%
Commuting AP	33,144	33,717	574	1.7%
Total	**2,005,718**	**2,039,852**	**34,134**	**1.7%**

Table 4-8 PLANET Midlands Rail Matrix Totals for 2026/27 by Journey Purpose

Journey purpose	PFMv5.1 Reference Case	PFMv5.2 New Fares Scenario	Difference	%
Business CA	12,433	12,842	409	3.3%
Business NCA	1,599	1,656	57	3.6%
Leisure CA	11,115	11,527	412	3.7%
Leisure NCA	1,560	1,621	61	3.9%
Commuting CA	59,390	61,278	1,888	3.2%
Commuting NCA	9,362	9,675	312	3.3%
Total	**95,459**	**98,599**	**3,140**	**3.3%**

Table 4-9 PLANET North Rail Matrix Totals for 2026/27 by Journey Purpose

Journey purpose	PFMv5.1 Reference Case	PFMv5.2 New Fares Scenario	Difference	%
Business CA	28,866	29,898	1,032	3.6%
Business NCA	5,166	5,349	182	3.5%
Leisure CA	23,475	24,462	987	4.2%
Leisure NCA	4,331	4,510	179	4.1%
Commuting CA	84,169	86,922	2,753	3.3%
Commuting NCA	17,423	17,985	562	3.2%
Total	**163,431**	**169,126**	**5,695**	**3.5%**

5. Quality Assurance

Confidence in analytical outputs is of paramount importance to HS2 Ltd. and the HS2 scheme itself. An effective Quality Assurance (QA) process is required to provide confidence that the inputs to PFM have been developed in line with HS2 Ltd.'s specification, and that the outcomes of the work are as expected. A clearly defined and staged delivery programme has been adopted throughout Work Package 2 with jointly-identified risks and mitigation strategies. Key features within this process have included:

- Specific and separate Author, Reviewer and Authoriser roles on all data and documents provided. The QA status of all data and deliverables has been defined by the level of sign-off;
- Structured checking mechanisms for all project inputs and outputs;
- Use of standard output reporting mechanisms and comparison / audit trail with previous versions of comparable data sets; and
- Documentation and results audit trail, so that all figures produced for reports can be verified as originating from the relevant outputs.

Atkins has developed a QA report template with an associated QA log, which has been signed off by HS2 Ltd. All deliverables have incorporated the standard Atkins reporting and spreadsheet QA logs. The individual QA reports for each task are included in Appendix C.

5.1. Internal QA Checks

The following sections provide evidence that all reasonable checks have been undertaken to a level to reduce the risk of incorrect modelling results to the lowest reasonable level.

5.1.1. Rail Forecasts

5.1.1.1. Standardised Internal Checks

The following checks have been undertaken for each of the six updates as part of the rail step through, except where stated:

1. Automation of Existing Process
2. Migration to EDGE 1.5
3. NTEM Case Study
4. WebTAG 2014 Updates
5. Amendments to Previous Process
6. Revised Economic Forecasts

Further details of the quality assurance undertaken for each of the steps can be found in Appendix C.

EDGE Log File Check – All Steps

The calculations undertaken by the EDGE demand forecasting tool (by applying the demand drivers and PDFH elasticities to the PLANET zoning) have been checked by performing manual example calculations to confirm that the EDGE results can be replicated. The manual calculations have been undertaken using a standardised spreadsheet that was created as part of the automation of the existing process. A new version of the spreadsheet has been created where required by the updates, for example, the revised zone correspondence required for the NTEM case study and the revised parameters introduced by the WebTAG 2014 updates. Each version of the spreadsheet is independently checked to ensure that it functions correctly.

Matrix totals – All Steps

Following the production of future year matrices using the EDGE growth outputs, matrix totals for each test have been checked against the previous forecasts to ensure that levels of growth were reasonable for each of the modelled years, compared with the changes to the inputs.

Cap year checks – All Steps

Following the process to derive the cap year by interpolating between the demand forecasts produced for five year intervals between 2026/27 and 2046/47, and calculating a sub-set of trips less than 100 miles in length for each year, checks have been carried out to ensure that the input matrix totals are consistent with the matrix totals produced above and that the totals of the <100 mile subset indicate similar levels of growth to the full matrices.

Origin demand comparison – Steps 3-6 only

For each of the four PLANET models, the demand originating from each zone for each test has been compared against previous forecasts, to check that the levels of growth are consistent across all zones and to check for anomalies. The top ten absolute and percentage changes by origin zone are observed and any anomalies have been checked against the demand driver inputs so that the driving factor behind the demand growth can be understood.

GIS – Steps 3-6 only

The demand matrices produced from the EDGE growth factors for each of the four models have been mapped in GIS to check for regional variation and if there are any unexpected results. In a similar way to the origin demand comparison, any outliers have been checked against the demand driver inputs so that the driving factor behind the demand growth can be understood.

Regional comparison – Steps 3-6 only

O-D demand has been aggregated to Government Office Region level and compared against the previous forecasts to check that levels of growth are consistent with the changes to the forecast inputs.

Independent check of demand driver inputs – Step 6 only

The revised demand driver inputs adapted from the October 2014 DfT forecasts have been independently checked to ensure that the forecasts have been calculated correctly, including redistribution of regional demographic forecasts into NTEM zones, and comparison with the previous forecasts. The adjustments to the inputs undertaken subsequently by Atkins, including conversion of demographic forecasts from absolute numbers to an indexation and calculation of relative population growth, have also been checked. The comparison against previous forecasts, and the production of graphs for this report has been checked to insure the correct inputs have been used for the new and previous forecasts. The data tables in the accompanying documentation describing how the drivers have changed from the previous forecasts has been checked and the technical note comparing the demand drivers has been signed off with HS2 Ltd.

5.1.2. Highway Forecasts

The following checks have been undertaken as part of the highway forecasting. Full details can be found in Appendix C.

- GDP global factors: check for consistency of calculation of factor for the new cap year of 2040/41;
- TEMPRO aggregation to PLD and 25 sectors: check that the sum of the TEMPRO data is equal to the PLD and 25 sector data, and that the resultant factors have been correctly imported to the EMME macros, which apply the TEMPRO growth;
- Preloads: check that the spreadsheet calculations are applied correctly and that the cap year preloads have been correctly interpolated, and that the resultant factors have been correctly imported to the EMME macros, which calculate the preloads; and
- Matrix forecasting: check that the EMME macro calls the correct input files.

5.1.3. Air Forecasts

The following checks have been undertaken as part of the air forecasting. Full details can be found in Appendix C.

- Transit line files: check that line codes, description and origin/destination nodes are correct, and check that transit line data for headway, journey time, business and leisure fares matches with the DfT data for each origin/destination pair;
- Transit line import: check that transit lines can be imported to EMME without errors;
- Air networks within EMME: check that air network is consistent with previous forecasts, in terms of network coverage, flights per day and distance travelled;

- Demand checks: check that sum of demand in PLD matches DfT data, that changes in demand forecasts are reasonable and correspond with the changes in supply, and that matrices are symmetrical;
- Matrix import: check that matrices can be imported to EMME without errors;
- Trial EMME assignment: check that all demand is assigned to the network, and that IVT and passenger kilometres are reasonable compared with previous forecasts.

