HS2 Phase Two
Model Development Report
PLANET Framework Model v5.2 to v6.1c

November 2016

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Department for Transport

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1 Introduction

1.1.1 HS2 Ltd is committed to preparing a range of Business Cases for the differing phases of the HS2 scheme. The HS2 scheme comprises a network of new high speed rail lines that are due to be connected and completed in a series of phases, as follows:

- The first phase of the scheme (Phase One) is due for completion in the year 2026 and will see high speed train services linking London and Birmingham;
- The second phase (Phase Two) of the scheme which is forecast for completion in 2033 is a Y shaped network which will further connect Manchester and Leeds to Birmingham and London; and
- Phase 2a is an intermediate phase of the HS2 scheme that aims to bring forward the provision of high speed services into Crewe, to provide a fast link to the West Coast Mainline (WCML) by 2027, just one year after completion of Phase One.

1.1.2 The PLANET Framework Model (PFM) is the primary tool for forecasting HS2 ridership and calculating associated benefits and revenue to support the HS2 Business Case. The most recent version of the PFM, which was used to support the Strategic Outline Business Case (SOBC) for Phase 2a in 2015, is PFMv5.2b. PFMv6.1c supersedes PFMv5.2b and will be used to support the upcoming Business Case work in 2016.

1.1.3 A programme of model development has been undertaken on the PFM in order to release PFMv6.1c for use in supporting the HS2 Business Case, and this development has required the future year demand forecasts to be recalculated.

1.1.4 The purpose of this Forecasting Report is to present the updated forecasts used in PFMv6.1c and to analyse and discuss the changes that have occurred as a result of the re-forecasting.

1.1.5 This report is structured as follows:

- The remainder of this first chapter presents an overview of the future year demand forecasts for each mode and sub-model of the PFM.
- Chapter 2 presents the forecasting approach for rail demand for the four sub-models of the PFM, and analyses the resulting future year demand forecasts.
- Chapter 3 presents in more detail the modelling updates, which impact the future year demand forecasts and quantify the impact – in step changes – that these changes are having on the level of demand that is forecast.
- Chapter 4 describes the forecasting approach for the highway mode and presents the resulting highway forecast demand.
- Chapter 5 details the future year air forecasts; and
- Chapter 6 summarises the quality assurance (QA) that has been carried out during the forecasting for PFMv6.1c.

2 Summary of rail demand forecasts

2.1.1 A summary of rail demand forecasts for the PFM future year model are presented within this chapter and compared to those used in PFMv5.2b, the previous Business Case model.

2.1.2 The rail demand forecasts for PFMv6.1c have been derived using the methodology described in in the PFMV6.1c Base Model Development Report.

2.1.3 Since PFMv5.2b, several inputs to the forecasting approach have been updated to improve the forecasting of future year rail demand, and can be summarised as follows:

- Migration to EDGEv1.5.1.0, the main consequence of which enables use of PDFHv5.1 variable elasticity values over the short-term and long-term forecasting period, functionality that was not previously possible within earlier versions of EDGE;
- Updated set of exogenous demand drivers from the DfT for input to EDGE;
- Updated base year rail demand matrices: the base year model for PFMv6.1c has been updated from a 2010/11 base year to represent the 2014/15 financial year; and
- Modelling of a 20-year appraisal horizon, which sets the second forecast year as 2036.

2.1.4 Table 1 shows the impact of the above changes on the forecast levels of demand. The forecast demand in the second forecast year is ~13% higher in PFMv6.1c than in PFMv5.2b. There are increases in demand in the regional models as well as the long distance model, resulting in a 12% increase in total demand across all models in both forecast years.

2.1.5 Further details about the new demand matrices in PFMv6.1c are contained within Chapter 4.

Table 1 - Summary of impact on rail demand forecasts

Matrix description	2026/27				Second forecast year			
	PFMv5.2b	PFMv6.1c	Difference (Abs)	Difference (%)	PFMv5.2b	PFMv6.1c	Difference (Abs)	Difference (%)
PLANET Long Distance	455,166	514,916	59,750	13.1%	584,934	662,268	77,334	13.2%
PLANET Midland	69,454	86,005	16,551	24%	83,213	104,298	21,085	25%
PLANET North	103,871	147,087	43,216	42%	124,105	173,168	49,063	40%
PLANET South	2,040,211	2,237,155	196,944	9.7%	2,316,227	2,530,796	214,569	9.3%
Total	2,668,702	2,985,163	316,461	12%	3,108,479	3,470,530	362,051	12%

3 Rail forecast step-through

3.1 Introduction

3.1.1 The following section provides a step-through of the various updates to the rail demand forecasts, and the impact of each on the resulting level of demand in the future years.

3.1.2 Each change to the forecasting approach was tested individually so that the impact of each update could be independently understood and verified. These were undertaken in step-changes from PFMv5.2b – making one change in turn – and after each change the full forecasting approach was undertaken to create future year demand matrices in order to analyse the level of demand that had been calculated.

3.1.3 The steps and resulting impact are summarised as:

- Migration to EDGEv1.5.1.0: 1% increase to PLD forecasts, no change to the demand cap year. Minimal impact in PS, around 2% increase in PM and PN;
- Updated demand drivers of rail growth: 0.5% increase to PLD forecasts and a change in demand cap to 2036/37. 3.6% increase in PS, 2.7% impact in PM and 0.2% increase in PN; and
- Base year and appraisal horizon updates: 11.5% increase in forecasts for PLD for 2026/27 and 2036/37. 5.5% increase in PS, 19% increase in PM and 35-40% increase in PN.

3.2 Migration to EDGEv1.5.1.0

Description of change

3.2.1 Forecasts held within PFMv5.2b used EDGEv1.5.0.0 to calculate the growth from the base year to the designated forecast years. It was functionally not possible to apply variable elasticity values – suggested by PDFHv5.1 – within EDGEv1.5.0.0; migration to EDGEv1.5.1.0 has made this possible.

3.2.2 PDFHv5.1 recommended elasticity values for non-London flow categories are presented in Table 2. These are the exogenous elasticity values that vary over the short and long-term forecasting horizon. The figures show that the recommended elasticity values for both the GDP per capita and employment demand drivers should vary across the forecasting horizon for non-London Core and Major city flow categories; the population elasticity does not vary from the value of 1.

3.2.3 PDFHv5.1 flow categories for non-London (and not wholly contained within the South East) flows break down to the following geographical sets:

- Non-London Core: Trips to and from cities defined as 'Core Cities'. The set of core cities is as follows: Birmingham, Bristol, Cardiff, Edinburgh, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield.
- Non-London Major: Trips between cities defined as 'Major Cities'. The set of major cities is as follows: Aberdeen, Bolton, Blackburn, Blackpool, Bournemouth, Bradford, Cambridge, Carlisle, Chester, Colchester, Coventry,

Crewe, Darlington, Derby, Doncaster, Dundee, Durham, Exeter, Huddersfield, Hull, Inverness, Ipswich, Leicester, Middlesbrough, Norwich, Peterborough, Plymouth, Preston, Stockport, Stoke-on-Trent, Sunderland, Swansea, Swindon, Wakefield, Watford, Wigan, Wolverhampton and York.

- Non-London Other: All other non-London and within the South East flows. These flows do not have variable elasticity values applied to them in PDFHv5.1.

Table 2 - PDFHv5.1 Variable Elasticity Values (Source: Table B1.4 – B1.6 PDFHv5.1)

PDFH Flow Category	**Demand driver**	**Short-term elasticities**		**Long-term elasticities**	
		Season	**Other**	**Season**	**Other**
Non-London Core Flows	GDP Per Capita	n/a	1.4	n/a	1.2
	Employment	1.7	n/a	1.3	n/a
	Population	1.0*	1.0	1.0*	1.0
Non-London Major Flows	GDP Per Capita	n/a	1.4	n/a	1.2
	Employment	1.3	n/a	1.2	n/a
	Population	1.0*	1.0	1.0*	1.0
Non-London Other Flows	GDP Per Capita	n/a	0.85	n/a	0.85
	Employment	1.3	n/a	1.3	n/a
	Population	1.0*	1.0	1.0*	1.0

* The population elasticity for commuting relates to relative population growth.

3.2.4 WebTAG (TAG Unit M4 Forecasting and Uncertainty) states: "In PDFH 5.1 short and long term elasticities for population and employment are provided for non-London flows…. It is recommended that short term elasticities are used for the years 2013/14 to 2018/19 and long term elasticities for all years from 2023/24 onwards (with a gradual transition between them as per PDFH recommendation)."

3.2.5 To maintain consistency with both PDFH and WebTAG guidance, the following elasticity values (Table 3) have been updated in the EDGE forecasting system in order to calculate future year rail demand for PFMv6.1c.

Table 3 - PFMv6.1c Exogenous Elasticity values applied in EDGE

Demand Driver	**Flow Category (All segments)**	**Ticket Type**	**Up to 2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24 & Beyond**
GDP Per Capita	Non-London Core & Non-London Major	F	1.4	1.36	1.32	1.28	1.24	1.2
		R	1.4	1.36	1.32	1.28	1.24	1.2
		S	n/a					
Employment	Non-London Core	F	n/a					
		R	n/a					
		S	1.7	1.62	1.54	1.46	1.38	1.3
	Non-London Major	F	n/a					
		R	n/a					
		S	1.3	1.28	1.26	1.24	1.22	1.2

3.2.6 For previous versions of the PFM, the forecasting approach applied the long-term elasticity values for all years and, in doing so, for non-London core and major flows underestimated growth in rail demand in the years up to 2023/24.

3.2.7 In making the change to the elasticity values used within EDGE, the rail demand forecasts for PFMv6.1c will increase slightly. This is more noticeable in regional models PM and PN, where a larger proportion of the demand is from the non-London core and major flow categories. It is expected to have a modest effect in PLD and a very marginal effect in PS, where almost all of the demand is associated with the London and South East flow categories.

Impact on forecasts

3.2.8 In this first step-change, EDGEv1.5.1.0 has been used to forecast the growth in rail demand for the PFMv5.2b business case model, using the variable elasticity values as described in the section above. It should be noted that the demand drivers input to EDGEv1.5.1.0 are the same as those used for calculating PFMv5.2b, and the resulting rail demand growth forecasts have been applied to the 2010/11 base demand in PFMv5.2b.

3.2.9 The impact on the PLD future year demand forecasts of including PDFHv5.1 variable elasticity values for GDP/Capita and Employment demand drivers increases the overall level of demand in 2026/27 and the second forecast year by 1%.

3.2.10 In this step-change test, the demand cap methodology was applied to the forecasts; this was calculated to be 2037/38 in line with the cap year for PFMv5.2b – the increases in demand were not large enough to affect the cap year.

3.2.11 Business trips are affected to a lesser extent by the change to variable elasticity values than for other modes, this is due to a smaller proportion of business trips being included within the non-London flow groups required for the variable elasticity values to be applied – only 38% of business trips are in-scope for variable elasticities in PLD, compared to around 70% for commuting and leisure purposes.

Table 4 - Impact to PLD Matrix Totals of the Migration to EDGE1.5.1.0

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	PFMv5.2b	Step1	Change (Abs)	Change (%)	PFMv5.2b (2037/38)	Step 1 (2037/38)	Change (Abs)	Change (%)
Commuting non-car available	12,140	12,297	158	1.3%	13,198	13,368	170	1.3%
Commuting car available from	47,560	48,143	583	1.2%	57,231	57,913	682	1.2%
Commuting car available to	47,560	48,143	583	1.2%	57,231	57,913	682	1.2%
Business non-car available	-	-	-	-	-	-	-	-
Business car available from	73,485	74,001	516	0.7%	98,442	99,095	653	0.7%
Business car available to	59,471	59,874	403	0.7%	79,766	80,276	510	0.6%
Other non-car available	40,257	40,706	448	1.1%	48,626	49,154	528	1.1%
Other car available from	98,244	99,396	1,153	1.2%	129,346	130,836	1,489	1.2%
Other car available to	76,448	77,347	899	1.2%	101,093	102,260	1,167	1.2%
Total	455,166	459,908	4,742	1.0%	584,934	590,815	5,881	1.0%

3.2.12 The impact to the future year rail forecasts for the regional AM peak models of the migration to EDGEv1.5.1.0 is presented in Tables 4 to 7. As expected, there is a minimal impact to the level of demand in PS – as this model is London-centric and there is little demand associated with the non-London PDFH flow groups.

3.2.13 The future year demand forecasts for PM and PN show a larger impact to demand by applying the variable elasticity values, an increase of around 2% – this level of increase is to be expected.

3.2.14 In both models the impact to commuting is the most significant, as this is the largest mode share – this is more pronounced in PM than in PN and this stronger growth in commuting trips is driving the greater growth in PM than PN. This is due to a stronger employment growth forecast - the driver of commuting trips - in the Midlands regions than Northern regions; applying the variable elasticity values to this stronger forecast will drive more growth in PM.

3.2.15 As an additional check, analysis of the regional variation in growth in the PLD sub-model has been carried out to ensure that the impact of the migration to EDGEv1.5.1.0 has had the required effect in terms of the geographical distribution of trips affected for PLD. This was shown to be the case with impacts for only non-London and South East forecasts of rail demand; more information on this is presented in Appendix A.

Table 5 - Impact to PS Matrix Totals of the Migration to EDGE1.5.1.0

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	PFMv5.2b	Step1	Change (Abs)	Change (%)	PFMv5.2b (2037/38)	Step 1 (2037/38)	Change (Abs)	Change (%)
Business PA	184,982	185,007	25	0.01%	249,295	249,402	107	0.0%
Business AP	11,944	11,947	3	0.02%	15,735	15,778	43	0.3%
Leisure PA	193,696	193,736	40	0.02%	253,001	253,291	290	0.1%
Leisure AP	21,969	21,972	4	0.02%	27,885	27,969	84	0.3%
Commuting PA	1,593,854	1,593,988	135	0.01%	1,733,015	1,733,337	322	0.0%
Commuting AP	33,766	33,773	7	0.02%	37,296	37,383	87	0.2%
Total	2,040,209	2,040,423	213	0.01%	2,316,227	2,317,161	933	0.04%

Table 6 - Impact to PM Matrix Totals of the Migration to EDGE1.5.1.0

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	PFMv5.2b	Step1	Change (Abs)	Change (%)	PFMv5.2b (2037/38)	Step 1 (2037/38)	Change (Abs)	Change (%)
Business CA	6,094	6,206	113	1.8%	7,825	7,968	143	1.8%
Business NCA	794	807	13	1.6%	925	940	15	1.6%
Leisure CA	6,707	6,832	125	1.9%	8,561	8,719	158	1.8%
Leisure NCA	923	939	16	1.7%	1,073	1,091	18	1.7%
Commuting CA	48,052	49,205	1,153	2.4%	57,329	58,665	1,336	2.3%
Commuting NCA	6,883	7,043	159	2.3%	7,500	7,668	168	2.2%
Total	69,454	71,032	1,578	2.3%	83,214	85,052	1,838	2.2%

Table 7 - Impact to PN Matrix Totals of the Migration to EDGE1.5.1.0

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	PFMv5.2b	Step1	Change (Abs)	Change (%)	PFMv5.2b (2037/38)	Step 1 (2037/38)	Change (Abs)	Change (%)
Business CA	16,801	17,084	283	1.7%	21,556	21,921	365	1.7%
Business NCA	2,961	3,008	47	1.6%	3,482	3,538	56	1.6%
Leisure CA	12,758	12,973	215	1.7%	16,260	16,535	275	1.7%
Leisure NCA	2,363	2,400	38	1.6%	2,764	2,808	45	1.6%
Commuting CA	56,953	57,990	1,038	1.8%	66,995	68,227	1,233	1.8%
Commuting NCA	12,036	12,238	201	1.7%	13,049	13,270	222	1.7%
Total	103,871	105,693	1,822	1.8%	124,105	126,300	2,195	1.8%

3.3 Updated demand drivers

Description of change

3.3.1 The DfT releases a set of demand drivers for use within the EDGE forecasting system at regular intervals. The July 2015 dataset has been incorporated into the forecasting system for PFMv6.1c; this dataset includes economic outlook forecasts from OBR for July 2015. PFMv5.2b used exogenous forecasts from October 2014 with the exception of fares demand drivers, which had been updated to represent the Government manifesto of no real fares increases until 2020.