5.1.4. PFM Run Results

The new demand forecast matrices were run through PFM to understand the impact of the changes to the matrices on the demand for HS2 and the scheme economic benefits. The results demonstrated that the net impact of the demand forecast updates on the benefit-cost ratio (BCR) for Phase One of the HS2 scheme was negligible, with a slight increase in revenue and business benefits offset by a decrease in benefits for other users. For Phase Two the increase in business user benefits was higher than the corresponding decrease in other user benefits, which, combined with the increased revenue contributed to an increased BCR overall. The increased revenue is driven by the increased proportion of business demand in the rail matrices, at the expense of leisure and commuting demand.

5.2. Model Audit

Atkins has worked closely with HS2 Ltd.'s appointed independent model auditor, Jacobs, throughout the development of the exogenous forecasts, to ensure that all work delivered within each Sprint has been appropriately audited and signed off by the third party. Atkins have liaised with the independent model auditor during a separate meeting at the start of each Sprint to advise on and jointly specify a checklist of QA deliverables and associated acceptance criteria. Atkins have set aside time and resource during each Sprint to allow for internal QA checks and sign-off, followed by provision of files and evidence of QA to the model auditor in good time so that the work can be audited prior to the end of the Sprint.

The audit has been arranged to start on an agreed date at which the internal QA checks for all deliverables will have been completed. Prior to the audit Atkins has delivered all work as agreed in the checklist, including documentation providing evidence of the internal QA checks. During the audit a member of the audit team has checked and approved Atkins' work, based on the agreed checklist and acceptance criteria. This checklist has been used by the auditor to provide further assurance on the correct implementation of the deliverables. The auditor's feedback from these checks has been discussed in the daily phone calls or in person, with any issues identified to be resolved by the development team. The outcomes of each audit have been reviewed by HS2 Ltd. at the Sprint review meeting.

5.2.1. Quality Assurance Issues Addressed During Development

The Development Opportunities Log (DOL) provides a summary of audit issues identified during previous phases of PFM model development. Table 5-1 below provides a summary of the issues relevant to demand forecasting that were present at the commencement of WP2, and action taken as part of WP2 to resolve these issues.

Table 5-1 Forecasting Issues Log: Historical Issues

ID	Issue	Concern	Action taken
37	PN EDGE review	PN growth forecasts are low compared to other industry forecasts, and demand and therefore crowding could be understated within PN in future years. While regional growth isn't of primary concern for HS2 Ltd, it could influence released capacity assumptions in the regions. Modelled demand growth on flows into Manchester/Leeds between 2010/11 and 2036/37 is around 30-40% (annualised growth rate ~1%) whereas 2012 HLOS forecasts 20% growth for the 5 years between 2013/14 and 2018/19 (annualised growth rate ~4%). Longer-term forecasts	Atkins have undertaken a review of the NTEM case study for PLANET North to ensure its correct implementation. It was concluded that the case study has been implemented in a manner consistent with the three other PLANET models, and that the long term forecasts in PFM are comparable with the "low growth scenario" forecasts in the Northern RUS.

ID	Issue	Concern	Action taken
		from Northern RUS show growth of around 60% between 2009 and 2029.	
95	PS growth factors	Error relating to zone 905013 resulting in growth not being applied to this zone.	The PS EDGE base demand matrix, EDGE distance matrix, NTEM – PS and PDFH – PS correspondences have been updated so that all references to zone 5013 are renamed “905013”:
115	DfT air growth forecasts	A query has established that DfT September 2012 forecasts used to develop the future year air matrices 'most likely' included HS2 within its surface access model and that it was not possible to edit.	DfT Aviation have agreed to provide revised air forecasts with HS2 competition removed from surface access assumptions. These forecasts can be used in subsequent updates to PFM.
117	PS airport growth	PS airport demand growth has not been updated with latest DfT input used in PLD.	PS airport growth factors have been updated to incorporate the air passenger forecasts for autumn 2014 supplied by DfT.
NT13	Highway preload growth calculation	Concern raised that highway preload growth calculation does not include growth from non -car traffic.	TRADS counts used in the preload process are volumetric, rather than classified, therefore the level of disaggregation required to undertake this task is not available. It is understood that the sensitivity of this parameter is small. No action has been taken.
BT11	Rhoose airport	The PFMv4.3 EDGE inputs show a large projected increases in air passenger demand at Rhoose (Cardiff) airport beyond 2036/37, causing significant increases in demand to/from The Vale of Glamorgan zone (PLD zone 214). This issue requires further investigation to better understand the impact and if necessary resolve	The issue is inherent in the forecasts as the demand growth for airport zones is based on air passenger forecasts supplied by DfT. No action has been taken.

5.2.2. New Quality Assurance Issues Identified

A small number of minor audit issues have been identified during the current model development by the quality assurance process and are summarised below. These issues will be addressed during future forecast updates.

Table 5-2 Forecasting Issues Log: Issues Raised by Auditor

ID	Issue	Concern	Recommended Action
AUD 43	Airport Zone PDFH5.1 elasticities	PLD only has Cardiff, Birmingham and Heathrow, as zones with air passenger elasticities applied (i.e. airport zones), zones that include Gatwick, Southampton, Stansted and Manchester should also have these elasticities but do not in PLD.	Investigate the raw annual data from DfT and its representation in PFM, to explain counterintuitive results or improve method of implementing annual network

ID	Issue	Concern	Recommended Action
			data in PFM (a weekday model).
AUD 52	Airport Forecasts	DfT domestic aviation forecasts at Cardiff and Birmingham airports appear high which may slightly overstate the benefits for HS2.	Liaise with DfT to improve understanding of air passenger growth provided.
AUD 34	NTEM Mapping (PFM/PN)	Jacobs conclude Atkins have mapped the National Trip End Model (NTEM) zoning system using GIS to the following PLANET zoning systems as described in model documentation. Jacobs suggest the documented method could be further improved if proxy point weightings in Scotland to be reduced, compared to England and Wales to reflect smaller OA size (average of 50 households rather than 125) when converting demand between NTEM and PFM zones.	Review NTEM mapping assumptions for Scotland.
AUD 64-66	Air network	There are a number of counter-intuitive differences between outbound and return air services in the PFM air network, for example, - Glasgow to Stansted has a flight time of 90 minutes in one direction but 75 minutes in the opposite direction, - Manchester to Southampton has a flight time of 58 minutes in one direction and 64 minutes in the other direction, - There are only flights in one direction between Norwich and Manchester in the air services file, DfT data suggests a headway of nearly treble in the reverse direction.	Investigate the raw annual data from DfT and its representation in PFM, to explain counterintuitive results or improve method of implementing annual network data in PFM (a weekday model).
AUD 53	Car Availability Forecasts	The car availability forecasts and conversion between CA and NCA are capped at 2041 up until 2050 due to the source TEMPRO data not going beyond 2041.	Extrapolate car availability forecasts to 2050 using existing TEMPRO data.
AUD 54	Forecasts: Heathrow internal trips in PS	Movements between Heathrow airport zones have been double factored in PS, when they should only have been factored once, so the growth applied is too high for these OD pairs.	Change the script for the PS airport matrix adjustment so that these airport zone to airport zone movements are only factored once, this should be applied to 5130012 PS Airport Demand Growth 300714 v5.0.xls which exports this macro.
AUD 55	Forecasts: EDGE car cost heading	The heading name and positioning from the EDGE log file is different for car costs between PLD and PN, in the latter it is referred to as fuel costs and is positioned in different columns which is confusing and inconsistent.	Have a consistent demand driver heading and ordering between PLD and regional models for car costs.
303	Employment demand driver bug	DFT has corrected the employment demand driver inputs used in PFMv4.7. The corrected data inputs are about 6-8% lower. Atkins have re-estimated the growth matrices for the four	Input the re-estimated matrices into PFM version 5.1

ID	Issue	Concern	Recommended Action
		PLANET models, most impact is on the commuting journey purpose. Total PLD trip numbers are reduced by 2%, impacts are slightly greater for the regional PLANETS because commuting is more significant in the peak period models. The benefits and revenues of HS2 are likely to be overestimated by about 2% with slightly more impact on Phase 1 compared to the Full Network.	

5.3. Comparison of PLD and NMF Forecasts

Introduction

As an additional check to build confidence in the rail demand forecasts used in PFM version 5, the EDGE forecasts derived for PLD were compared with equivalent forecasts undertaken by DfT using the Network Modelling Framework (NMF) case study. Both sets of forecasts were undertaken using EDGE version 1.5, using similar inputs; therefore, similar results were expected. The following explains why there are differences and provides confidence the EDGE process has been correctly implemented in PFM v4.7.

Comparison results

Results were compared at PDFH flow and journey purpose level and the forecast comparison for 2026/27 is presented in Table 5-3 below.

Table 5-3 Comparison of PLD and NMF rail demand growth forecasts (2010/11 – 2026/27)

PDFH Flow Category	Business			Commuting			Leisure			Total		
	PLD	NMF	Delta	PLD	NMF	Delta	PLD	NMF	Delta	PLD	NMF	Delta
LT to LT	55%	56%	-1%	31%	35%	-4%	50%	50%	0%	38%	40%	-2%
LT to ROC	40%	43%	-3%	36%	36%	0%	40%	35%	5%	39%	37%	2%
LT to ROSE	40%	52%	-12%	32%	46%	-14%	40%	45%	-4%	35%	47%	-12%
ROC to LT	41%	47%	-6%	36%	32%	4%	40%	38%	3%	39%	37%	2%
ROSE to ROSE	31%	37%	-6%	22%	22%	0%	33%	31%	1%	27%	26%	1%
ROSE to LT	38%	38%	0%	32%	36%	-5%	38%	31%	8%	34%	36%	-1%
Non-London Other	14%	17%	-4%	10%	12%	-3%	10%	12%	-2%	10%	13%	-2%
Non-London Major	22%	28%	-6%	16%	18%	-2%	19%	22%	-3%	18%	22%	-4%
Non-London Core	19%	25%	-6%	15%	21%	-6%	16%	20%	-4%	16%	21%	-5%
Birmingham Airport	54%	51%	3%	58%	51%	7%	53%	51%	2%	56%	51%	4%
Cardiff Airport	-26%	-27%	1%	-24%	-27%	3%	-26%	-27%	1%	-25%	-27%	2%
Overall	36%	40%	-4%	26%	31%	-4%	30%	31%	1%	29%	32%	-3%

It can be seen from the table that at the overall national level the PLD forecasts are slightly lower than NMF, but at flow level the differences can be significant, in particular for the London – Rest of South East flow. As the results were not comparable as we initially expected, further analysis was undertaken by Atkins and DfT to understand the source of the differences between the forecasts.

Explanation of differences

The sources of the differences between the forecasts are described briefly below, while Table 5-4 provides a step through of the incremental impact of each difference between the PLD and NMF forecasting approaches, demonstrating how the individual impacts sum to create the overall difference between the forecasts. A positive value indicates that the PLD value is higher than the NMF value.

- **Weighting and aggregation of demand drivers:** EDGE aggregates demand drivers, such as population and employment, at TEMPRO level to the model zoning system, with forecasts of rail demand growth generated at model zone level. For the HS2 forecasting aggregation from TEMPRO to PLD zones is based on population weighting, whereas DfT uses an unweighted distribution, with TEMPRO zones allocated to multiple NMF zones based on station catchment areas. This drives some differences in the forecasts at flow level.

- **Model zone structure:** Aggregation from model zone to flow level is based on a demand weighted average in both models. However the different zoning structure in the models results in different demand forecasts at flow level. The model zone structure has a significant impact on the forecasts and explains the majority of the difference between the two models.
- **Application of relative population:** PDFH v5.1 recommends that relative population growth is used for commuting trips within the south east and London, and for non-London commuting. Relative population growth has been applied only in the HS2 forecasting, by applying the population growth for each input zone relative to the Government Office Region within which that zone lies, which results in slightly lower forecasts overall.
- **Airport car cost elasticity:** PDFH v5.0 does not include a car cost elasticity for commuting travel to and from airports. Hence, the HS2 forecasts assume an elasticity of zero for these flows, whereas DfT has applied an elasticity of 0.25 (as per the values for business and leisure travel), which results in DfT forecasting slightly lower demand as car travel becomes more attractive.
- **GDP per Capita:** The DfT forecasts use a slightly more accurate approach of using absolute values of GDP per capita, as opposed to a growth index adopted by HS2. The variation in approach results in a very minor difference in the forecasts, with HS2 forecasts approximately -0.1% lower overall.
- **Application of short/long term elasticities:** PDFH v5.1 guidance defines separate short term (2013/14 – 2018/19) and long term elasticities (2023/24 onwards) for non-London flows, which influence employment and GDP per capita growth. HS2 forecasts have not included the impact of the higher short term elasticities, therefore HS2 non-London forecasts are lower than DfT forecasts.

Table 5-4 Step through of differences between PLD and NMF forecasts (2010/11 - 2026/27)

PDFH Flow Category	Population Weighting	Zone Structure	Relative Population	Airport Elasticity	GDP per Capita	Short/ Long run	Total
LT to LT	-1.6%	0.2%	-0.8%	0.0%	-0.2%	0.0%	-2.5%
LT to ROC	-0.4%	2.2%	0.0%	0.0%	0.0%	0.0%	1.8%
LT to ROSE	0.6%	-13.1%	0.5%	0.0%	-0.3%	0.0%	-12.2%
ROC to LT	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	2.2%
ROSE to ROSE	-0.3%	1.8%	0.0%	0.0%	0.0%	0.0%	1.4%
ROSE to LT	-0.8%	-0.6%	0.3%	0.0%	-0.1%	0.0%	-1.2%
Non-London_Other	-0.7%	-2.2%	0.4%	0.0%	0.0%	0.0%	-2.5%
Non-London_Major	-0.1%	-1.9%	0.7%	0.0%	0.0%	-2.3%	-3.6%
Non-London_Core	-0.3%	-1.2%	0.2%	0.0%	0.0%	-3.8%	-5.2%
Heathrow Airport	0.0%						
Birmingham Airport	0.0%	0.2%	0.0%	4.1%	0.0%	0.0%	4.3%
Cardiff Airport	0.0%	0.3%	0.0%	1.3%	0.0%	0.0%	1.6%
Overall	-5.9%	3.7%	-0.1%	0.1%	-0.1%	-0.8%	-3.2%

Conclusion

The process of explaining the comparison with NMF provides us with reassurance that EDGE is correctly implemented in PFMv4.7.