3.3.2 The DfT's demand driver set includes the following exogenous drivers:

- GDP per capita – Regional CEBR forecasts constrained to OBR Economic and Fiscal Outlook.
- Employment – NTEM forecasts constrained to regional CEBR constrained to National OBR Fiscal Sustainability forecasts.
- Population (and relative population for commuting purposes) - NTEM forecasts constrained to regional CEBR constrained to National ONS forecasts.
- National Rail fares
- London Underground fares
- Air passenger forecasts from DfT's aviation forecasts (TR13 forecasts).
- Car cost – data based on TAG databook November 2014.
- Car ownership – NTEM forecasts.
- Car and bus journey time forecasts – TAG databook November 2014.
- Bus fare and bus service – data provided by DfT local economics.

3.3.3 The July 2015 demand driver set has been compared back to the October 2014 set. This comparison shows that the following demand drivers have been updated between PFMv5.2b and PFMv6.1c:

- GDP per capita – updated as per July 2015 economic outlook forecasts.
- Employment – updated as per July 2015 economic outlook forecasts.
- Population – updated as per July 2015 economic outlook forecasts.
- Bus fare and service provision (headway) – forecasts have been updated and fares forecasts have also been extended to 2040 from 2035 in the October 2014 forecasts.
- London Underground fares – in PFMv5.2b the Government manifesto of RPI+0% growth in rail fares until 2020 was incorrectly applied to the London Underground fares growth as well; this has been corrected in PFMv6.1c.

3.3.4 For those demand drivers listed above which have been updated since PFMv5.2b, the national forecasts from July 2015 are presented in the figures below, and compared to the October 2014 forecasts used within PFMv5.2b.

3.3.5 The July 2015 economic drivers (Figure 1) used in PFMv6.1c are generally stronger than those used within PFMv5.2b. This is most significant for the employment forecasts; however, this driver only affects commuting trips, and therefore is expected to affect growth in the regional models more significantly than for PLD. At an aggregate level the GDP economic forecast has not changed, and the population forecast is slightly higher.

3.3.6 The bus fares growth forecasts (Figure 2) are similar to previous, with slightly lower growth by 2026 and slightly higher growth after 2035/36. The bus service frequency forecasts are more significantly different in PFMv6.1c with positive growth in bus headway, leading to an 8-9% increase in service provision in 2035/36 compared to a 4-5% decrease in PFMv5.2b. Small PDFH elasticity values applied in the bus competition framework in PDFH will only cause a small resulting impact to the rail demand growth.

Figure 1 - PFMv6.1c Economic Forecasts vs PFMv5.2b

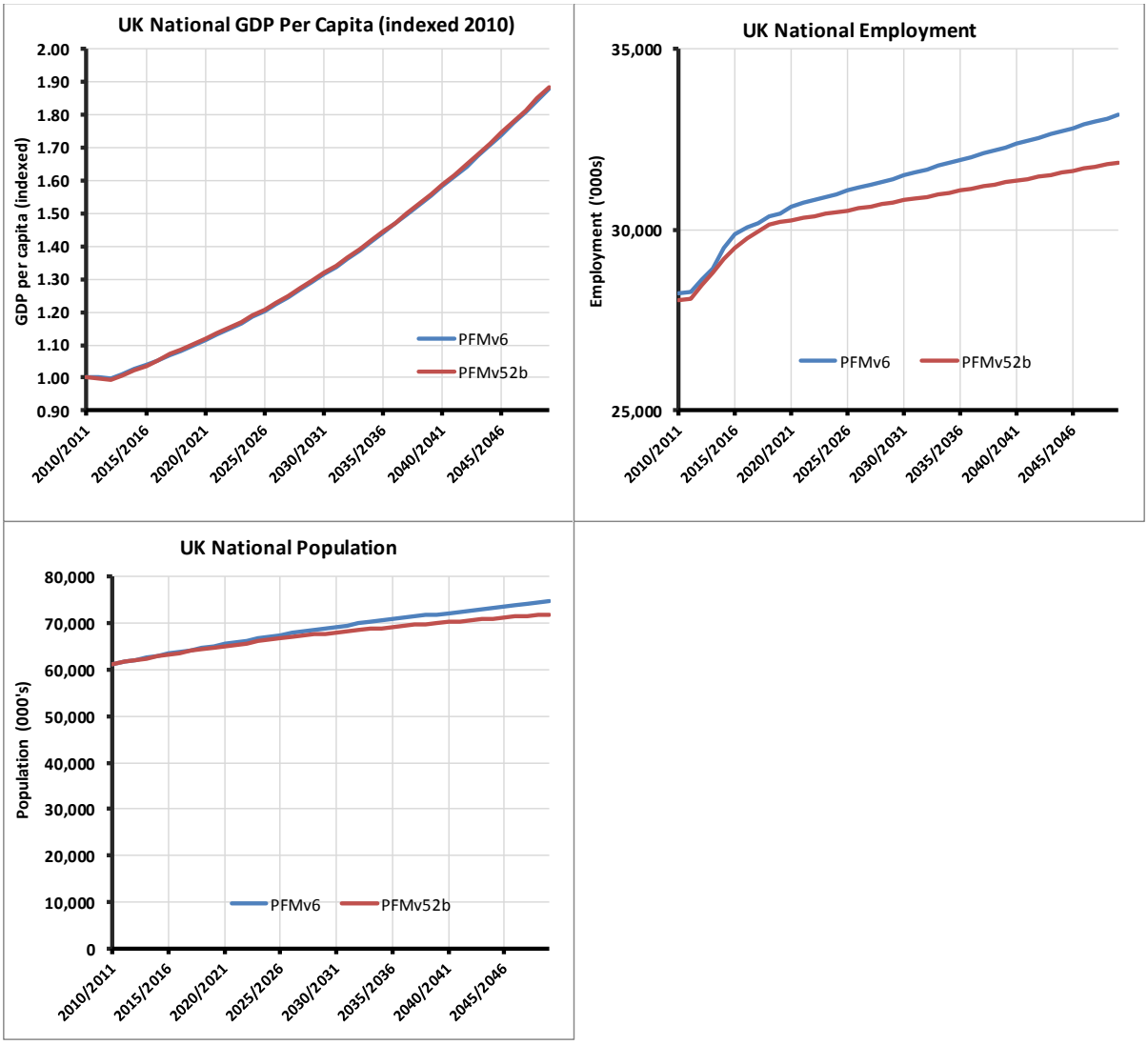
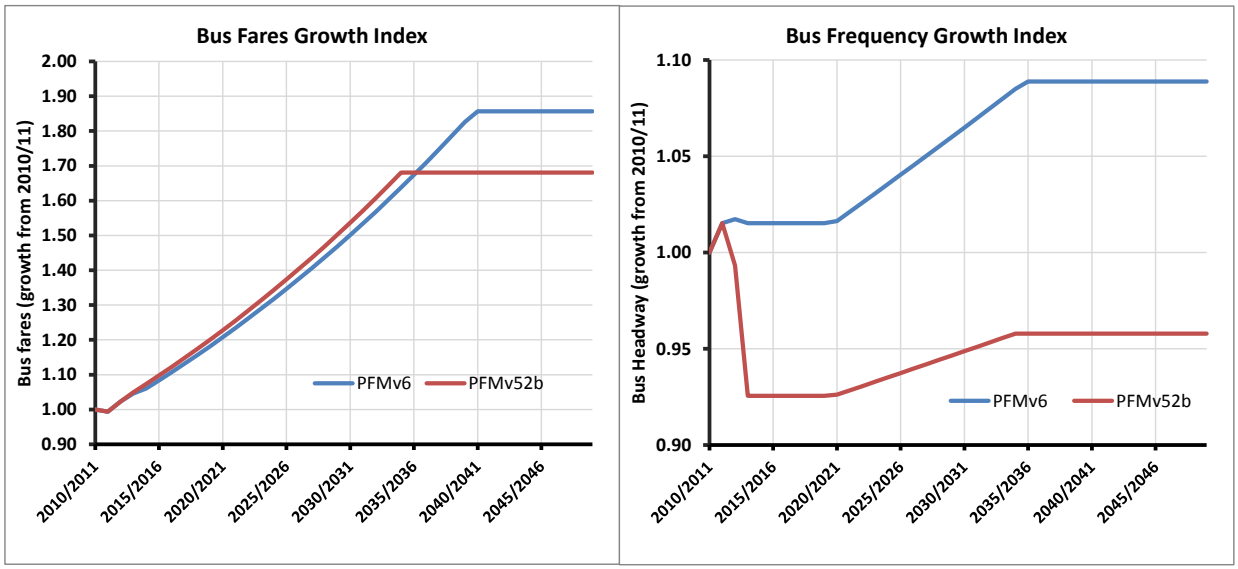
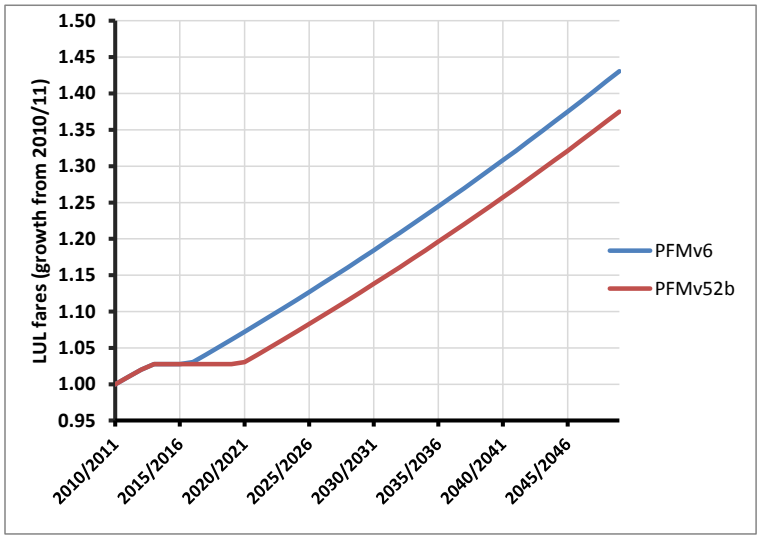


Figure 2 - PFMv6.1c Bus Fare & Service vs PFMv5.2b



3.3.7 London Underground fares (Figure 3) grow faster in the PFMv6.1c forecasts with the correction to the real fares growth forecast to model RPI+1% for all years except 2014/15 – 2015/16.

Figure 3 - PFMv6.1c London Underground Fares Growth vs PFMv5.2b



3.3.8 When applied within the forecasting process, however, the resulting rail demand growth will be affected by regional variations in the demand drivers and how these interact with the distributional level of demand.

3.3.9 Regional growth forecasts for GDP/Capita, population and employment have been compared between the two sets of demand drivers for the period 2010/11 – 2026/27 and 2010/11 to 2036/37. The resulting change in the forecasts in July 2015 compared to October 2014 is presented in Table 8 for these three drivers; the other drivers have not been presented as the bus competition drivers have changed consistently for all regions and the London Underground fares driver is only applied to London trips.

3.3.10 The national GDP forecast has decreased slightly; most of the individual regions have experienced a reduction in the GDP/Capita forecast. This is most significant for the North East, followed by the North West. London, Scotland and the West Midlands have experienced improvements in the GDP/Capita forecasts.

3.3.11 Population forecasts have increased by 1.3% in 2026/27 and 2.4% by 2036/37 in all regions. Employment is much more variable – there is an overall increase in 2026/27 of 1% in the forecast for employment, but Wales and East of England forecasts drop by around 1%, whereas London and the North West increase by over 3%. In 2036/37 there is an even bigger increase in the overall employment forecast: all regions see increases in the forecasts ranging from 0.1% to 4.7%.

3.3.12 The update to the set of demand drivers varies by region. Key winners are London, West Midlands and Scotland, rail demand growth will be stronger for these regions with the updated exogenous drivers – these are key markets for HS2.

Table 8 - Regional Change in Exogenous Demand Driver Forecasts (July 2015 vs October 2014)

Region	2010/11 – 2026/27			2010/11 – 2036/37		
	GDP/Capita	Population	Employment	GDP/Capita	Population	Employment
North East	-2.8%	1.3%	0.2%	-2.7%	2.4%	1.1%
North West	-1.7%	1.3%	3.3%	-1.7%	2.4%	4.3%
Yorks & Humber	-0.8%	1.3%	-0.3%	-0.7%	2.4%	0.7%
East Midlands	-0.2%	1.3%	0.3%	-0.1%	2.4%	1.3%
West Midlands	1.4%	1.3%	1.2%	1.5%	2.4%	2.2%
East of England	-0.7%	1.3%	-0.8%	-0.6%	2.4%	0.1%
London	0.9%	1.3%	3.7%	1.0%	2.4%	4.7%
South East	-0.3%	1.3%	0.6%	-0.3%	2.4%	1.5%
South West	-0.8%	1.3%	1.8%	-0.7%	2.4%	2.8%
Wales	-3.0%	1.3%	-0.9%	-2.9%	2.4%	0.1%
Scotland	1.4%	1.3%	0.5%	1.4%	2.4%	1.5%
Great Britain	-0.3%	1.3%	1.1%	-0.3%	2.4%	2.1%

Impact on forecasts

3.3.13 The July 2015 set of demand drivers have been implemented in this second step-change to understand the isolated impact of updating the demand drivers on the resulting rail demand growth. This step-change represents a further increment from the step-change presented in the previous sub-section. It should be noted that the resulting rail demand growth forecasts have been applied to the 2010/11 base demand in PFMv5.2b, and the demand cap methodology has been applied to calculate the cap or second forecast year.

3.3.14 The impact on the PLD sub-model of updating the demand drivers is presented in Table 9. In 2026/27 there has been a marginal increase in demand for all journey purposes of between 0 – 1%, resulting in an overall increase in demand of 0.4%. This is

due to the small increases in the overall demand drivers at a national level. GDP, the biggest driver, has decreased slightly at a national level but employment forecasts increased nationally by over 2%. Population forecasts have also increased nationally by 1.3% in 2026/27 and 2.4% in 2036/37.