It is recommended that the assumptions adopted by DfT and HS2 are aligned to best reflect the recommendations in PDFH, such as the application of relative population and the change to the airport commuting car cost elasticity in NMF, and the use of absolute GDP per capita and short/long term elasticities in PLD. However, the majority of differences are driven by the level of model aggregation and zone structure, rather than model assumptions. This implies that EDGE will produce different forecasts for any model, including the regional PLANET models, regardless of whether the inputs are identical.

Appendices

Appendix A. Rail Forecasting Methodology

A.1. Inputs for PFMv5.1 Assumptions Report

The following section summarises the metrics for the revised HS2 assumptions report. The table reference from the previous assumptions report is shown for each table in brackets.

Table A-1 Regional population growth used in rail demand forecasts (Table 2-1)

Region	% Growth in Population from 2010/11	
	2026/27	2040/41
North East	3.2%	5.5%
North West	4.4%	6.1%
Yorkshire & Humberside	6.8%	13.6%
East Midlands	8.9%	15.9%
West Midlands	7.5%	11.4%
East of England	12.4%	21.2%
London	18.9%	27.7%
South East	11.1%	17.2%
South West	9.9%	17.3%
Wales	4.7%	7.1%
Scotland	4.7%	4.1%
Great Britain	9.3%	14.6%

Table A-2 Regional employment growth used in rail demand forecasts (Table 2-2)

Region	% Growth in Employment from 2010/11	
	2026/27	2040/41
North East	5.4%	5.6%
North West	3.4%	3.3%
Yorkshire & Humberside	9.5%	14.9%
East Midlands	10.7%	10.7%
West Midlands	9.2%	13.8%
East of England	14.3%	17.0%
London	17.1%	20.4%
South East	8.1%	9.0%
South West	4.7%	5.4%
Wales	4.8%	15.9%
Scotland	5.5%	10.7%
Great Britain	9.0%	11.8%

Table A-3 Regional GDP growth used in rail demand forecasts (Table 2-3)

Region	% Growth in GDP from 2010/11	
	2026/27	2040/41
North East	23.2%	59.2%
North West	20.4%	55.5%
Yorkshire & Humberside	18.0%	52.5%
East Midlands	20.2%	55.4%
West Midlands	20.6%	55.8%
East of England	22.5%	58.3%
London	28.1%	65.5%
South East	28.5%	66.0%
South West	17.9%	52.4%
Wales	21.6%	57.2%
Scotland	23.1%	59.1%
Great Britain	22.8%	58.8%

Table A-4 National rail fare growth used in rail demand forecasts (Table 2-4)

Region	% Growth in Rail Fares from 2010/11	
	2026/27	2040/41
Great Britain	14.9%	32.1%

Table A-5 Car ownership growth used in rail demand forecasts (Table 2-5)

Region	% Growth in Car Owning Households from 2010/11	
	2026/27	2040/41
Central London	10.5%	18.0%
Central Manchester	5.7%	8.8%
Rest of Manchester	4.9%	7.5%
Central Birmingham	8.5%	13.4%
Rest of West Midlands	4.0%	6.0%
Leeds	6.8%	10.5%
Rest of West Yorkshire	4.9%	7.4%
Great Britain	3.8%	5.8%

Table A-6 Car journey time growth used in rail demand forecasts (Table 2-6)

Region	% Growth in Car Journey Time from 2010/11	
	2026/27	2040/41
Rest of GB	5.7%	9.7%

Table A-7 Car fuel price growth used in rail demand forecasts (Table 2-7)

Region	% Growth in Car Cost Price from 2010/11	
	2026/27	2040/41
Great Britain	-24.0%	-21.7%

Table A-8 Bus and coach fare growth used in rail demand forecasts (Table 2-8)

Region	% Growth in Bus Costs from 2010/11	
	2026/27	2040/41
Great Britain	40.5%	68.1%

Table A-9 Bus and coach journey time growth used in rail demand forecasts (Table 2-9)

Region	% Growth in Bus Coach Journey Times from 2010/11	
	2026/27	2040/41
Rest of GB to London	9.1%	15.0%

Table A-10 Bus and coach frequency growth used in rail demand forecasts (Table 2-10)

Region	% Growth in Bus and Coach Frequency from 2010/11	
	2026/27	2040/41
Great Britain	-6.0%	-4.2%

Table A-11 Air fares growth used in rail demand forecasts (Table 2-11)

Region	% Growth in Air Fares from 2010/11	
	2026/27	2040/41
Great Britain	-4.1%	-4.5%

Table A-12 Air frequency growth used in rail demand forecasts (Table 2-12)

Region	% Growth in Air Frequency from 2010/11	
	2026/27	2040/41
Great Britain	-1.2%	-5.1%

Table A-13 Air passengers growth used in rail demand forecasts (Table 2-13)

Region	% Growth in Air Passengers from 2010/11	
	2026/27	2040/41
Gatwick Airport	25.9%	31.7%
Heathrow Airport	17.9%	28.2%
Luton Airport	Not included	Not included
Stansted Airport	72.8%	99.1%
Birmingham Airport	64.6%	238.8%
Manchester Airport	40.9%	114.6%
Southampton Airport	61.1%	296.6%
Cardiff Airport	-20.2%	57.5%

Table A-14 Input forecast PLD matrices – growth in rail demand by journey purpose (Table 2-14)

Journey Purpose	% Growth in Rail Demand from 2010/11 (Note this is the growth in PLD matrices only)	
	2026/27	2040/41
Commuting NCA	-9.0%	-3.0%
Commuting CA from	12.0%	36.5%
Commuting CA to	12.0%	36.5%
Business CA from	24.3%	70.6%
Business CA to	25.4%	72.8%
Leisure NCA	-0.7%	18.2%
Leisure CA from	20.6%	61.9%
Leisure CA to	22.6%	65.6%
Total	**14.5%**	**46.7%**

Table A-15 Forecast regional PLANET matrices – growth in rail demand PFMv4.3 (2026/27 and 2040/41) (Table 2-15)

Regional Model	Journey Purpose	% Growth in Rail Demand from 2010/11 (Note this is the growth in PLD matrices only)	
		2026/27	2040/41
Planet South (PS)	Business PA	50.5%	118.2%
	Business AP	46.3%	105.6%
	Leisure PA	46.4%	102.7%
	Leisure AP	39.3%	86.3%
	Commuting PA	24.6%	37.2%
	Commuting AP	24.9%	40.4%
	Total	**28.6%**	**49.7%**
Planet Midlands (PM)	Business CA	19.8%	53.8%
	Business NCA	1.7%	19.0%
	Leisure CA	19.5%	54.6%
	Leisure NCA	0.8%	18.4%
	Commuting CA	16.2%	41.8%
	Commuting NCA	-4.6%	3.4%
	Total	**14.0%**	**39.3%**
Planet North (PN)	Business CA	22.1%	66.5%
	Business NCA	0.0%	20.8%
	Leisure CA	22.0%	66.1%
	Leisure NCA	0.1%	20.9%
	Commuting CA	13.4%	38.0%
	Commuting NCA	-7.1%	1.4%
	Total	**12.4%**	**40.5%**

Table A-16 Implied elasticity of highway demand to GDP (Table 2-16)

Attribute	Purpose		
	Commuting	Business	Other
Implied Elasticity	0.087	0.151	0.147

Table A-17 Growth applied highway demand to correct for change in GDP forecasts (Table 2-17)

Year	Growth applied to TEMPROv6.2 outputs		
	Commuting	Business	Others
2026/27	-0.7%	-1.2%	-1.2%
2040/41	-0.8%	-1.4%	-1.4%

Table A-18 Highway forecasts for long distance trips used in PFM4.3 (Table 2-18)

Journey Purpose	Growth in Highway Trips from 2010/11	
	2026/27	2040/41
Commuting	8%	14%
Business	10%	17%
Leisure	13%	23%
Total	12%	21%

Table A-19 Highway Forecasts by Vehicle Type and Road type, England (Table 2-19)

Growth from 2010/11 to 2040/41	Motorway	Trunk	Principal	Other Roads	All Roads
Cars	51%	48%	42%	42%	44%
LGV	106%	105%	105%	106%	105%
HGV	54%	51%	48%	47%	51%
Bus & Coach	0%	-60%	-13%	-9%	-13%
All Traffic	58%	55%	50%	51%	53%

Table A-20 DfT Aviation Matrices – Growth in Domestic Air Passengers in PFMv4.3 (annual domestic trips) (Table 2-20)

	Growth in Domestic Air Passengers from 2010/11	
Journey Purpose	2026/27	2040/41
Business	31.20%	35.30%
Leisure	25.10%	34.20%
Combined	28.50%	34.80%

Table A-21 Air Network Changes in PFMv4.3 (Table 4-2)

2026/27 Routes added relative to 2010/11	2026/27 Routes removed relative to 2010/11
Exeter - Stansted	Aberdeen - Luton
Inverness - Bristol	Aberdeen - Durham
Inverness - Edinburgh	Edinburgh - Gatwick
Inverness - London City	Edinburgh - Manchester
London City - Inverness	Edinburgh - Stansted
Newquay - Leeds Bradford	Exeter - Edinburgh
Stansted - Exeter	Glasgow - Luton
	Glasgow - Southampton
	Gatwick - Edinburgh
	Luton - Aberdeen
	Luton - Glasgow
	Luton - Inverness
	Manchester - Bristol
	Manchester - Edinburgh
	Manchester - Norwich
	Durham - Aberdeen
	Prestwick - Stansted
	Stansted - Edinburgh
	Stansted - Prestwick
2040/41 Routes added relative to 2026/27	**2040/41 Routes removed relative to 2026/27**
Aberdeen - Exeter	Glasgow - Gatwick
Edinburgh - Gatwick	Inverness - Bristol
Edinburgh - Inverness	Inverness - Luton
Exeter - Aberdeen	Gatwick - Glasgow
Gatwick - Edinburgh	Gatwick - Manchester
Inverness - Stansted	Manchester - Gatwick
Manchester - Bristol	Stansted - Glasgow
Manchester - Norwich	
Newquay - Manchester	
Norwich - Exeter	
Stansted - Inverness	

Table A-22 Real Fare Index Factors – Air Fares (Table 4-3)

Purpose	Growth in Rail Fares from 2008		
	2010/11	2026/27	2040/41
Business	-3.8%	-1.1%	1.0%
Leisure	-2.5%	16.0%	23.3%

A.2. Summary of Rail Forecasting Methodology

This process of producing updated rail demand forecasts for the HS2 model is undertaken using the DfT's Exogenous Demand Growth Estimation Tool (EDGE).

A.2.1. The PDFH Framework

The purpose of EDGE is to perform the calculations defined in the PDFH mathematical framework for rail demand forecasting, defined below[7]. The framework provides the methodology for forecasting the effects of external factors on the incremental demand for rail travel, which can be applied to a known level of base demand between stations, on a route, or at a more aggregate regional or train operating company level.

The factors included in the forecasting framework can be considered under the headings of socio-economic, i.e. GDP per capita / employment, socio-demographic, i.e. population, and competition between modes, such as car fuel cost. For the purpose of rail demand forecasting for HS2, we add to this national rail fares policy and air passenger demand.

$$I_E = \left(\frac{GDP\,percapita_{new}}{GDP\,percapita_{base}}\right)^g \times \left(\frac{POP_{new}}{POP_{base}}\right)^p \times \exp\left(n\left(NC_{new} - NC_{base}\right)\right) \times$$
$$\left(\frac{FUELCOST_{new}}{FUELCOST_{base}}\right)^f \times \left(\frac{CARTIME_{new}}{CARTIME_{base}}\right)^c \times \left(\frac{BUSCOST_{new}}{BUSCOST_{base}}\right)^b \times \left(\frac{BUSTIME_{new}}{BUSTIME_{base}}\right)^t \times$$
$$\left(\frac{BUSHEAD_{new}}{BUSHEAD_{base}}\right)^b \times \left(\frac{AIRCOST_{new}}{AIRCOST_{base}}\right)^a \times \left(\frac{AIRHEAD_{new}}{AIRHEAD_{base}}\right)^r$$

Where:

- I_E is the index for change in demand volume from base to new period
- GDP per capita = changes in GDP per capita or, for commuting trips, changes in employment at the destination, disaggregated at a regional or local level
- POP = changes in population in the origin zone
- NC = non-car ownership, i.e. the proportion of households without a car
- FUELCOST = fuel cost of car use
- CARTIME = journey time by car
- BUSCOST = the cost of making the journey by bus or coach
- BUSTIME = the journey time by bus or coach
- BUSHEAD = the headway of the bus service
- AIRCOST = the cost of making the journey by air
- AIRHEAD = air headway
- Parameters g, p, f, c, b, t, b, a and r are elasticities, with the exception of n that determines the non car-ownership elasticity
- Monetary amounts are expressed in real terms, i.e. no inflation

A.2.2. Exogenous Forecasting using EDGE

The EDGE software applies the PDFH calculations using a set of input data defined by the user, using an "assignment set". The assignment set consists of a set of labels that point to the relevant input data to be used in the EDGE, such as the base data, case study zoning system, demand drivers and elasticities.

[7] Source: PDFH v5, Chapter B1 (2009)

A.2.2.1. EDGE Input Data

Base Data
Contain base year demand, revenue and distance information (crow flies distance is used for PLANET) in the input zoning system, i.e. the relevant PLANET model zoning system. Demand and revenue data are specified for movements between the PLANET zones for each ticket type: full, reduced and season. For the purposes of demand forecasting for HS2, the base demand and revenue values are set to 1, so that the forecast demand output from EDGE is, in reality, a demand growth index from base to future year, which can be applied to the 2010/11/11 base year demand in PLANET to calculate the forecast year demand. For example, a factor of 1.34 = 34% growth, for each zone pair.