3.3.15 In the second forecast year there has also been an increase in overall demand to a similar level as for 2026/27. This increase in demand has had the effect of moving the cap year forward to 2036/37. Compared to step 1, the overall increase in demand is smaller, and it is most likely the combination of these two updates that has moved the cap year forward to 2036/37, rather than the impact of step 2 alone.

3.3.16 Through the demand cap methodology, the level of demand in the cap year between any two tests should be at a similar level. This is true at an overall level for this step change; however, there is more variation within the journey purposes. The demand cap applies to long-distance trips, and for business and leisure trips the level of demand in the second forecast year is within 1% between these two tests. For commuting trips, which are typically a shorter distance, there is more of an increase; this is due to the stronger employment driver forecast in the longer term.

Table 9 - Impact to PLD Matrix Totals of the Update to Exogenous Forecasts

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	Step1	Step2	Change (Abs)	Change (%)	Step 1 (2037/38)	Step 2 (2036/37)	Change (Abs)	Change (%)
Commuting non-car available	12,297	12,374	77	0.6%	13,368	13,674	306	2.3%
Commuting car available from	48,143	48,575	432	0.9%	57,913	58,703	790	1.4%
Commuting car available to	48,143	48,575	432	0.9%	57,913	58,703	790	1.4%
Business non-car available	-	-	-	-	-	-	-	-
Business car available from	74,001	74,377	376	0.5%	99,095	99,038	-57	-0.1%
Business car available to	59,874	60,210	336	0.6%	80,276	80,248	-28	0.0%
Other non-car available	40,706	40,760	55	0.1%	49,154	49,656	502	1.0%
Other car available from	99,396	99,554	158	0.2%	130,836	131,245	409	0.3%
Other car available to	77,347	77,513	166	0.2%	102,260	102,577	317	0.3%
Total	459,908	461,939	2,031	0.4%	590,815	593,844	3,029	0.5%

3.3.17 The impact to the future year rail demand in the regional models due to the update to the demand drivers is presented in Tables 10 to 12. For PS there is a more significant impact than in PLD of updating the set of demand drivers. As AM peak models the regional models typically represent commuting trips, and the employment forecasts have changed most significantly within the July 2015 update. The employment driver has increased most significantly for London of 3-4%, which is similar to the growth in rail trips in PS.

Table 10 - Impact to PS Matrix Totals of the Update to Exogenous Forecasts

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	Step1	Step2	Change (Abs)	Change (%)	Step 1 (2037/38)	Step 2 (2036/37)	Change (Abs)	Change (%)
Business PA	185,007	188,438	3,432	1.9%	249,402	245,263	-4,139	-1.7%
Business AP	11,947	12,106	159	1.3%	15,778	15,421	-357	-2.3%
Leisure PA	193,736	198,055	4,319	2.2%	253,291	252,386	-905	-0.4%
Leisure AP	21,972	22,313	341	1.6%	27,969	27,860	-110	-0.4%
Commuting PA	1,593,988	1,663,468	69,480	4.4%	1,733,337	1,820,119	86,782	5.0%
Commuting AP	33,773	34,934	1,161	3.4%	37,383	38,420	1,037	2.8%
Total	2,040,423	2,119,315	78,892	3.9%	2,317,161	2,399,470	82,309	3.6%

3.3.18 PM shows an increase in overall rail demand of around 2-3% for both forecast years – the effect is stronger in 2036/37 than in 2026/27. These increases are driven by the change in forecasts for the West and East Midlands. The West Midlands has some of the largest increases in forecasts with the update to demand drivers; East Midlands population and employment forecasts also increase, which will further drive growth in rail demand.

3.3.19 In PN the impact of the update to the demand drivers is small for all journey purposes. In 2026/27 there are decreases in business and leisure trips in line with the small decreases in the GDP forecasts for the North and Yorkshire & Humber. As the employment forecast gets stronger by 2036/37, there is enough of an increase to commuting trips to cause an increase in overall demand.

Table 11- Impact to PM Matrix Totals of the Update to Exogenous Forecasts

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	Step1	Step2	Change (Abs)	Change (%)	Step 1 (2037/38)	Step 2 (2036/37)	Change (Abs)	Change (%)
Business CA	6,206	6,334	128	2.1%	7,968	8,174	205	2.6%
Business NCA	807	825	18	2.3%	940	979	39	4.2%
Leisure CA	6,832	6,980	148	2.2%	8,719	8,965	246	2.8%
Leisure NCA	939	961	22	2.3%	1,091	1,138	47	4.3%
Commuting CA	49,205	49,992	787	1.6%	58,665	60,162	1,497	2.6%
Commuting NCA	7,043	7,164	121	1.7%	7,668	7,968	300	3.9%
Total	71,032	72,257	1,225	1.7%	85,052	87,386	2,334	2.7%

Table 12 - Impact to PN Matrix Totals of the Update to Exogenous Forecasts

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	Step1	Step2	Change (Abs)	Change (%)	Step 1 (2037/38)	Step 2 (2036/37)	Change (Abs)	Change (%)
Business CA	17,084	16,933	-151	-0.9%	21,921	21,765	-156	-0.7%
Business NCA	3,008	2,985	-23	-0.8%	3,538	3,557	20	0.6%
Leisure CA	12,973	12,840	-133	-1.0%	16,535	16,407	-128	-0.8%
Leisure NCA	2,400	2,378	-22	-0.9%	2,808	2,818	10	0.3%
Commuting CA	57,990	58,139	148	0.3%	68,227	68,541	313	0.5%
Commuting NCA	12,238	12,259	21	0.2%	13,270	13,427	157	1.2%
Total	105,693	105,533	-160	-0.2%	126,300	126,515	215	0.2%

3.3.20 As with the previous step-change, the regional variation in forecasts for PLD have been examined to ensure that the expected impact to demand forecasts at a regional level has been achieved. The analysis shows that the impact to demand forecasts can be explained by the regional variation in the change in demand drivers. For more information, see Appendix A.

3.4 Base year and appraisal horizon update

Description of change

3.4.1 The base year model for PFMv6.1c has been updated to represent a 2014/15 year. This is an update from the 2010/11 base year for previous versions of the PFM. The base model update provides a revised level of base demand from which to forecast. A comparison of the 2014/15 base year rail demand with the previous base year 2010/11 rail demand is shown in Table 13 for PLD. More information on the PLD base matrix update to 2014/15 can be found in the document PFMv6.1c Base Model Development Report.

3.4.2 The overall level of demand in the base year has increased by 13% with the update of the base year model. At a more disaggregate level, the business trip purpose has increased most significantly by 22%, with leisure trips increasing by 12% and commuting trips increasing by 7%. All trip purposes increase in demand in the base year update, with the exception of non-car available commuting trips.

3.4.3 The largest increases in demand are for trips within the North West; elsewhere, there are large increases in demand for trips between London and the West Midlands, East Midlands, North West and Yorkshire & Humber. These are all key flows for the HS2 scheme, and represent around a 25-30% growth on previous base levels.

3.4.4 There are also significant increases between Yorkshire & Humber and the North West, and West Midlands and the North West.

3.4.5 The biggest decreases in trips are for movements within Yorkshire & Humber, an 18% decrease on previous levels. Elsewhere there are decreases in base year rail trips within the sectors West Midlands, Wales and the North East.

3.4.6 Outside of these, the changes in the base level of demand are generally smaller increases in demand. For some movements these represent large proportional changes, but they are small in magnitude overall.

Table 13 - PLD Base Year Rail Demand (PFMv6.1c vs PFMv5.2b)

Matrix Description	**16 Hr Daily Base Year Rail Demand**			
	PFMv5.2b (2010/11)	**PFMv6.1c (2014/15)**	**Difference (Absolute)**	**Difference (%)**
Commuting non-car available	12,145	11,988	-158	-1.3%
Commuting car available from	38,941	42,438	3,497	9.0%
Commuting car available to	38,941	42,183	3,242	8.3%
Business non-car available	-	-	-	-
Business car available from	53,774	66,805	13,031	24.2%
Business car available to	43,391	51,666	8,274	19.1%
Other non-car available	36,072	39,229	3,158	8.8%
Other car available from	73,568	84,282	10,714	14.6%
Other car available to	56,595	62,432	5,837	10.3%
Total	353,427	401,023	47,596	13.5%

3.4.7 The base year demand has also been updated in the regional models to represent 2014/15. The update is documented within the report PFM v6.1c Base Model Development Report. The resulting change in the level of base demand for the regional models is shown in Tables 14 to 16.

3.4.8 There has been a significant increase in the level of base demand for the regional models of between 18% and 40%, the increase is most significant for PN where there has been just over a 40% increase in the level of base demand. PM has also increased by more than 20%; the base demand for these two models has been recreated using LENNON data infilled using station data from the ORR representing trips made on travelcards. In addition to the level of demand change, this update has brought about a significant change in the underlying distribution of trips for these two sub-models.

3.4.9 For PS there have been an increase in base demand of 18%, which is still a significant increase in demand over the four years from 2010/11 – 2014/15, even though it is a smaller increase than for the other sub-models.

Table 14 - PS Base Year Rail Demand (PFMv6.1c vs PFMv5.2b)

Matrix Description	3 Hr AM Peak Base Year Rail Demand			
	PFMv5.2b (2010/11)	PFMv6.1c (2014/15)	Difference (Absolute)	Difference (%)
Business PA	120,765	142,256	21,491	17.8%
Business AP	7,945	8,978	1,033	13.0%
Leisure PA	127,326	150,331	23,005	18.1%
Leisure AP	15,257	17,695	2,438	16.0%
Commuting PA	1,261,296	1,492,228	230,932	18.3%
Commuting AP	26,542	31,612	5,071	19.1%
Total	1,559,129	1,843,099	283,970	18.2%

Table 15 - PM Base Year Rail Demand (PFMv6.1c vs PFMv5.2b)

Matrix Description	3 Hr AM Peak Base Year Rail Demand			
	PFMv5.2b (2010/11)	PFMv6.1c (2014/15)	Difference (Absolute)	Difference (%)
Business CA	4,844	4,305	-540	-11.1%
Business NCA	763	740	-23	-3.1%
Leisure CA	5,363	4,762	-601	-11.2%
Leisure NCA	894	835	-59	-6.6%
Commuting CA	40,279	52,308	12,029	29.9%
Commuting NCA	7,029	9,900	2,871	40.8%
Total	59,173	72,851	13,677	23.1%

Table 16 -PN Base Year Rail Demand (PFMv6.1c vs PFMv5.2b)

Matrix Description	3 Hr AM Peak Base Year Rail Demand			
	PFMv5.2b (2010/11)	PFMv6.1c (2014/15)	Difference (Absolute)	Difference (%)
Business CA	13,663	5,843	-7,820	-57.2%
Business NCA	2,937	1,217	-1,720	-58.6%
Leisure CA	10,424	10,152	-271	-2.6%
Leisure NCA	2,353	2,261	-92	-3.9%
Commuting CA	49,461	89,252	39,791	80.4%
Commuting NCA	12,733	20,530	7,798	61.2%
Total	91,570	129,255	37,684	41.2%

3.4.10 The base year demand changes are significant for the rail mode, far greater than would have been forecast using EDGE for the period 2010/11 – 2014/15. In fact, during this period, the PDFH framework would have forecast, for example, around 1% growth in PLD demand, whereas the base model update has increased the level of demand much more significantly. Forecasting from this higher level of base demand will increase the forecasts significantly. It should be noted that beyond 2014/15, using the PDFH framework demand growth would pick up above the 2010/11 – 2014/15 growth rate.

3.4.11 In addition to the change in the level of base demand, there has been a change to the application of the appraisal horizon to bring the appraisal approach for the HS2 scheme in line with the assessment for other rail schemes. This revised approach sets the appraisal horizon to the 20-year period from the starting year of the appraisal in 2016/17; therefore, the future year forecasts for the modelling are required to be 2026/36 and 2036/37.

3.4.12 These two updates have not been split out into separate step-changes, as the order in which they are carried out affects that impact that is attributed to them. The second forecast year in the second step-change as described in the section above is 2036/37. Therefore, applying the appraisal horizon change on its own first would have no impact attributed to it – the base changes would therefore look to cause all of the impact. The other way round, applying the demand cap methodology to the forecasts achieved through forecasting from the new base year will calculate a similar level of demand in the second forecast year as for the previous step change by definition of the cap year. Therefore, all of the impact would be attributed to the appraisal horizon change.

3.4.13 For this reason, these two impacts have been combined in the final step change, as both of these changes are contributing significantly to the changes in the level of future year rail demand.

Impact on forecasts

3.4.14 The new base rail demand for 2014/15 has been input to the forecasting process as a final step-change. Through the 20-year appraisal horizon methodology change the forecast years are set to 2026/27 and 2036/37, and EDGEv1.5.1.0 with the PDFHv5.1 variable elasticity values and July 2015 demand drivers has been used to forecast future year rail growth for the periods 2014/15 – 2026/27 and 2014/15 – 2036/37.

3.4.15 The impact to the future year rail demand in the PLD model in this final step change is presented in Table 17. The resulting level of demand is that which has been used within the PFMv6.1c forecast model.

3.4.16 There is an 11.5% increase overall in future year PLD rail forecasts as a result of the base year and appraisal horizon updates in both the 2026/27 and 2036/27 forecast years. Commuting trips increase by 5%, business trips by 18% and leisure trips by 10%.

3.4.17 The impact to the forecasts is less pronounced than the impact to demand in the base year, with 2% less growth in commuting and leisure trips and 4% lower growth in business trips than is experienced in the base year update, as the forecasts from the 2014/15 base year apply four years' less growth than from the 2010/11 base; this is the

case for both forecast years. The GDP/Capita and population forecasts are 3-4% lower at a national level to 2026/27 and 2036/37 starting from a base of 2014/15 and employment forecasts are almost 5% lower – this is around half of the total growth in employment over the forecasting horizon.

Table 17 - Impact to PLD Matrix Totals of the Base and Appraisal Horizon Update

Matrix Description	2026/27				2nd Forecast Year			
	Step2	PFMv6.1c	Change (Abs)	Change (%)	Step 2 (2036/37)	PFMv6.1c (2036/37)	Change (Abs)	Change (%)
Commuting non-car available	12,374	12,884	510	4.1%	13,674	14,238	564	4.1%
Commuting car available from	48,575	51,297	2,722	5.6%	58,703	61,787	3,084	5.3%
Commuting car available to	48,575	51,081	2,506	5.2%	58,703	61,598	2,895	4.9%
Business non-car available	-	-	-	-	-	-	-	-
Business car available from	74,377	89,586	15,209	20.4%	99,038	118,997	19,959	20.2%
Business car available to	60,210	69,585	9,375	15.6%	80,248	92,927	12,679	15.8%
Other non-car available	40,760	46,420	5,660	13.9%	49,656	56,427	6,771	13.6%
Other car available from	99,554	111,084	11,530	11.6%	131,245	146,253	15,008	11.4%
Other car available to	77,513	82,979	5,466	7.1%	102,577	110,040	7,463	7.3%
Total	461,939	514,916	52,977	11.5%	593,844	662,268	68,424	11.5%

3.4.18 The impact on the future year demand forecasts in the regional models as a result of the base year and appraisal horizon forecasts is presented in Tables 18 to 20.