Case Studies
These define the zone system at which EDGE calculations are to be performed. A separate bespoke case study, with an associated zone correspondence, has been set up for each of the four PLANET models that make up the HS2 modelling suite. For HS2 forecasting, the PLANET zoning system is used as each of the base, case study and output zoning systems.

Market Segmentation Correspondences
These link the base input data which are specified in terms of ticket types to elasticity data which can often be specified in terms of journey purposes.

Scenarios
Contain the demand driver data, which define the way in which exogenous impacts on demand vary over time, and elasticity data, which define the strength of the effect of a driver change on passenger demand in different categories of impact, as defined in PDFH. A bespoke scenario is set up for HS2 demand forecasting, based on the demand driver inputs supplied by DfT and recommended elasticities from PDFH.

A.2.2.2. EDGE Process

During the EDGE run for HS2, the following processes are performed[8]:

- Base year demand, revenue and distance data are read from input files in the relevant PLANET zoning system. Using the market segmentation correspondences, each ticket type's demand and revenue are split into journey purposes.

- Files of demand driver data are read from selected files in their own zoning systems and formats, as specified through the HS2 bespoke scenario. Files of elasticities are read from files associated with each of the demand driver inputs. Elasticities are defined in terms of a set of flow categories.

- The demand driver data are converted from their input zoning system into the PLANET zoning system with the use of correspondence files. Each demand driver zonal movement is then associated with one of the flow categories used in the elasticity files so that the correct elasticity may be applied.

- For each of the specified forecast years, EDGE cycles over all of the converted base year data at PLANET zone level. For each combination of origin, destination, ticket type and journey purpose, the corresponding change in each demand driver is calculated and with the relevant elasticity applied to calculate the resulting change in demand.

- The demand changes due to all specified demand drivers are accumulated for the given base year movement, and used to calculate the forecast year demand and revenue, which is written to the output file. The output file displays the raw output data for each movement (combination of origin and destination zones and ticket type) in the case study zone system, including the demand and revenue growth factors specified for each movement and each combination of ticket type and journey purpose.

A.2.2.3. Ticket Type to Journey Purpose Conversion

The demand growth factors produced from the EDGE process vary by a combination of ticket type (full, reduced and season) and journey purpose (business, leisure and commuting), whereas the PLANET models disaggregate demand by journey purpose only. A separate module, HS2GrowthFactors.exe, is used to

[8] Source: adapted from the EDGE v1.5.0.0 User Guide

undertake a conversion process, based on the market segmentation correspondences defining the PDFH recommended ticket type – journey purpose weightings. The output of the process is a set of growth factor matrices for each journey purpose formatted for input to EMME.

A.2.3. Matrix Processing

The matrix processing consists of the following stages, with a separate macro set up to run each of the processes, called from a batch file.

Import base demand and growth factor matrices

Once all the growth factor matrices varying by journey purpose have been produced, appropriate matrix headers have been added to suit the desired matrix structure within the EMME databank. An empty EMME databank has been set up for each PLANET model with all the existing matrices removed. The base demand matrices and growth uplift matrices are then imported to the databank.

Produce transpose of growth factor matrix to apply to non-home based trips (for PS and PLD only)

A transpose matrix is required to be produced from each demand growth matrix for the purposes of calculating forecast demand matrices for PS and PLD. This is because the demand in these models is separated between home based and non-home based trips. The transpose matrix represents growth in demand "to home".

Calculate future year demand matrices at the desired intervals

The forecast demand matrices are calculated by multiplying the base demand by the relevant growth matrix, specifically:

- For "from home" matrices (PLD and PS only) multiply by the original growth matrix;
- For "to home" matrices (PLD and PS only) multiply by the transpose of the growth matrix;
- For PLD, NCA matrices are derived from the average of "from home" and "to home", i.e. base demand*growth + base demand*transpose growth / 2;
- For PN and PM there is no segregation of "from home" and "to home" so the base demand is simply multiplied by the original growth matrix.

Apply car availability redistribution (for PLD, PM and PN)

To reflect increased car availability in future years, demand has to be redistributed from the non-car available (NCA) to the car available (CA) matrix. A matrix of factors is produced based on the non-car ownership driver used in the EDGE process, which is imported to EMME and applied to the forecast year matrix. The calculation is as follows:

- For PM and PN, add to the CA matrix the NCA matrix multiplied by the (origin) redistribution factor, then multiply the NCA matrix by 1 minus (origin) redistribution factor, i.e.
  - New CA matrix = CA matrix + NCA matrix*factor
  - New NCA matrix = NCA matrix*(1 – factor)
- For PLD, as "from home and "to home" demand is separated, the demand matrices need to be multiplied by the average of the origin and destination redistribution factors, i.e.
  - New CA from = CA from + (NCA*((origin factor + destination factor)/2)/2)
  - New CA to = CA to + (NCA*((origin factor + destination factor)/2)/2)
  - New NCA = NCA*(1 – (origin factor + destination factor)/2)

Re-distribution of Business NCA demand (PLD only).

A high-level assumption has been made that all passengers making a business trip owns a car. Therefore, Business NCA demand is redistributed to the Business CA matrix.

Apply airport demand growth (PS only)

The PLANET South model contains point zones (with no spatial representation), with the purpose of representing rail demand accessing airports. There are zones representing Heathrow, Gatwick, Stansted and Luton airports. A growth factor is applied to these zones to reflect airport passenger growth influencing rail demand. A matrix of factors is derived based on the air passenger growth driver supplied by DfT, which is applied to the PLANET South forecast year matrices.

Batch out demand matrices from EMME

Once the matrix processing is complete, the demand matrices for each forecast year are exported from the EMME databank.

A.2.4. Derivation of Cap Year

The first forecast year in the HS2 model is set to 2026/27. The second forecast year used in HS2 modelling is referred to as the cap year and this represents the year at which long distance rail demand is deemed to reach a saturation point, beyond which no further demand growth occurs. The concept of the cap year is described in WebTAG Unit A5.3, January 2014. Its application for HS2 appraisal has been agreed with DfT.

The revision to the levels and distribution of forecast demand necessitates a change to the cap year due to the accelerated growth. To derive the cap year long distance rail trips over 100 miles (within PLD) are matched to the level originally predicted in the February 2011 HS2 London – West Midlands consultation model: 290,146 trips.

In order to derive the cap year the number of forecast trips greater than 100 miles in length in PLD is calculated at five year intervals between 2026/27 and 2051. A linear interpolation is applied to calculate demand for the interim years. Once the cap year has been calculated demand matrices are produced for each of the four models by applying linear interpolation between the relevant matrices. For example, if the cap year is 2037 then the calculation is 2036/37 demand matrix*0.8 + 2041 demand matrix*0.2.

Appendix B. Highway Forecasting

B.1. TEMPRO growth

Table B-1 and Table B-2 show the trips growth forecasted in TEMPRO for the 25 sector system.