3.4.19 The regional models all have a commuting mode share of around 80% or more, and the resulting growth in rail demand is heavily impacted by the forecast for employment growth.

3.4.20 In PS, forecasting off a base year demand that is 18% higher than previous has yielded only a 5-6% increase in resulting rail demand forecasts. The PS model is London-centric, the employment forecast for London is strong in the period 2010/11 – 2014/15, and this forecast reduces from 25% growth to 13% in employment over the period to 2036.

3.4.21 In PM, the future year demand forecasts have increased by 19% as a result of forecasting from the 2014/15 base level of demand, and PN by 35-40%. For both these models this is up to 5% lower than the increase in demand in the base year update. Again, this is due to losing the rail demand generated from the forecasts between 2010/11 – 2014/15; the employment forecasts for regions in-scope to these models have reduced by 2-4% as a result of forecasting off 2014/15.

3.4.22 The impact to the regional PLD forecasts has been examined for this step-change and compared to the regional variation in base year demand between PFMv5.2b and PFMv6.1c. This analysis is presented in Appendix A.

Table 18 - Impact to PS Matrix Totals of the Base and Appraisal Horizon Update

Matrix Description	2026/27				2nd Forecast Year			
	Step2	PFMv6.1c	Change (Abs)	Change (%)	Step 2 (2036/37)	Step 2 (2036/37)	Change (Abs)	Change (%)
Business PA	188,438	201,778	13,340	7.1%	245,263	262,720	17,457	7.1%
Business AP	12,106	12,540	434	3.6%	15,421	15,967	546	3.5%
Leisure PA	198,055	214,631	16,576	8.4%	252,386	273,443	21,057	8.3%
Leisure AP	22,313	24,093	1,780	8.0%	27,860	29,984	2,124	7.6%
Commuting PA	1,663,468	1,746,715	83,247	5.0%	1,820,119	1,907,700	87,581	4.8%
Commuting AP	34,934	37,398	2,464	7.1%	38,420	40,983	2,563	6.7%
Total	2,119,315	2,237,155	117,840	5.6%	2,399,470	2,530,796	131,326	5.5%

Table 19 - Impact to PM Matrix Totals of the Base and Appraisal Horizon Update

Matrix Description	2026/27				2nd Forecast Year			
	Step2	PFMv6.1c	Change (Abs)	Change (%)	Step 2 (2036/37)	Step 2 (2036/37)	Change (Abs)	Change (%)
Business CA	6,206	5,392	-814	-13.1%	8,174	7,006	-1,168	-14.3%
Business NCA	807	825	18	2.2%	979	993	14	1.4%
Leisure CA	6,832	5,937	-895	-13.1%	8,965	7,686	-1,279	-14.3%
Leisure NCA	939	926	-13	-1.4%	1,138	1,111	-27	-2.4%
Commuting CA	49,205	62,427	13,222	26.9%	60,162	75,693	15,531	25.8%
Commuting NCA	7,043	10,499	3,456	49.1%	7,968	11,809	3,841	48.2%
Total	72,257	86,005	13,748	19.0%	87,386	104,298	16,912	19.4%

Table 20 - Impact to PN Matrix Totals of the Base and Appraisal Horizon Update

Matrix Description	2026/27				2nd Forecast Year			
	Step2	PFMv6.1c	Change (Abs)	Change (%)	Step 2 (2036/37)	Step 2 (2036/37)	Change (Abs)	Change (%)
Business CA	16,933	7,231	-9,702	-57.3%	21,765	9,287	-12,478	-57.3%
Business NCA	2,985	1,335	-1,650	-55.3%	3,557	1,588	-1,969	-55.4%
Leisure CA	12,840	12,422	-418	-3.3%	16,407	15,820	-587	-3.6%
Leisure NCA	2,378	2,450	72	3.0%	2,818	2,885	67	2.4%
Commuting CA	58,139	102,727	44,588	76.7%	68,541	120,808	52,267	76.3%
Commuting NCA	12,259	20,922	8,663	70.7%	13,427	22,778	9,351	69.6%
Total	105,533	147,087	41,554	39.4%	126,515	173,168	46,653	36.9%

4 Impact to rail demand forecasts

4.1 Introduction

4.1.1 This chapter presents in more detail the impact to the rail demand forecasts of the updates discussed in the previous chapters. The revised PFMv6.1c forecasts have been compared against the previous PFMv5.2b forecasts at a disaggregated level to highlight the impact of the reforecasting and the effect this will have to the HS2 scheme, in particular:

- For PLD the reforecasting has increased the business mode share – business trips within the PFM drive most of the benefits for HS2; therefore, this will have an impact on the scheme assessment.
- The number of long-distance rail trips has increased in the future year forecasts for PLD. Long-distance trips are more likely to switch to HS services when the HS2 scheme is introduced. This could drive more demand for the scheme and in particular, long-distance trips to/from London, which is the key market for the HS2 scheme;
- Demand for key movements on HS2 routes have generally increased from anywhere between 0 – 15%. Only Birmingham to Edinburgh future year demand has decreased. This will cause more demand for the HS2 scheme;
- Key origin cities in PLD with proposed HS2 station calls have seen some of the largest increases in future year rail demand; and
- The regional models contribute fewer benefits for the HS2 scheme within the PFM than for PLD, although increased rail forecasts within these regional sub-models will generate small increases in the level of benefits that they do contribute. There are large increases for trips originating at key cities such as London, Birmingham, Nottingham, Liverpool, Manchester, Leeds and Sheffield.

4.2 Impacts to PLD rail demand

Future year matrix totals

4.2.1 Tables 21 and 22 present the latest rail demand forecasts for the PLD sub-model for PFMv6.1c and compare these to the previous forecasts in PFMv5.2b, for the masked PLD matrices. The Model Overview Report provides a definition of full and masked matrices – the masked matrices are those used within the forecast PFM.

4.2.2 In 2026/27, the updates to the forecasts have increased demand significantly by 13% overall. The largest increases in demand are for business trips – almost 20% increase – there is a more modest increase to commuting trips of around 7%. Further details and explanation of this increase can be found in the Model Development Report: PFMv6.1c and in the Summary of Key Changes to the Economic Case Since November 2015 report.

Table 21 - 16 Hr Daily PLD Forecast Rail Demand in 2026/27 by Journey Purpose

Matrix Description	Masked Matrix			
	PFMv5.2b	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Commute non-car available	12,140	12,884	744	6.1%
Commute car available from	47,560	51,297	3,737	7.9%
Commute car available to	47,560	51,081	3,521	7.4%
Business non-car available	-	-	-	-
Business car available from	73,485	89,586	16,101	21.9%
Business car available to	59,471	69,585	10,114	17.0%
Other non-car available	40,257	46,420	6,163	15.3%
Other car available from	98,244	111,084	12,840	13.1%
Other car available to	76,448	82,979	6,531	8.5%
Total	455,166	514,916	59,750	13.1%

4.2.3 The second forecast year in PFMv6.1c is defined as 2036/37 through the 20-year appraisal horizon; in PFMv5.2b, the second forecast year was defined as 2037/38 through the application of the cap year methodology. These changes – along with the others summarised in paragraph 2.1.3 – have impacted the demand forecasts in the second forecast year significantly, with a 13% increase in total demand.

Table 22 - 16 Hr Daily PLD Forecast Rail Demand in the second forecast year by Journey Purpose

Matrix Description	Masked Matrix			
	PFMv5.2b	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Commute non-car available	13,198	14,238	1,040	7.9%
Commute car available from	57,231	61,787	4,556	8.0%
Commute car available to	57,231	61,598	4,367	7.6%
Business non-car available	-	-	-	-
Business car available from	98,442	118,997	20,555	20.9%
Business car available to	79,766	92,927	13,161	16.5%
Other non-car available	48,626	56,427	7,801	16.0%
Other car available from	129,346	146,253	16,907	13.1%
Other car available to	101,093	110,040	8,947	8.9%
Total	584,934	662,268	77,334	13.2%

4.2.4 The percentage increase in demand in the second forecast year is similar to 2026/27 - both around 13%. In the second forecast year there is a slightly lower increase in business trips and slightly higher increase in leisure and commuting trips than in 2026/27.

Journey purpose

4.2.5 The variable changes to the base year demand, rail demand drivers and elasticity values of rail demand have caused the rail demand segments by journey purpose to be impacted to different extents as a result of the reforecasting.

4.2.6 The resulting shares by journey purpose for PFMv6.1c are presented in Tables 23 and 24 for 2026/27 and the second forecast year respectively, and compared to PFMv5.2b.

Table 23 - PLD Rail Mode Share in 2026/27

Journey Purpose	PFMv5.2b		PFMv6.1c		Change in Mode Share
	16Hr Daily Demand	Mode Share	16Hr Daily Demand	Mode Share	
Commute	107,260	24%	115,262	22%	-1.2%
Business	132,957	29%	159,171	31%	1.7%
Leisure	214,949	47%	240,482	47%	-0.5%
Total	455,166	-	514,916	-	-

Table 24 - PLD Rail Mode Share in the second forecast year

Journey Purpose	PFMv5.2b (2037/38)		PFMv6.1c (2036/37)		Change in Mode Share
	16Hr Daily Demand	Mode Share	16Hr Daily Demand	Mode Share	
Commute	127,660	22%	137,624	21%	-1.0%
Business	178,208	30%	211,924	32%	1.5%
Leisure	279,065	48%	312,720	47%	-0.5%
Total	584,934	-	662,268	-	-

4.2.7 In 2026/27 the mode share for business trips has grown to 31% in PFMv6.1c, an increase of 1.7%. There is a corresponding decrease in the mode share of 1.2% and 0.5% in commute and leisure respectively. In the second forecast year, this trend continues with an increase in business mode share of 1.5%.

Long distance demand

4.2.8 The combination of the update to the base year from 2010/11 to 2014/15, as well as the change in the methodology to model a 20-year appraisal horizon, allows long-distance rail demand – defined as those trips greater than 100 miles - in the future years to grow beyond the previously designated cap of 290,146 trips. A comparison of the long-distance demand in the future year demand matrices in PFMv6.1c compared to PFMv5.2b is shown in Table 25.

Table 25 - Future Year Long Distance Demand in PLD

	Trips > 100 miles in PLD sub-model in:	
	2026/27	2nd Forecast Year
PFMv5.2b	210,309	278,539
PFMv6.1c	246,456	325,625

	Trips > 100 miles in PLD sub-model in:	
	2026/27	**2nd Forecast Year**
Change (Abs)	36,147	47,086
Change (%)	17.2%	16.9%

4.2.9 In PFMv6.1c the long distance demand in the second forecast year – without the demand capping – has gone up to 325,626 trips which is an increase of 17%. The level of long-distance demand in 2026/27 has also increased significantly by a similar proportion.

4.2.10 This increase in demand for trips above 100 miles (17%) is larger than the increase in demand for trips of all mileage of ~13%.

4.2.11 To evaluate where the increased long-distance rail demand is located, the future year PLD forecasts have been compared between PFMv6.1c and PFMv5.2b at Government Office Region (GOR). The comparison is displayed in Appendix B: this shows that there is increased demand for long-distance trips to/from London for the West Midlands, East Midlands, North West, North East, Yorkshire & Humber and Scotland. Movements between these areas are the key market for the HS2 scheme.

Growth in key rail movements

4.2.12 The growth in the PLD matrices for key zone-to-zone movements – those that are identified as having an impact to the HS2 Business Case - for 2026/27 and 2036/37 is presented in Table 26 for PFMv6.1c. The table shows total daily trips in both directions.

Table 26 - Growth in 16Hr Daily Demand for key movements

Key HS2 zone to zone movement	**2014/15 Demand**	**2026/27 Demand**	**% Growth (14/15-26/27)**	**2036/37 Demand**	**% Growth (14/15-36/37)**
Movements to/from London					
Central London - Birmingham	8,842	12,151	37%	16,370	85%
Central London - Manchester	7,842	11,150	42%	14,965	91%
Central London - Leeds	4,755	6,784	43%	9,166	93%
Central London - Glasgow	1,424	1,989	40%	2,654	86%
Central London - Liverpool	3,117	4,295	38%	5,716	83%
Central London - Newcastle	2,661	3,668	38%	4,873	83%
Central London - Edinburgh	2,738	3,950	44%	5,310	94%
Movements in the Wider Network					
Birmingham - Manchester	705	1,412	100%	1,769	151%
Birmingham - Glasgow	140	192	37%	243	74%
Birmingham - Leeds	312	484	55%	616	97%
Birmingham - Newcastle	129	216	67%	274	112%

Key HS2 zone to zone movement	2014/15 Demand	2026/27 Demand	% Growth (14/15-26/27)	2036/37 Demand	% Growth (14/15-36/37)
Birmingham - Edinburgh	143	208	45%	265	85%
Manchester - Glasgow	359	512	43%	648	81%
Leeds - Newcastle	518	906	75%	1,142	120%

4.2.13 In 2026/27 the growth from 2014/15 in demand in key zones from/to Central London is in the range 37%-44%, with the highest growth in Central London – Edinburgh (44%), followed by London – Leeds (43%). In the wider network, growth from 2014 /15 on key movements is in the range 37%-100%, with the highest growth between Birmingham and Manchester (100%).

4.2.14 In 2036/37 the growth from 2014/15 in demand in key zones from/to Central London is in the range 85%-94%, with the highest growth again for Edinburgh and Leeds. In the wider network the growth from 2014 /15 on key movements is in the range 74%-151%, with the highest growth between Birmingham – Manchester (151%), followed by Leeds – Newcastle (120%).

4.2.15 A comparison of this future year demand for key movements within the PLD sub-model between PFMv6.1c and PFMv5.2b has been carried out and is shown in Table 27 for the total 16-hour daily demand in 2026/27 and the second forecast year.