Table B-1 TEMPRO growth between 2010/11 and 2026/27

Sector No.	HBW Production	HBW Attraction	HBEB Production	HBEB Attraction	HBO Production	HBO Attraction	NHB Production	NHB Attraction
1	1.0731	1.0731	1.1049	1.1049	1.1214	1.1214	1.1047	1.1047
2	1.0175	1.0194	1.0360	1.0377	1.0918	1.0917	1.0627	1.0626
3	1.0593	1.0593	1.0789	1.0791	1.1297	1.1297	1.0991	1.0991
4	1.0636	1.1122	1.0766	1.1329	1.1391	1.1651	1.1471	1.1464
5	1.0838	1.0736	1.1130	1.0996	1.1146	1.1057	1.0944	1.0944
6	1.1134	1.1075	1.1385	1.1311	1.1987	1.1961	1.1565	1.1566
7	1.0526	1.0528	1.0724	1.0728	1.0976	1.0960	1.0819	1.0819
8	1.0211	1.0697	1.0358	1.0967	1.0532	1.0961	1.0929	1.0932
9	1.0431	1.0423	1.0536	1.0566	1.1298	1.1304	1.0896	1.0895
10	1.0752	1.0783	1.0917	1.0950	1.1588	1.1612	1.1255	1.1255
11	1.0680	1.0563	1.0814	1.0694	1.1611	1.1515	1.1089	1.1085
12	1.0963	1.0952	1.1071	1.1061	1.2057	1.2105	1.1613	1.1605
13	1.1339	1.1294	1.1503	1.1453	1.2359	1.2321	1.1832	1.1857
14	1.1223	1.1200	1.1357	1.1347	1.2496	1.2500	1.1888	1.1886
15	1.1000	1.0995	1.1157	1.1119	1.1411	1.1409	1.1224	1.1227
16	1.0257	1.0280	1.0364	1.0413	1.0964	1.0951	1.0659	1.0655
17	1.1277	1.1274	1.1569	1.1562	1.1429	1.1437	1.1421	1.1420
18	1.0126	1.0115	1.0208	1.0203	1.1345	1.1325	1.0764	1.0767
19	1.1144	1.1179	1.1257	1.1338	1.1584	1.1542	1.1383	1.1395
20	1.0740	1.1203	1.0856	1.1399	1.1586	1.2012	1.1706	1.1723
21	1.1468	1.1086	1.1686	1.1224	1.1902	1.1647	1.1361	1.1350
22	1.0791	1.0933	1.0917	1.1172	1.1428	1.1508	1.1283	1.1285
23	1.0807	1.0911	1.0915	1.1056	1.1269	1.1308	1.1152	1.1158
24	1.1155	1.1175	1.1326	1.1336	1.1762	1.1781	1.1520	1.1519
25	1.0584	1.0569	1.0744	1.0736	1.1744	1.1738	1.1211	1.1210

Table B-2 TEMPRO growth between 2010/11 and 2040/41

Sector No.	HBW Production	HBW Attraction	HBEB Production	HBEB Attraction	HBO Production	HBO Attraction	NHB Production	NHB Attraction
1	1.1436	1.1435	1.2078	1.2079	1.1633	1.1633	1.1693	1.1693
2	1.0146	1.0165	1.0509	1.0526	1.1572	1.1559	1.1001	1.1001
3	1.0973	1.0973	1.1325	1.1326	1.2210	1.2210	1.1687	1.1687
4	1.0934	1.1976	1.1226	1.2426	1.2228	1.2871	1.2620	1.2611
5	1.1291	1.1119	1.1832	1.1599	1.1876	1.1724	1.1525	1.1524
6	1.2141	1.2016	1.2669	1.2514	1.3449	1.3381	1.2814	1.2815
7	1.1376	1.1339	1.1841	1.1805	1.1410	1.1361	1.1488	1.1491
8	1.0175	1.1000	1.0457	1.1519	1.0915	1.1659	1.1526	1.1533
9	1.0802	1.0770	1.1041	1.1087	1.2154	1.2129	1.1528	1.1527
10	1.1138	1.1190	1.1458	1.1516	1.2768	1.2814	1.2123	1.2126
11	1.0925	1.0728	1.1205	1.0994	1.2726	1.2543	1.1747	1.1740
12	1.1561	1.1551	1.1803	1.1779	1.3650	1.3763	1.2837	1.2817
13	1.2112	1.2060	1.2436	1.2378	1.4148	1.4066	1.3116	1.3158
14	1.1739	1.1712	1.1977	1.1973	1.4504	1.4515	1.3194	1.3191
15	1.1997	1.2021	1.2334	1.2296	1.2389	1.2434	1.2298	1.2303
16	1.0510	1.0443	1.0712	1.0689	1.1667	1.1528	1.1058	1.1053
17	1.2800	1.2812	1.3456	1.3466	1.2160	1.2183	1.2637	1.2635
18	1.0045	1.0031	1.0216	1.0215	1.2247	1.2214	1.1219	1.1222
19	1.1801	1.1845	1.2050	1.2174	1.2757	1.2619	1.2287	1.2313
20	1.1102	1.1938	1.1333	1.2321	1.2760	1.3554	1.2944	1.2972
21	1.2388	1.1759	1.2820	1.2045	1.3300	1.2920	1.2350	1.2332
22	1.1103	1.1280	1.1361	1.1730	1.2451	1.2508	1.2018	1.2018
23	1.1164	1.1356	1.1386	1.1637	1.2171	1.2223	1.1879	1.1893
24	1.1980	1.2015	1.2307	1.2327	1.3035	1.3071	1.2637	1.2636
25	1.0842	1.0813	1.1140	1.1123	1.3109	1.3096	1.2065	1.2065

B.2. Future year matrices

Following tables show the final output matrices by trip purpose for 2026/27 and 2040/41, aggregated into Government Office Regions.

Table B-3 2026/27 Daily Highway Commuting Demand matrix (daily person trips)

Area	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	Grand Total
East Midlands	6,765	6,483	1,123	130	2,841	86	1,848	251	354	9,042	5,146	34,069
East of	5,961	21,549	4,847	18	136	1	12,691	706	208	2,608	302	49,026
London	999	4,804	0	17	56	0	23,564	3,243	249	787	132	33,850
North East	131	28	24	303	494	476	33	11	9	34	2,027	3,569
North West	2,788	170	66	497	13,888	270	128	95	642	3,530	5,925	27,999
Scotland	107	2	0	450	261	20,837	5	2	18	171	188	22,039
South East	1,780	12,867	23,534	24	127	2	30,939	6,137	180	2,963	263	78,819
South West	281	881	3,458	6	123	2	5,993	17,833	2,193	2,123	53	32,946
Wales	344	217	308	9	715	23	200	2,399	1,320	2,383	106	8,022
West Midlands	8,142	2,560	847	36	3,739	157	3,001	1,990	2,149	4,875	946	28,441
Yorks &	5,693	389	144	2,154	6,156	203	260	60	96	979	22,510	38,642
Grand Total	32,991	49,948	34,351	3,644	28,536	22,057	78,661	32,727	7,417	29,494	37,597	357,423

Table B-4 2040/41 Daily Highway Commuting Demand matrix (daily person trips)