Table 27 - Comparison of Future Year Rail Demand for Key Movements in PLD (PFMv5.2b vs PFMv6.1c)

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	PFMv5.2b	PFMv6.1c	Change (Abs)	Change (%)	PFMv5.2b (2037/38)	PFMv6.1c (2036/37)	Change (Abs)	Change (%)
Movements to/from London								
Central London - Birmingham	10,569	12,151	1,582	15%	14,116	16,370	2,254	16%
Central London - Manchester	10,570	11,150	580	5%	14,291	14,965	674	5%
Central London - Leeds	6,509	6,784	275	4%	9,202	9,166	-36	0%
Central London - Glasgow	1,737	1,989	252	15%	2,239	2,654	415	19%
Central London - Liverpool	3,982	4,295	313	8%	5,223	5,716	493	9%
Central London - Newcastle	3,361	3,668	307	9%	4,478	4,873	395	9%
Central London - Edinburgh	3,400	3,950	550	16%	4,536	5,310	774	17%
Movements in the Wider Network								
Birmingham - Manchester	1,263	1,412	149	12%	1,567	1,769	202	13%
Birmingham - Glasgow	145	192	47	32%	175	243	68	39%
Birmingham - Leeds	459	484	25	5%	592	616	24	4%
Birmingham - Newcastle	213	216	3	1%	265	274	9	3%
Birmingham - Edinburgh	266	208	-58	-22%	331	265	-66	-20%
Manchester - Glasgow	421	512	91	22%	513	648	135	26%

Key HS2 zone to zone movement	2026/27				2nd Forecast Year			
	PFMv5.2b	PFMv6.1c	Change (Abs)	Change (%)	PFMv5.2b (2037/38)	PFMv6.1c (2036/37)	Change (Abs)	Change (%)
Leeds - Newcastle	849	906	57	7%	1,089	1,142	53	5%

4.2.16 When comparing the level of future year demand in 2026/27 for key movements between PFMv6.1c and PFMv5.2b, there has been an increase for key movements from/to Central London in the range of 4%-16%, with the highest increases for Edinburgh, Glasgow and Birmingham. In the wider network future year demand for key movements has generally increased in PFMv6.1c; however, there is a reduction in demand of 22% between Birmingham and Edinburgh. The largest increases in demand for key movements in the wider network are between Birmingham and Glasgow and Manchester and Glasgow.

4.2.17 In PFMv6.1c in the second forecast year there is an increase in demand from PFMv5.2b for key zones from/to Central London of up to 19%, with the highest increase in demand between Central London and Glasgow. In the wider network there is a similar pattern as in 2026/27. This analysis shows that there is a significant increase in demand – higher than the average of 13% – for some key movements for the HS2 scheme.

Regional variation of growth in PLD

4.2.18 Finally, the variation of changes in demand within the PLD matrix at a zonal level have been analysed as a result of the reforecasting for PFMv6.1c. This analysis is presented in more detail in Appendix B.

4.2.19 The analysis shows that key origins zones in London, Manchester, Birmingham, Liverpool, Edinburgh and Glasgow have some of the large increases in future year rail demand in PFMv6.

4.3 PLANET South (PS) forecasts

4.3.1 The future year matrix totals for the PS sub-model in 2026/27 are presented in Table 28 and compared to PFMv5.2b. As for PFMv5.2b, only masked matrices have been developed and are therefore presented.

4.3.2 There is a significant increase in the level of demand in PFMv6.1c of almost 10%, with the highest increase for leisure trips of 11%, followed by commuting trips of 10% and business trips of 9%. The updated forecasts have not affected mode shares.

Table 28 - 3Hr AM Peak PS Matrix Totals for 2026/27

Matrix Description	**PFMv5.2b**	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Business PA	184,982	201,778	16,796	9.1%
Business AP	11,944	12,540	596	5.0%
Leisure PA	193,696	214,631	20,935	10.8%
Leisure AP	21,969	24,093	2,124	9.7%
Commuting PA	1,593,854	1,746,715	152,861	9.6%
Commuting AP	33,766	37,398	3,632	10.8%
Total	2,040,211	2,237,155	196,944	9.7%

4.3.3 The PS matrix totals for the second forecast year are presented in Table 29. There is also a significant increase in the level of demand in PFMv6.1c of just over 9% in the second forecast year. The percentage increase in future year demand is slightly lower than the increase in 2026/27 in all categories. The highest increase in demand is for commuting trips of 10%, followed by leisure trips of 8% and business trips of 5%. There is a small shift to commuting trips (+0.6%) from other modes in the second forecast year.

Table 29 - 3Hr AM Peak PS Matrix Totals for the Second Forecast Year

Matrix Description	**PFMv5.2b (2037/38)**	**PFMv6.1c (2036/37)**	**Difference (Abs)**	**Difference (%)**
Business PA	249,295	262,720	13,425	5.4%
Business AP	15,735	15,967	232	1.5%
Leisure PA	253,001	273,443	20,442	8.1%
Leisure AP	27,885	29,984	2,099	7.5%
Commuting PA	1,733,015	1,907,700	174,685	10.1%
Commuting AP	37,296	40,983	3,687	9.9%
Total	2,316,227	2,530,796	214,569	9.3%

4.4 PLANET Midlands (PM) forecasts

4.4.1 Tables 30 and 31 present the 2026/27 PM matrix totals for PFMv6.1c and compare these to PFMv5.2b.

4.4.2 For 2026/27, there is a large increase in the level of demand in PFMv6.1c of 24% overall. There has been a significant shift to the commuting mode as a result of the revised forecasts for PFMv6.1c – there is a 32% increase in commuting trips, and a 10% reduction in demand for the other modes resulting in a 5% increase in the commuting mode share to 85%.

Table 30 - 3Hr AM Peak PM Matrix Totals for 2026/27

Matrix Description	Masked Matrix			
	PFMv5.2b	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Business CA	6,094	5,392	-702	-12%
Business NCA	794	825	31	4%
Leisure CA	6,707	5,937	-770	-11%
Leisure NCA	923	926	3	0%
Commuting CA	48,052	62,427	14,375	30%
Commuting NCA	6,883	10,499	3,616	53%
Total	69,454	86,005	16,551	24%

4.4.3 For the second forecast year, there is a 25% increase in the level of forecast demand. There is a 35% increase in commuting demand, but a 9% reduction for other modes. In 2036/7, commuting represents 84% of total demand.

Table 31 - 3Hr AM Peak PM Matrix Totals for the Second Forecast Year

Matrix Description	Masked Matrix			
	PFMv5.2b	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Business CA	7,825	7,006	-819	-10%
Business NCA	925	993	68	7%
Leisure CA	8,561	7,686	-875	-10%
Leisure NCA	1,073	1,111	38	4%
Commuting CA	57,329	75,693	18,364	32%
Commuting NCA	7,500	11,809	4,309	57%
Total	83,213	104,298	21,085	25%

4.5 PLANET North (PN) forecasts

Table 32**Error! Reference source not found.** presents the 2026/27 PN matrix totals for PFMv6.1c and compares these to PFMv5.2b. There is a significant increase in the level of demand in PFMv6.1c of over 40%, with commuting demand increasing by almost 80%. This is countered by a decrease in business trips of over 50% and a small decrease in leisure trips of 2%. These changes cause a significant shift in the commuting mode share of almost 20% to 84% in PFMv6.1c.

Table 32 - 3Hr AM Peak PN Matrix Totals for 2026/27

Matrix Description	Masked Matrix			
	PFMv5.2b	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Business CA	16,801	7,231	-9,570	-57%
Business NCA	2,961	1,335	-1,626	-55%
Leisure CA	12,758	12,422	-336	-3%
Leisure NCA	2,363	2,450	87	4%
Commuting CA	56,953	102,727	45,774	80%
Commuting NCA	12,036	20,922	8,886	74%
Total	103,871	147,087	43,216	42%

4.5.1 The PN matrix totals for the second forecast year are presented in Table 33. There is a similar change in the PN future year demand forecasts in the second forecast as in 2026/27, with significant increase in demand – particularly for commuting which has an 83% share of total demand in PFMv6.1c following the updates.

Table 33 - 3Hr AM Peak PN Matrix Totals for the Second Forecast Year

Matrix Description	Masked Matrix			
	PFMv5.2b	**PFMv6.1c**	**Difference (Abs)**	**Difference (%)**
Business CA	21,556	9,287	-12,269	-57%
Business NCA	3,482	1,588	-1,894	-54%
Leisure CA	16,260	15,820	-440	-3%
Leisure NCA	2,764	2,885	121	4%
Commuting CA	66,995	120,808	53,813	80%
Commuting NCA	13,049	22,778	9,729	75%
Total	124,105	173,168	49,063	40%

4.6 Detailed impacts to rail demand in regional sub-models

4.6.1 The impact of the reforecasting for PFMv6.1c has been analysed at a more detailed zonal and regional level within the regional sub-models. This analysis is presented in full within Appendix B.

4.6.2 Trip demand originating from all London zones has grown significantly in PS, with the Greater London area as an aggregate having the largest increase by region.

4.6.3 In PM, trip demand for Birmingham and Nottingham has increased significantly. The trip distribution within PM has changed significantly.

4.6.4 In PN, trips originating at Liverpool have increased the most significantly; however, trips originating within Manchester, Leeds and Sheffield have also grown significantly.

4.6.5 With more trips in the regional models being produced by key cities with links to the HS2 scheme, this demand will get passed to PLD and cause greater levels of crowding into, out of, and in the general area of these cities, which may be relieved by the HS2 scheme and cause greater benefits.

5 Future year highway forecasts

5.1 Introduction

5.1.1 The highway mode within the PFM exists within the PLD sub-model, and represents long-distance travel by car, as well as some shorter-distance trips that could potentially shift to high speed rail with the introduction of the HS2 scheme.

5.1.2 Future year highway demand for PLD is derived by forecasting off the base year level of highway demand, and has therefore been updated in PFMv6.1c as a result of the PFM base year update to 2014/15.

5.1.3 In addition to the highway demand contained within the PLD demand matrices, local highway demand is also represented on the highway network as preloads to give a more accurate representation of the level of highway demand on the network. However, this preload demand is not able to mode shift. Highway preloads are also forecast from the base year to the designated future years.

5.1.4 This chapter details the methodology used to forecast both the highway demand matrices and the highway preloads from the base year level of demand in 2014/15 to the forecast years of 2026/27 and 2036/37 for the PLD model; and the resulting future year highway demand; in particular:

- The highway demand and preload forecasting for PFMv6.1c has been re-worked, however the methodology applied is in line with that which has been used previously; and
- This has resulted in a small (just under 1%) increase in the future year highway forecasts for both modelled years.

5.1.5 This chapter also discusses the derivation of the future highway occupancy factors from the base year values.

5.2 Future year highway demand forecasting

Methodology

5.2.1 The forecasting approach for the highway mode applies furness targets derived from the DfT's Trip End Model Program TEMPro to the 2010/11 base highway matrices to obtain future year highway forecasts for the designated years.

5.2.2 This approach is consistent with the forecasting approach used in previous versions of the PFM without making use of the same processing system. Instead, a spreadsheet-based approach, developed in order to update the base year highway demand matrices from 2010/11 – 2014/15[1], has been utilised to calculate the highway demand forecasts for PFMv6.1c.

[1] A description of the base year highway demand update can be found within the PFM v6.1 Base Model Development Report.

TEMPRO data

5.2.3 Data from TEMPro was obtained using TEMPro version 6 with data set versions 6.2 across the entire country. Trip ends were obtained by time period for car driver and car passenger combined and were obtained for weekday AM Peak, Inter Peak, PM peak and Off Peak time periods.

5.2.4 The purposes within TEMPro were combined in the following way with the TEMPro purpose first followed by the PLD purposes:

- HB Work – Commute;
- HB Employer Business – Business;
- HB Education – Education;
- HB Shopping – Leisure;
- HB Personal Business – Leisure;
- HB Recreation/Social – Leisure;
- HB Visiting friends and relatives – Leisure;
- HB Holiday/Day trip – Leisure;
- NHB Work – Commute;
- NHB Employers Business – Business;
- NHB Education – Education;
- NHB Shopping – Leisure;
- NHB Personal Business – Leisure;
- NHB Recreation/Social – Leisure; and
- NHB Holiday/Day trip – Leisure.

It should be noted that Education is not a PLD purpose and was not included in the later calculations.

5.2.5 The PFM 20-year appraisal horizon – which has been adopted within PFMv6.1c – designates that the PFM is used to forecast the impact of the HS2 scheme for the years 2026/27 and 2036/37. Trip ends were therefore downloaded in the standard format from TEMPro for all combinations of the above purposes, time periods and car availability for 2014, 2015, 2026, 2027, 2036 and 2037.

5.2.6 The trip ends downloaded from TEMPRO were combined into 24hr financial year trip ends (by PLD purpose) using the following formulation:

$$(AM + IP + PM + OP)_{YEAR1} * 275/365 + (AM + IP + PM + OP)_{YEAR2} * 90/365$$

5.2.7 Once aggregated by financial year, the trip ends are mapped from TEMPro zones to PLD zones using the same mappings that are applied within the rail forecasting approach.

5.2.8 Finally, the aggregated totals for 2026/27 and 2036/37 were divided by the totals for 2014/15 to calculate a set of growth factors by purpose at PLD zone level.

Matrix Forecasting

5.2.9 Once the financial year trip end growth factors have been developed they are passed to a furnessing process which has been built using spreadsheet techniques. This process undertakes the following steps for each purpose:

1. First, a single step is undertaken where the derived pattern is multiplied by both the production and attraction trip ends to get the 0^{th} iteration matrix. Each zone is then scaled to get the correct production trip end.
2. Attraction trip end ratios are then produced and applied to the matrix; this is averaged with the matrix produced in the step above.
3. Next, production trip end ratios are produced and applied to the matrix; this is then averaged with the matrix produced in the previous step.
4. Steps 2 and 3 are then repeated for 100 iterations.

5.2.10 This process produces a forecast matrix for each modelled purpose – commute, business and leisure – within PLD. This process was carried out for both the full and masked matrices to produce a full set of future year highway demand forecasts. For each modelled purpose, a high level of convergence was achieved by 100 iterations.

GDP correction factor

5.2.11 The GDP growth assumptions used in the development of the TEMPro dataset 6.2 differs from the OBR GDP growth forecasts for June and July 2015, which have been used within the July 2015 demand driver dataset in the rail forecasting. To ensure consistency between the rail and highway forecasts, a correction factor is applied to the forecast highway matrices; this is in line with the approach used in previous versions of the PFM. This factor is calculated based on a GDP elasticity, which is a function of demand.

5.2.12 GDP was first 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 4 provides the comparison of the GDP forecasts to illustrate the differences between both sources.

5.2.13 To be consistent with the approach in previous versions of the PFM, the elasticities to be applied to the GDP growth were taken from the report PLANET Long Distance and Long Distance Model Comparison[2]. 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 34 shows the demand elasticities with respect to GDP.