Area	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	Grand Total
East Midlands	6,793	6,819	1,197	129	2,855	86	1,913	253	381	9,421	5,363	35,210
East of	6,088	22,759	5,188	18	137	1	12,999	720	227	2,792	318	51,247
London	1,074	5,334	0	18	59	0	25,210	3,482	290	871	146	36,485
North East	133	30	26	305	495	484	34	11	10	36	2,126	3,688
North West	2,846	182	72	498	14,139	274	133	97	681	3,678	6,288	28,888
Scotland	115	2	0	476	277	22,155	5	2	19	190	209	23,450
South East	1,820	13,493	24,668	24	128	2	31,609	6,276	197	3,179	276	81,672
South West	283	934	3,687	6	123	2	6,220	18,172	2,430	2,231	55	34,143
Wales	374	248	360	10	755	24	225	2,670	1,519	2,656	118	8,958
West Midlands	8,520	2,828	935	37	3,858	164	3,264	2,101	2,378	5,109	1,023	30,218
Yorks &	6,048	437	164	2,244	6,522	214	286	64	108	1,077	24,719	41,882
Grand Total	34,093	53,065	36,297	3,764	29,347	23,405	81,900	33,849	8,240	31,241	40,642	375,843

Table B-5 2026/27 Daily Highway Business Demand matrix (daily person trips)

Area	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	Grand Total
East Midlands	10,091	6,578	2,651	1,132	6,723	664	3,996	1,204	2,224	9,012	7,294	51,568
East of	5,998	24,720	3,703	201	1,246	108	13,791	2,420	1,564	5,565	2,027	61,342
London	2,860	4,236	0	193	645	101	14,967	6,822	2,346	3,944	1,112	37,228
North East	1,044	243	234	512	2,582	2,459	343	135	260	582	5,467	13,862
North West	6,262	1,606	770	2,989	22,322	2,199	1,274	870	2,932	9,156	9,601	59,982
Scotland	474	111	96	1,776	1,525	30,116	160	99	225	854	887	36,322
South East	3,672	14,611	14,908	279	1,094	176	39,310	14,306	1,240	7,965	1,602	99,163
South West	1,043	2,388	6,891	94	1,065	171	14,389	30,783	5,078	5,429	477	67,810
Wales	2,195	1,505	2,393	235	2,503	344	1,350	4,681	2,430	6,415	1,151	25,204
West Midlands	8,957	5,654	3,912	610	8,992	1,054	7,659	5,004	6,450	4,657	3,807	56,755
Yorks &	7,258	2,309	1,144	6,138	9,692	1,349	1,739	583	1,218	4,053	17,021	52,504
Grand Total	49,855	63,962	36,704	14,159	58,389	38,741	98,978	66,906	25,967	57,632	50,446	561,739

Table B-6 2040/41 Daily Highway Business Demand matrix (daily person trips)

Area	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	Grand Total
East Midlands	10,376	7,046	2,806	1,148	6,938	699	4,200	1,258	2,479	9,444	7,864	54,257
East of	6,310	26,537	3,978	205	1,299	114	14,463	2,545	1,762	5,946	2,208	65,367
London	3,068	4,691	0	203	693	111	16,175	7,347	2,751	4,333	1,252	40,623
North East	1,064	256	246	519	2,641	2,564	357	139	287	608	5,862	14,542
North West	6,482	1,716	819	3,059	23,027	2,315	1,336	904	3,194	9,661	10,384	62,897
Scotland	508	123	106	1,872	1,622	32,612	175	107	254	940	990	39,310
South East	3,807	15,547	15,742	284	1,131	185	41,073	14,866	1,380	8,518	1,740	104,274
South West	1,084	2,564	7,314	96	1,104	181	15,085	31,960	5,670	5,795	520	71,374
Wales	2,448	1,735	2,768	256	2,732	384	1,523	5,249	2,811	7,286	1,332	28,522
West Midlands	9,378	6,154	4,230	628	9,458	1,133	8,280	5,356	7,292	4,905	4,204	61,016
Yorks &	7,868	2,591	1,282	6,564	10,456	1,483	1,925	641	1,413	4,500	19,195	57,917
Grand Total	52,394	68,960	39,290	14,834	61,100	41,780	104,592	70,372	29,292	61,935	55,550	600,099

Table B-7 2026/27 Daily Highway Leisure Demand matrix (daily person trips)

Area	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	Grand Total
East Midlands	30,133	21,497	3,895	2,514	11,075	2,382	13,084	2,178	2,997	13,518	20,115	123,389
East of	20,279	69,563	18,026	1,339	3,849	1,034	36,322	10,321	4,323	5,009	4,315	174,381
London	4,692	20,232	0	1,425	2,218	750	51,630	18,304	5,107	8,506	2,757	115,621
North East	2,263	1,112	1,167	2,891	9,199	9,512	1,672	703	771	778	11,520	41,586
North West	11,922	3,795	2,302	10,133	68,485	7,643	4,660	3,274	18,498	19,519	28,737	178,968
Scotland	2,145	902	792	9,032	7,074	108,531	1,151	862	1,194	1,640	3,956	137,280
South East	14,940	33,929	48,106	1,548	4,909	1,167	101,959	44,625	3,269	15,195	5,730	275,376
South West	1,970	10,884	18,050	420	4,208	922	41,625	94,966	16,329	19,735	1,370	210,478
Wales	2,964	3,233	4,756	1,005	16,024	1,305	2,920	17,062	33,783	15,803	2,723	101,577
West Midlands	13,994	4,829	8,538	1,043	17,162	2,403	15,153	17,017	16,358	16,796	4,478	117,770
Yorks &	20,280	4,174	2,589	12,167	26,918	5,085	6,061	2,131	2,845	4,510	78,497	165,256
Grand Total	125,582	174,149	108,221	43,514	171,121	140,734	276,235	211,443	105,473	121,009	164,199	1,641,682

Table B-8 2040/41 Daily Highway Leisure Demand matrix (daily person trips)

Area	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	Grand Total
East Midlands	33,476	24,125	4,354	2,731	11,743	2,517	14,228	2,401	3,244	14,684	22,335	135,840
East of	22,524	78,918	20,312	1,475	4,174	1,107	39,541	11,449	4,704	5,516	4,893	194,613
London	5,282	23,206	0	1,581	2,414	808	56,606	20,422	5,598	9,369	3,138	128,425
North East	2,466	1,244	1,283	3,108	9,720	9,963	1,793	768	818	834	12,645	44,643
North West	12,713	4,170	2,490	10,759	71,657	7,926	4,912	3,511	19,204	20,657	31,209	189,207
Scotland	2,290	990	855	9,531	7,355	112,399	1,212	926	1,237	1,736	4,296	142,825
South East	16,403	37,570	52,550	1,666	5,187	1,222	109,309	48,579	3,467	16,393	6,344	298,690
South West	2,187	12,286	20,010	458	4,527	984	45,283	105,197	17,695	21,451	1,534	231,612
Wales	3,220	3,564	5,175	1,067	16,610	1,341	3,099	18,430	35,264	16,813	2,984	107,567
West Midlands	15,269	5,361	9,342	1,121	18,169	2,530	16,281	18,516	17,364	17,818	4,961	126,733
Yorks &	22,635	4,806	2,933	13,370	29,132	5,472	6,698	2,391	3,104	4,994	88,455	183,990
Grand Total	138,465	196,240	119,304	46,869	180,687	146,269	298,962	232,590	111,698	130,266	182,795	1,784,145

Appendix C. Quality Assurance Reports

Atkins Limited
Euston Tower
286 Euston Road
London
NW1 3AT