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

Figure 4 - Comparison of OBR July 2015 and TEMProv6.2 GDP Forecasts

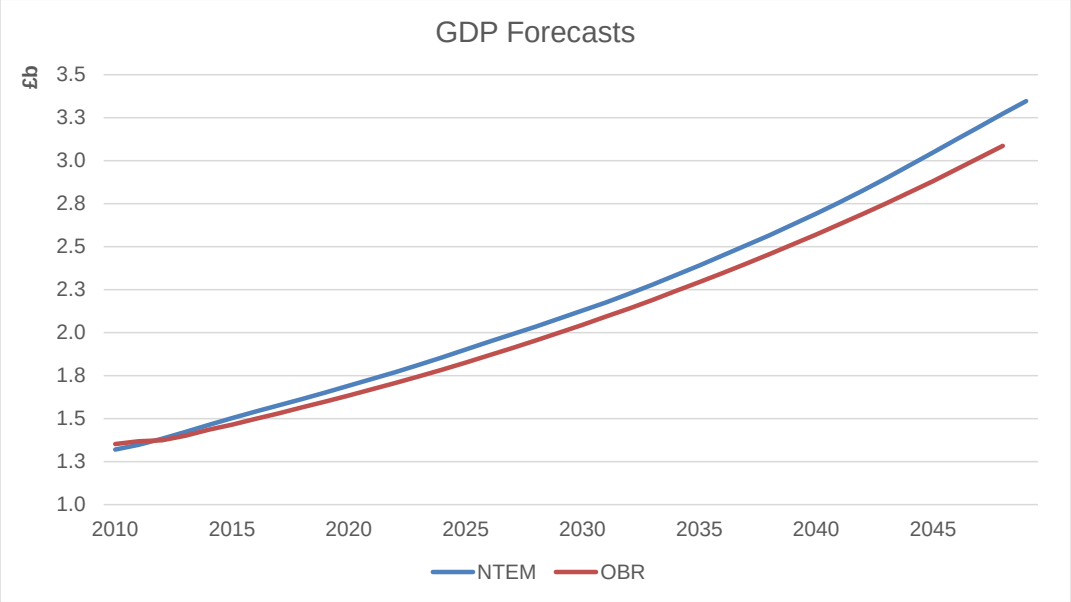


Table 34 - Relative changes in GDP for Standard and High forecasts (constant household)

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

5.2.14 From these sets of GDP, two sets of highway demand forecast were produced, as shown in Table 35, and from these totals the implied arc elasticities were calculated, which are provided in Table 36. These elasticities were then applied to the relative growth in GDP, which is shown in Table 37**Error! Reference source not found.**.

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

	Commuting		**Work**		**Other**	
	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 36 - Implied elasticity of highway demand to GDP

Purpose	Commuting	Work	Other
Implied Elasticity	0.087	0.151	0.147

Table 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

5.2.15 The factors shown in Table 38**Error! Reference source not found.** were calculated from these values and applied globally to the forecast matrices to adjust for the differences in GDP.

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

Year	Commute	Business	Leisure
2026/27	0.994300	0.990142	0.990392
2036/37	0.994226	0.990014	0.990268

Resulting highway demand forecasts

5.2.16 The resulting future year highway demand forecasts for PFMv6.1c following the methodology described in the previous sections are presented in Table 39 and compared to PFMv5.2b forecasts. The growth in highway demand from the base year is also presented in Table 40.

5.2.17 The future year demand forecasts have grown by around 1% in PFMv6.1c, commute and leisure trips have grown more significantly than for business. In the second forecast year PFMv6.1c forecasts for 2036/37 – a year earlier than in pFMv5.2b – however the forecasts are still marginally higher. In the second forecast year, business trips have reduced.

5.2.18 There is 9% growth in highway demand by 2026/27 and 15% growth by 2036/37, leisure trips grow more significantly than for the other journey purposes.

Table 39 - Future Year Highway Forecasts for PFMv6.1c

Matrix Description	**2026/27**				**2nd Forecast Year**			
	PFMv5.2b	PFMv6.1c	Change	Change (%)	PFMv5.2b (2037/38)	PFMv6.1c (2036/37)	Change	Change (%)
Commute	155,666	157,415	1,749	1.1%	162,322	163,791	1,468	0.9%
Business	320,204	321,049	845	0.3%	338,471	336,191	-2,279	-0.7%
Leisure	884,996	894,997	10,001	1.1%	941,935	952,827	10,893	1.2%
Total	1,360,866	1,373,461	12,595	0.9%	1,442,727	1,452,809	10,082	0.7%

Table 40 - Growth in Highway Demand Forecasts from Base Year

Matrix Description	**2014/15**	**2026/27**	**2036/37**	**Growth from Base**	
				2014/15 -2026/27	**2014/15 – 2036/37**
Commute	148,215	157,415	163,791	6%	11%
Business	300,091	321,049	336,191	7%	12%
Leisure	813,608	894,997	952,827	10%	17%
Total	1,261,914	1,373,461	1,452,809	9%	15%

5.2.19 Regional changes in future year highway demand have been analysed to understand any changes in the future year forecasts at a distributional level; this is presented in more detail in Appendix C.

5.3 Future year highway preload flows

5.3.1 In PFM short-distance trips and goods vehicles are represented as pre-loaded flows on the PLD highway 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 lead to realistic travel costs for use in the demand model. Future year preloads are calculated by forecasting the base year preloads.

5.3.2 Base year preloads are calculated by subtracting the total assigned volumes for the highway network link in the base year model from the observed count value for that link. This process is documented in full in the PFM v6.1c Base Model Development Report.

Factoring base preloads for future years

5.3.3 The methodology to calculate the future year preloads is consistent with that followed for previous versions of the model and utilises the DfT's National Transport Model (NTM) traffic forecast component of the Road Transport Forecasts 2015 (RTF15). Previous versions of the PFM used RTF11 forecasts to calculate the future year preloads.

5.3.4 RTF15 is a new forecasting approach for the NTM compared to previous versions of the RTF, in which different forecast scenarios are developed motivated by uncertainty around how some trends will carry on into the future, as well as uncertainty around the key economic and demographic inputs. Scenario 1 within RTF15 has been utilised in order to perform the preload factoring. A description of scenario 1 as provided by the DfT is as follows:

> "In scenario 1 we have used the same assumptions as we did in Road Traffic Forecasts 2013 (RTF13), with some slight improvements. In this scenario we assume that the number of trips people make remains constant at the historic average, that incomes and costs affect travel choices in the same way as previously modelled, and use Office for Budget Responsibility (OBR) and Department of Energy and Climate Change (DECC) central forecasts for future changes in incomes and fuel prices."

5.3.5 The forecasts for car and other vehicle travel by road type in England and Wales as provided by RTF15 scenario 1 are presented in Table 41. It should be noted that the DfT provides forecasts for 2010 – 2040 in five-yearly intervals. The forecasts for other years have been derived by interpolation of these values. Motorway, trunk and principal road forecasts are used, a total is calculated from these road types and a growth factor calculated from 2014/15 to 2026/27 and 2036/37.

5.3.6 The growth in total traffic from 2014/15 for car and other vehicles is applied to the corresponding base year preload value to obtain future year highway preloads. These values are attached to the future year highway networks and input to the forecast PFM.

Table 41 - RTF15 Traffic Forecasts in Billion Vehicle Miles by Road and Vehicle Type

	Year	Motorway	Trunk	Principal	Total	Growth in Total Traffic from 2014/15
Cars	2014/15	42.7	29.7	74.3	146.8	-
	2026/27	49.8	34.4	84.5	168.7	15%
	2036/37	55.7	38.2	93.0	186.9	27%
Other Vehicles	2014/15	14.3	8.6	17.0	39.9	-
	2026/27	17.1	10.4	20.6	48.1	20%
	2036/37	19.4	11.8	23.6	54.9	38%

5.4 Future year highway occupancy factors

5.4.1 The future year highway occupancy factors are unchanged from the base year highway occupancy factors. The base year factors have been applied in the future year following advice from the DfT contained within the report[3] Understanding and Valuing Impacts of Transport Investment; October 2015.

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/470998/Understanding_and_Valuing_Impacts_of_Transport_Investment.pdf

6 Future year air forecasts

6.1 Introduction

6.1.1 The air mode within the PFM exists within the PLD sub-model, and represents domestic travel by air within Great Britain.

6.1.2 Future year air demand for PLD is informed by the DfT's aviation model. The DfT provides air demand and supply-side forecasts for the designated future years required by the PFM. The methodology used to create the demand forecasts for the PFM within the DfT aviation model is described in Appendix D.

6.1.3 The remainder of this chapter presents the methodology described to process the output data from the DfT's Aviation Model into inputs for the PFM, along with the resulting air demand and supply side forecasts. In particular:

- This methodology is the same as that which has been applied in previous versions of the PFM.
- The DfT has supplied data for 2026/27 and 2036/37 – the data for 2026/27 is very similar to that which has been incorporated previously in PFMv5.2b; as a result, the future year air demand forecasts for 2026/27 are largely unchanged.
- Using the data supplied by the DfT for 2036/37, there is a small decrease in the future year air forecasts in line with the one-year reduction in growth as a result of the second forecast year change from 2037/38. There are some small changes to available flight routes in the second forecast year.

6.2 Future year air demand forecasts

6.2.1 Following the methodology described in Appendix D, the DfT supplied the following data for the aviation demand forecasts:

- Latest annual aviation demand forecasts for both 2026/27 and 206/37. 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.

6.2.2 To derive the air demand matrices for business and leisure purposes, the aviation demand forecasts at NAAM level are first mapped to LDM zones and then to PLD zones. The resulting demand matrices were divided by an annualisation factor of 313 – which was provided by the DfT – to obtain 16-hour daily demand matrices at PLD zone level. The following assumptions were applied during this 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.

- 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%.

6.2.3 The resulting air demand forecasts for 2026/27 and 2036/37 are presented in Table 42 and compared back to those used within PFMv5.2b.

Table 42 - Future Year Air Forecasts for PFM (PFMv6.1c vs PFMv5.2b)

Matrix Description	**2026/27**				**2nd Forecast Year**			
	PFMv5.2b	PFMv6.1c	Change	Change (%)	PFMv5.2b (2037/38)	PFMv6.1c (2036/37)	Change	Change (%)
Business	19,769	19,769	0	0.0%	25,166	24,684	-482	-1.9%
Leisure	15,082	15,082	0	0.0%	19,069	18,718	-351	-1.8%
Total	34,850	34,851	1	0.0%	44,234	43,402	-832	-1.9%

6.2.4 The revised air demand forecasts for 2026/27 show no change from the PFMv5.2b forecasts at matrix total level. There is a small decrease of around 2% in the air demand forecasts for the second modelled year. The growth in air demand from the base year 2014/15 is presented in Table 43. Overall, there is almost 20% growth in the air demand by 2026/27 and almost 50% growth in air demand forecasts by 2036/37; there is faster growth in business trips than for leisure trips. The forecasts suggest that there is on average around 2% growth per annum in air demand and therefore the change in air demand in the second forecast year is consistent with the second forecast year moving forward one year.

Table 43 -Growth in Air Demand Forecasts from Base Year

Matrix Description	2014/15	2026/27	2036/37	Growth from Base	
				2014/15 -2026/27	2014/15 – 2036/37
Business	16,333	19,729	24,684	21%	51%
Leisure	12,898	15,082	18,718	17%	45%
Total	29,231	34,851	43,402	19%	48%

6.2.5 A comparison between the air demand forecasts for PFMv6.1c and PFMv5.2b has been carried out at GOR sector level in order to understand if there are greater changes in the distribution of future year air demand. This analysis is presented in Appendix D.

6.3 Air supply forecasts

6.3.1 The PLD model requires the following data in order to be able to derive air transit lines that model air trips on domestic flights within mainland UK:

- Headway: air headways 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 year;

- Business fares, updated fares data for business trips has not been provided by the DfT;
- Leisure fares, updated fares data for leisure trips has not been provided by the DfT; and
- Journey time data, this data has also not been provided by the DfT.

6.3.2 The flights per year data is converted to flights per day using the same annualisation factor that is used in the air demand derivation, and the airports are mapped to nodes within the PLD network to identify the route within the model that each transit line will take. This mapping is shown in Table 44. The following assumptions are applied in the processing of the aviation supply data:

- The annualisation factor was assumed to be 313.
- 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.

6.3.3 On review of the methodology used to derive air transit lines adopted within previous versions of the PFM, it was found that the DfT had not provided updated fares and journey time data since PFMv4.3. For model versions since then, the adopted approach has been to apply the journey times and fares from PFMv4.3 to the air transit lines created using the aviation supply data provided by the DfT. The following assumptions were applied in deriving the associated journey time and fare for any new transit lines that had not previously been modelled:

- Every flight has the same journey time as its reverse flight; if a journey time was missing for one forecast year but available in the other, the journey time was approximated using this value.
- Each airport in London has the same journey time to/from other airports outside of London.
- The journey time for Inverness to Cardiff was approximated using the Aberdeen to Cardiff journey time and applying an additional 5 minutes' journey time consistent with the difference in journey time between Birmingham – Aberdeen and Birmingham – Inverness flights. A flight time could not be taken form the online flight timetable as direct flights are not currently in operation.
- The fares data previously provided by the DfT was derived using a distance function therefore where fares were missing for new transit lines the fare was approximated using the fare corresponding to a flight of similar length.

Table 44 - Mainland UK Airports Modelled within PLD

Code	Airport	IATA	PLD Node	Code	Airport	IATA	PLD Node
461	Aberdeen Airport	ABZ	5007	477	Liverpool Airport	LPL	5019
464	Birmingham Airport	BHX	5009	478	London City Airport	LCY	5014
466	Bristol Airport	BRS	5018	479	Luton Airport	LTN	5016
467	Cardiff Airport	CWL	5028	480	Manchester Airport	MAN	5008
468	East Midlands Airport	EMA	5010	481	Newcastle Airport	NCL	5004
469	Edinburgh Airport	EDI	5003	482	Newquay Airport	NQY	5029
470	Exeter Airport	EXT	5025	483	Norwich Airport	NWI	5023
471	Gatwick Airport	LGW	5012	484	Plymouth Airport	PLH	5024
472	Glasgow Airport	GLA	5001	485	Southampton Airport	SOU	5020
473	Heathrow Airport	LHR	5013	486	Stansted Airport	STN	5015
474	Humberside Airport	HUY	5017	488	Blackpool Airport	BLK	5030
475	Inverness Airport	INV	5002	492	Prestwick Airport	PIK	5011
476	Leeds/Bradford Airport	LBA	5006				

6.3.4 The resulting air transit lines for PFMv6.1c have been compared to those in PFMv5.2b in order to understand the changes that have occurred. There has been no change to the set of air transit lines modelled in 2026/27 between PFMv5.2b and PFMv6.1c – this is consistent with the air demand data being very similar between these two model versions. Further to this, there have been small fluctuations in the flights per year between these set of airports but these changes do not have a significant impact to the number of flights per day and hence the headway modelled in the PFM.

6.3.5 In PFMv6.1c for 2036/37 the following air transit lines have been added/removed to the set that was previously modelled within PFMv5.2b for 2037/38. The Cardiff to Inverness route has been added in both directions as a new route with around 2-3 flights per day, also flights from Prestwick to Stansted. The flights that are no longer modelled represented services only offering one flight per day.

Table 45 -Modifications to the modelled air transit lines in PFMv6.1c in 2036/37

New Route	Flights Per Day	Deleted Routes	Flights Per Day
Cardiff to Inverness	1.7	Aberdeen to Exeter	1.0
Inverness to Cardiff	2.7	Exeter to Aberdeen	1.0
Prestwick to Stansted	1.0	Norwich to Exeter	1.0
		Stansted to Glasgow	1.0

6.3.6 The number of flights per day for the set of transit lines that remain consistent between PFMv5.2b and PFMv6.1c has also been analysed to understand if the level of service has changed. Routes with a change of one or more flights per day are presented in the table below. Only three routes show a more significant change in headway between the two modelled versions – all of them reductions in the level of service. The other flights modelled only show small fluctuations in the number of flights per year, which do not have a significant impact in terms of the flights over the 16-hour day that are modelled in the PFM.

Table 46 -Changes in headway of air transit lines modelled in the PFMv6.1c for 2036/37

Route	Flights Per Day modelled in PFM for Second Forecast Year		Change
	PFMv5.2b (2037/38)	PFMv6.1c (2036/37)	
London City to Glasgow	48.0	45.7	-2.3
London City to Edinburgh	36.9	35.6	-1.4
Edinburgh to London City	32.0	31.0	-1.0

7 Quality assurance

7.1 Introduction

7.1.1 When model development updates are made to the PFM, the work carried out under these model developments is subject to rigorous quality assurance (QA) processes to ensure that implementation has been carried out correctly. This is carried out by both the model developers and HS2 Ltd's independent auditor.

7.1.2 This chapter summarises the QA that has been carried out on the development of the future year forecasts by mode for PFMv6.1c and that is documented within this report.

7.2 Rail forecasting QA

7.2.1 The rail forecasting approach was adopted from previous versions of the PFM; therefore, a rigorous set of checks were applied during application of the forecasting approach for PFMv6.1c to ensure that this approach was applied correctly. This was carried out internally by the model developers; the internal checking process is summarised as follows:

- Firstly, the forecasting approach was applied to replicate the forecasts for PFMv5.2b. This task was carried out to ensure that a full understanding of the methodology was gained.
- The updates to the forecasting approach were carried out in step changes to ensure that the expected level of change was achieved at each step change. For each of these step changes, the input change and the results and analysis were independently checked by a model developer not directly involved in the application process.
- The final forecasting approach for PFMv6.1c was thoroughly checked from start to finish, independently verifying the source of all input and control files.

7.2.2 In addition to the internal checks carried out by the model developers, the rail forecasting approach has been audited by HS2 Ltd's independent auditor. All input and output files are provided to the auditor so that they can verify that the entire approach has been carried out correctly. The independent auditors have previously audited the forecasts for earlier versions of the PFM; therefore, this check ensures that the approach is consistent with previous versions of the PFM, and that the changes to the approach match the methodology as described within this report.

7.3 Highway forecasting QA

7.3.1 The following quality assurance which has been undertaken on the development of the forecast year highway matrices:

- **Internally checked process** – all the processes were checked by the consultants to ensure that they have been set up correctly and that they are operating as intended. This was found to have been the case;
- **External Auditor** – The processes and results have been reviewed and commented on by the external audit process. This has included a number of

discussions to resolve any issues / questions that may have occurred; and

- **Sense-checking of results –** the results have been sense-checked to ensure they seem reasonable in scale compared to 2014/15. This was also found to be the case, although it should be noted that, like the base matrices, the underlying pattern within the matrices has not been checked.

7.4 Air forecasting QA

7.4.1 As for the other modes, the QA carried out on the air forecasts is made up of a combination of internal checking procedures carried out by the model developers and independent review by HS2 Ltd's auditor.

7.4.2 The internal checking process is summarised as follows:

- Matrix totals and certain movements have been cross-checked against the data received from the DfT to make sure the demand in the matrices is a true reflection of the air movements from the DfT's model.
- Sectored demand matrices have been compared to the airport-to-airport movement data from DfT to ensure these movements look sensible.
- Checks on the growth in air demand from the base have been carried out to make sure this is sensible.
- The resulting air demand has been assigned to the air networks to ensure that all trips have a possible path.
- Independent review of the full forecasting approach, including all input and output files, and resulting analysis.

7.4.3 The independent auditor has verified that the future year air demand has been produced following the adopted methodology as described in this report.

7.5 Conclusion

7.5.1 The checks carried out by the model developers and the independent auditor ensure that the resulting forecasts have been derived correctly following the agreed methodology.

7.5.2 The resulting forecasts have been included within PFMv6.1c, further checks are carried out by both the model developers and the independent auditor to ensure that they have been included correctly. These are documented within the model release notes.

7.5.3 Following successful completion of the QA documented within this chapter, the future year forecasts are fit for the purpose of assessing the HS2 scheme.

Appendices

Appendix A: Rail forecast step-through

Impact of rail step-through on regional PLD forecasts

Migration to EDGEv1.5.1.0

The change in PLD demand at a geographical level as a result of the migration to EDGEv1.5.10 is presented in the tables below. The tables show that all trips to/from London and within the South East have no growth in demand for this step change – this is as expected as the elasticity values have not changed for PDFH flow groups associated with London and the South East.

Outside of these areas demand has typical been uplifted by around 2%, the variability in change in these regions is down to the variability in the proportion of trips associated with each sector movement can be classified as non-London Core and non-London Major flows. The greater the proportion of trips that are classified by these flow groups within each sector movement, the greater the increase in the overall level of demand for that sector movement as the growth for these trips is calculated using the variable elasticity values.

For instance, Scotland, the North East and Eastern segments each have five core and major cities within their region, and therefore a larger proportion of the trips between these sectors will be subjected to the elasticity changes brought about by the migration to EDGEv1.5.1.0.

Wales only has Cardiff as a core city and Swansea as a major city – therefore only trips to/from Cardiff will be in-scope to have the variable elasticity values applied in the forecasting, out of all trips within the Wales sector. The South East also only has one major city (Watford) and no core cities, therefore for trips between here and the East Midlands only trips between Watford and Leicester / Derby fit into the non-London core and major categories. These patterns drive low growth in this step change between these sectors.

Percentage Change in Regional PLD Demand through the migration to EDGEv1.5.1.0 for 2026/27

Rail Step-Through EDGEv1.5.1.0 Migration	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Scotland	-	2.3%	2.0%	2.0%	1.8%	2.0%	1.8%	1.7%	1.9%	0.0%	2.2%	1.4%
North East	2.3%	1.9%	2.1%	1.9%	1.7%	2.0%	1.9%	1.7%	2.1%	0.0%	2.1%	1.7%
North West	2.0%	2.0%	1.6%	1.8%	1.7%	1.8%	1.8%	1.5%	1.9%	0.0%	1.9%	1.4%
Yorks & Humber	1.9%	1.9%	1.8%	1.6%	1.7%	1.7%	1.7%	1.5%	1.9%	0.0%	1.9%	1.4%
Wales	1.9%	1.7%	1.8%	1.8%	0.4%	1.0%	1.4%	1.8%	1.4%	0.0%	1.6%	1.0%
West Midlands	2.0%	2.0%	1.8%	1.8%	1.0%	1.1%	1.9%	1.3%	1.4%	0.0%	1.8%	1.0%
East Midlands	1.7%	1.8%	1.8%	1.7%	1.3%	1.9%	1.2%	1.2%	0.5%	0.0%	1.5%	0.9%
South West	1.7%	1.7%	1.5%	1.5%	1.7%	1.3%	1.1%	0.8%	0.0%	0.0%	0.9%	1.2%
South East	1.9%	2.2%	1.9%	2.0%	1.5%	1.5%	0.6%	0.0%	-	-	-	1.5%
London	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	0.0%
Eastern	2.2%	2.1%	1.9%	1.9%	1.6%	1.8%	1.5%	0.9%	-	-	-	1.8%
	1.4%	1.7%	1.4%	1.4%	1.0%	1.0%	0.9%	1.2%	1.4%	0.0%	1.8%	1.0%

Percentage Change in Regional PLD Demand through the migration to EDGEv1.5.1.0 for the second forecast year (2037/38)

Rail Step-Through EDGEv1.5.1.0 Migration	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Scotland	-	2.3%	2.0%	2.0%	1.9%	1.9%	1.8%	1.7%	1.9%	0.0%	2.2%	1.4%
North East	2.3%	2.0%	2.1%	1.9%	1.8%	1.9%	1.9%	1.7%	2.2%	0.0%	2.1%	1.7%
North West	2.0%	2.1%	1.7%	1.8%	1.7%	1.8%	1.8%	1.6%	1.9%	0.0%	1.9%	1.4%
Yorks & Humber	1.9%	1.9%	1.8%	1.6%	1.7%	1.7%	1.7%	1.5%	2.0%	0.0%	1.9%	1.4%
Wales	1.9%	1.8%	1.8%	1.8%	0.4%	1.0%	1.4%	1.7%	1.5%	0.0%	1.6%	1.0%
West Midlands	1.9%	1.9%	1.8%	1.7%	1.0%	1.1%	1.8%	1.3%	1.4%	0.0%	1.8%	0.9%
East Midlands	1.8%	1.8%	1.8%	1.7%	1.4%	1.8%	1.2%	1.2%	0.6%	0.0%	1.6%	0.8%
South West	1.7%	1.7%	1.5%	1.5%	1.7%	1.3%	1.2%	0.8%	0.0%	0.0%	0.9%	1.2%
South East	2.0%	2.2%	2.0%	2.0%	1.5%	1.5%	0.6%	0.0%	-	-	-	1.5%
London	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	0.0%
Eastern	2.2%	2.1%	1.9%	1.9%	1.6%	1.8%	1.6%	0.9%	-	-	-	1.8%
	1.4%	1.7%	1.4%	1.4%	1.0%	1.0%	0.8%	1.2%	1.4%	0.0%	1.8%	1.0%

Updated demand drivers

Analysis of the regional variation in growth in the PLD sub-model has been carried out to ensure that the impact of the July 2015 demand driver update has had the required effect in terms of the geographical distribution of trips affected.

The change in PLD demand at a geographical level as a result of the demand driver update is presented in the tables below for the two forecast years. The tables show a varied impact at a regional level in response to the regional variations in demand drivers.

In 2026/27 the biggest increases in demand are for trips between London, West Midlands and Scotland, the three regions with the largest overall increases in forecasts for the three exogenous demand drivers. Trips to/from these three regions generally increase overall and provide the biggest increases in demand. Demand to/from Wales and the North East decrease most significantly, these regions have the biggest decrease in GDP/Capita forecast.

Percentage Change in Regional PLD Demand through the July 2015 DDG Updates for 2026/27

Rail Step-Through July 2015 DDG Update	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Scotland	-	0.1%	1.3%	1.2%	0.0%	2.6%	1.6%	1.6%	1.6%	3.1%	1.1%	1.7%
North East	-0.3%	-2.1%	-1.9%	-1.5%	-2.2%	-0.4%	-0.8%	-1.1%	-0.7%	-1.5%	-1.3%	-1.7%
North West	1.0%	-1.8%	0.2%	-0.5%	-1.5%	1.0%	0.3%	-0.4%	0.0%	-0.2%	-0.5%	0.0%
Yorkshire & Humber	1.0%	-1.3%	-0.4%	-0.2%	-1.5%	0.9%	0.2%	-0.2%	0.3%	0.5%	-0.3%	-0.1%
Wales	-0.5%	-2.2%	-1.7%	-1.8%	-1.1%	0.0%	-0.9%	-1.3%	-0.7%	-1.7%	-1.2%	-1.3%
West Midlands	2.6%	0.0%	1.3%	1.1%	0.5%	2.5%	1.2%	1.4%	1.5%	2.9%	1.2%	2.0%
East Midlands	1.4%	-0.6%	0.5%	0.2%	-0.5%	1.1%	0.6%	0.7%	1.0%	1.2%	0.4%	0.9%
South West	1.4%	-0.9%	-0.4%	-0.2%	-1.0%	1.2%	0.6%	1.0%	1.2%	0.8%	0.6%	0.2%
South East	1.4%	-0.5%	0.1%	0.3%	-0.4%	1.3%	1.0%	1.2%	-	-	-	0.7%
London	2.9%	-1.0%	0.1%	0.7%	-1.1%	2.8%	1.3%	0.9%	-	-	-	1.2%
Eastern	0.9%	-1.2%	-0.4%	-0.3%	-1.0%	1.0%	0.4%	0.6%	-	-	-	0.1%
	1.4%	-1.6%	0.1%	-0.1%	-1.0%	1.9%	0.9%	0.1%	0.7%	1.0%	0.2%	0.4%

In the second forecast year, there is a similar pattern of change in response to the changing forecasts, but the effect is more pronounced for some movements as the increase in forecasts gets stronger. Growth between the South East and South West is particularly strong as the employment forecasts improve longer term. The reduction in demand forecasts for the North East and Wales are smaller as employment and population forecasts get stronger.

Percentage Change in Regional PLD Demand through the July 2015 DDG Update for the second forecast year (Step 2 2036/37 vs Step 1 2037/38)

Rail Step-Through July 2015 DDG Update	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Scotland	-	2.5%	4.7%	2.0%	2.6%	4.9%	2.7%	3.1%	3.0%	3.9%	0.5%	3.4%
North East	2.0%	0.2%	0.1%	-0.4%	-0.6%	1.2%	0.2%	-0.1%	0.5%	-1.5%	-1.7%	0.0%
North West	4.2%	0.1%	2.7%	-0.5%	1.3%	2.5%	1.0%	0.3%	0.3%	-0.4%	-0.4%	1.4%
Yorkshire & Humber	1.5%	-0.5%	-0.7%	-0.4%	-2.0%	0.5%	-0.1%	-1.5%	-0.4%	-1.9%	-2.7%	-0.8%
Wales	1.8%	-0.8%	1.0%	-2.0%	2.0%	1.5%	-0.7%	-1.9%	-0.7%	-2.9%	-1.9%	-0.4%
West Midlands	4.7%	1.6%	2.7%	1.0%	1.9%	3.7%	1.5%	2.1%	1.5%	2.1%	0.7%	2.3%
East Midlands	2.2%	0.2%	0.9%	0.0%	-0.5%	1.3%	-0.5%	0.6%	0.2%	-1.0%	-0.9%	-0.3%
South West	2.5%	-0.2%	0.1%	-1.4%	-1.7%	1.8%	0.5%	2.6%	4.2%	1.3%	0.9%	0.5%
South East	2.5%	0.5%	0.2%	-0.3%	-0.5%	1.2%	0.2%	3.9%	-	-	-	0.6%
London	3.4%	-1.3%	-0.4%	-1.7%	-2.4%	1.9%	-0.9%	1.2%	-	-	-	-0.1%
Eastern	-0.2%	-1.9%	-0.7%	-2.8%	-1.9%	0.3%	-1.1%	0.6%	-	-	-	-1.2%
	2.9%	0.1%	1.3%	-0.6%	-0.1%	2.0%	-0.2%	0.4%	0.8%	-0.1%	-0.9%	0.5%

Base Year update to 2014/15

The change in base year demand in the PLD sub-model by region is presented in the table below. This distribution has been compared to the regional change in future year rail forecasts for PLD for the base year update step-change.

Regional Change in Base Year Demand in PLD (PFMv6.1c 2014/15 vs PFMv5.2b 2010/11)

	Scotland	North East	North West	Yorkshire & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (Abs)												
Scotland	-	508	682	197	19	52	31	- 38	47	599	9	**2,107**
North East	427	- 683	175	419	- 5	0	16	- 2	63	790	32	**1,233**
North West	678	197	7,682	2,188	279	1,203	252	67	377	2,242	194	**15,359**
Yorkshire & Humber	203	578	1,947	- 3,410	28	84	675	12	229	1,952	368	**2,667**
Wales	13	- 7	- 230	14	- 500	82	- 9	490	96	149	27	**125**
West Midlands	57	14	1,081	101	279	- 1,169	265	360	743	3,579	252	**5,563**
East Midlands	20	20	177	569	2	- 132	- 123	32	301	1,105	266	**2,239**
South West	- 43	- 5	46	- 8	794	270	28	414	71	77	5	**1,648**
South East	39	67	363	224	169	761	357	95	-	-	-	**2,075**
London	592	914	2,386	2,157	442	4,292	2,309	160	-	-	-	**13,252**
Eastern	11	52	190	376	40	277	378	6	-	-	-	**1,329**
	1,997	**1,655**	**14,500**	**2,828**	**1,547**	**5,720**	**4,180**	**1,596**	**1,928**	**10,493**	**1,153**	**47,596**
Difference (%)												
Scotland	-	24%	26%	15%	25%	12%	10%	-22%	14%	21%	2%	**20%**
North East	20%	-4%	13%	12%	-10%	0%	4%	-1%	19%	28%	8%	**4%**
North West	26%	14%	24%	20%	9%	22%	14%	8%	21%	19%	25%	**21%**
Yorkshire & Humber	15%	17%	17%	-18%	12%	6%	20%	2%	25%	23%	32%	**5%**
Wales	15%	-12%	-6%	5%	-11%	4%	-4%	11%	10%	4%	12%	**1%**
West Midlands	13%	4%	19%	7%	15%	-13%	5%	16%	19%	25%	26%	**12%**
East Midlands	6%	5%	9%	17%	1%	-2%	-2%	6%	17%	8%	12%	**6%**
South West	-25%	-3%	5%	-1%	20%	11%	5%	15%	25%	8%	17%	**13%**
South East	11%	20%	20%	24%	18%	20%	21%	36%	-	-	-	**20%**
London	21%	34%	20%	26%	14%	31%	17%	18%	-	-	-	**23%**
Eastern	3%	13%	25%	34%	20%	29%	18%	23%	-	-	-	**22%**
	19%	**6%**	**19%**	**6%**	**8%**	**13%**	**11%**	**12%**	**19%**	**18%**	**19%**	**13%**

The regional variation in the future year demand forecasts for PLD as a result of updating the base year and demand level is presented in the tables below for the 2026/27 and 2036/37 future years.

The pattern of change in the future years as a result of the step change is similar to the pattern of demand change in the base year. The largest increases in demand in magnitude are for trips

within the North West, and between London and the West Midlands, North West, Yorkshire & Humber, East Midlands and the North East; also between Yorkshire & Humber and the North East.

Trips between London and the West Midlands though have not increased as significantly as for the base, this is due to strong growth forecasts for these regions in the period 2010/11 – 2014/15 which is not sustained over the full forecasting horizon. London, the West Midlands and Scotland future year rail forecasts have not grown as strongly as the base in general for this reason.

The growth forecasts are generally stronger for the south of the country between 2010/11 and 2014/15 and therefore future year demand forecasts for these regions do not grow as much as base year demand. In the north the forecasts are slower 2010/11 – 2014/15 and even negative in some cases causing more rail growth in the future year matrices than in the base year matrices.

Percentage Change in Regional PLD Demand through the Base Year and Appraisal Horizon Updates for 2026/27

Rail Step-Through Base Year & Appraisal Horizon Updates	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Scotland	-	23%	25%	14%	28%	8%	8%	-24%	9%	14%	-1%	16%
North East	19%	-3%	14%	13%	-6%	-2%	4%	-1%	16%	24%	7%	5%
North West	25%	16%	27%	21%	9%	19%	14%	9%	18%	16%	25%	22%
Yorkshire & Humber	14%	18%	18%	-18%	13%	3%	20%	2%	21%	19%	30%	5%
Wales	17%	-8%	-7%	6%	-11%	2%	-4%	12%	7%	0%	11%	0%
West Midlands	8%	2%	16%	4%	13%	-17%	1%	12%	13%	15%	19%	7%
East Midlands	5%	5%	9%	16%	1%	-5%	-3%	6%	14%	3%	9%	3%
South West	-27%	-3%	6%	-1%	20%	8%	5%	15%	25%	5%	16%	12%
South East	7%	17%	17%	21%	16%	14%	18%	36%	-	-	-	16%
London	13%	29%	16%	21%	9%	21%	12%	14%	-	-	-	17%
Eastern	0%	12%	25%	32%	19%	23%	15%	22%	-	-	-	20%
	15%	7%	20%	6%	8%	8%	9%	12%	15%	12%	16%	11%

Percentage Change in Regional PLD Demand through the Base Year and Appraisal Horizon Updates for the second forecast year (2036/37)

Rail Step-Through Base Year & Appraisal Horizon Updates	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Scotland	-	23%	24%	14%	32%	8%	8%	-24%	8%	16%	-1%	17%
North East	18%	-3%	14%	12%	-3%	-3%	4%	-1%	15%	23%	7%	5%
North West	25%	16%	27%	21%	8%	19%	14%	9%	18%	16%	25%	21%
Yorkshire & Humber	14%	18%	18%	-17%	14%	3%	20%	2%	21%	20%	29%	6%
Wales	20%	-5%	-8%	6%	-11%	2%	-4%	12%	7%	1%	11%	0%
West Midlands	8%	1%	16%	4%	13%	-17%	1%	11%	12%	15%	17%	7%
East Midlands	5%	5%	9%	16%	1%	-6%	-3%	6%	14%	2%	9%	2%
South West	-27%	-3%	6%	-1%	21%	7%	5%	15%	24%	5%	16%	12%
South East	7%	16%	17%	21%	16%	13%	17%	35%	-	-	-	16%
London	14%	29%	17%	22%	9%	20%	11%	13%	-	-	-	17%
Eastern	1%	13%	25%	32%	20%	21%	15%	22%	-	-	-	19%
	15%	7%	20%	6%	8%	8%	8%	12%	14%	12%	15%	12%

Appendix B: Impact to rail demand forecasts

Impact of reforecasting on regional PLD forecasts

The change in PLD demand at a geographical level as a result of the reforecasting for PFMv6.1c is presented in the tables below. The tables present the absolute and percentage change for regional sector-to-sector movement between PFMv5.2b and PFMv6.1c for the two forecast years.

In 2026/27, there is a large increase in demand for internal travel within the North West region. Outside of this, there are significant increases in general to/from London – particularly for long-distance trips between West & East Midlands, North West and Yorkshire & Humber to/from London – all key movements for the HS2 scheme. There are also large increases in demand between the North West and Yorkshire & Humber. These increases typically signify around a 20% – 30% increase in demand from PFMv5.2b levels.

The largest reductions in 2026/7 demand are for trips within Yorkshire & Humber (3,697) and for trips internal to the West Midlands (1,460), otherwise reductions in demand at a sectoral level are relatively small.

For some sector-sector movements there are no trips in PLD, hence some cells in the matrix show zero change (e.g. London to London). This demand is picked up in one of the regional models.

Outside of the key changes in the absolute level of demand, there are some large proportional changes in demand; however, these are typically movements where the volume of demand is small in magnitude and do not have a significant bearing on the HS2 scheme, such as:

- South West – Scotland – 20% decrease in demand in both directions,
- East – Yorkshire & Humber – 30% increase in demand in both directions; and
- South East – South West – almost 40% increase in demand.

Change in 16Hr Daily Demand in 2026/27

PFMv6 demand change from PFM52b 2026/27	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (Abs)												
Scotland	-	676	951	286	28	72	48	-45	57	733	11	**2,816**
North East	561	-600	245	553	-4	-3	25	-0	75	901	44	**1,798**
North West	936	273	10,957	3,043	342	1,549	370	109	482	2,664	265	**20,990**
Yorkshire & Humber	285	753	2,736	-3,697	39	112	892	28	290	2,390	473	**4,301**
Wales	19	-6	-296	19	-561	78	-10	634	101	-86	31	**-77**
West Midlands	74	15	1,381	130	324	-1,460	325	431	813	3,870	283	**6,186**
East Midlands	33	28	274	758	5	-172	-126	51	361	822	328	**2,362**
South West	-52	-4	80	2	1,010	323	46	528	87	79	6	**2,105**
South East	49	81	474	291	204	859	428	116	-	-	-	**2,503**
London	686	1,074	2,789	2,614	338	4,835	2,536	188	-	-	-	**15,059**
Eastern	17	71	264	497	50	327	473	8	-	-	-	**1,706**
	2,609	**2,361**	**19,855**	**4,496**	**1,774**	**6,521**	**5,005**	**2,047**	**2,266**	**11,374**	**1,442**	**59,750**

Percentage Change in 16Hr Daily Demand in 2026/27

PFMv6 demand change from PFM52b 2026/27	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (%)												
Scotland	-	26%	29%	17%	30%	13%	12%	-21%	12%	18%	2%	**20%**
North East	21%	-3%	14%	13%	-6%	-1%	5%	0%	17%	22%	8%	**5%**
North West	29%	16%	29%	23%	9%	23%	17%	10%	20%	16%	26%	**23%**
Yorkshire & Humber	17%	18%	20%	-17%	14%	6%	22%	4%	24%	20%	32%	**7%**
Wales	19%	-9%	-7%	6%	-11%	3%	-3%	12%	8%	-2%	11%	**0%**
West Midlands	13%	4%	20%	7%	15%	-14%	5%	15%	16%	18%	22%	**10%**
East Midlands	8%	6%	12%	18%	2%	-2%	-2%	8%	16%	4%	11%	**5%**
South West	-24%	-2%	7%	0%	21%	11%	7%	17%	26%	6%	18%	**14%**
South East	10%	19%	20%	24%	17%	17%	20%	37%	-	-	-	**19%**
London	16%	27%	16%	22%	7%	24%	13%	15%	-	-	-	**18%**
Eastern	3%	13%	27%	34%	20%	26%	17%	24%	-	-	-	**22%**
	18%	**7%**	**22%**	**7%**	**8%**	**11%**	**10%**	**13%**	**17%**	**13%**	**18%**	**13%**

In the second forecast year, there are similar distributional changes to future year demand as in 2026/27. Demand increases to/from London by more than 30,000 daily trips, this is around a 15% increase in demand – this is the most significant impact on the HS2 scheme.

Change in 16Hr Daily Demand in the Second Forecast Year – PFMv6.1c (2036/37) vs PFMv5.2b (2037/38)

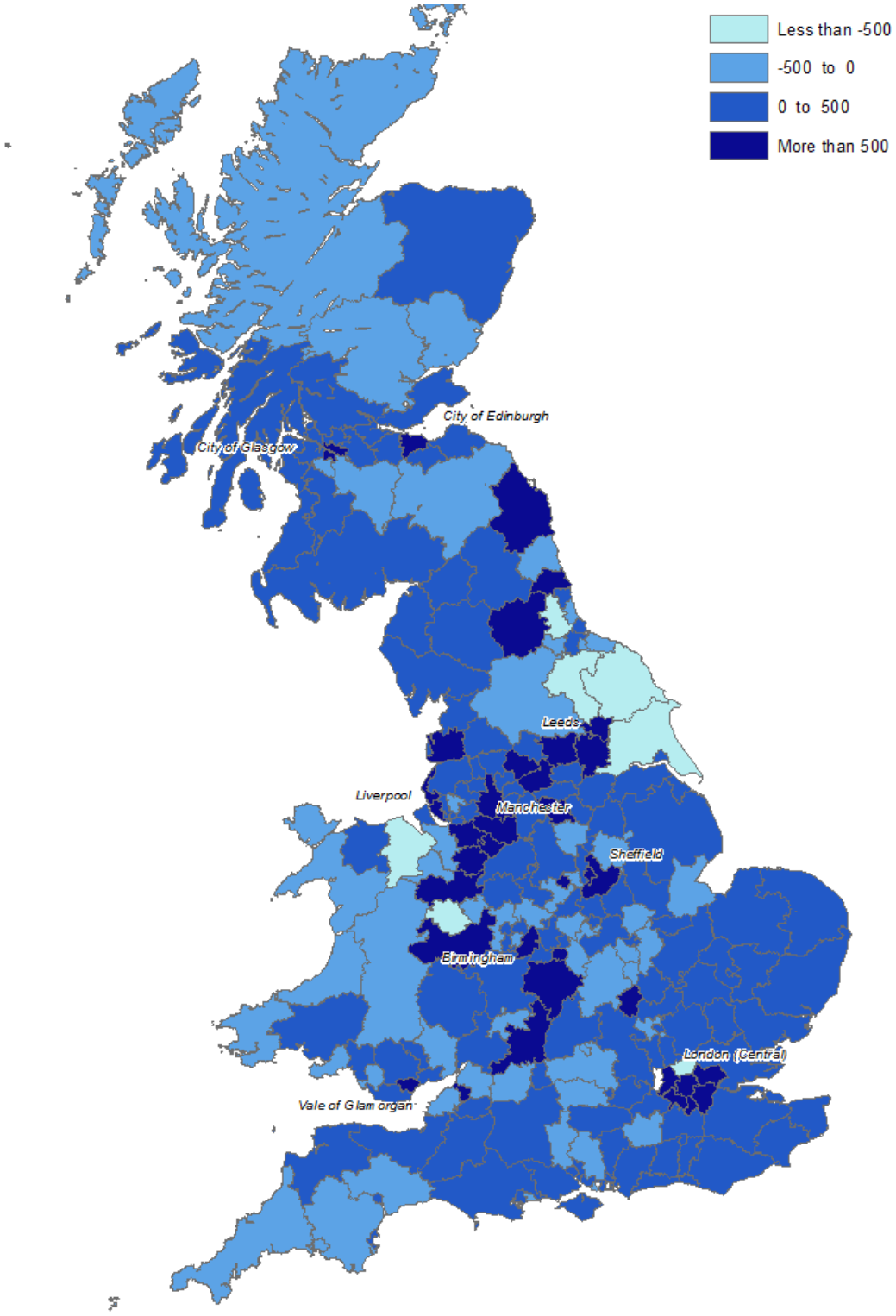
PFMv6 demand change from PFM52b second Forcast year	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (Abs)												
Scotland	-	923	1,330	376	42	108	67	- 54	78	1,117	11	**3,998**
North East	780	- 196	348	750	- 1	1	37	2	98	1,146	56	**3,020**
North West	1,311	382	14,564	3,754	508	2,016	476	149	616	3,680	340	**27,796**
Yorkshire & Humber	370	987	3,319	- 4,511	48	119	1,096	21	356	2,924	551	**5,282**
Wales	30	- 4	- 291	24	- 492	141	- 13	764	130	- 125	37	**203**
West Midlands	111	24	1,802	149	449	- 1,654	404	542	1,014	5,309	325	**8,477**
East Midlands	47	39	350	926	6	- 253	- 248	64	412	146	341	**1,829**
South West	- 62	- 3	108	- 11	1,244	399	57	704	114	108	8	**2,665**
South East	66	104	599	360	261	1,061	494	149	-	-	-	**3,093**
London	972	1,437	3,804	3,155	403	6,318	2,636	247	-	-	-	**18,971**
Eastern	17	86	337	582	62	383	521	10	-	-	-	**1,998**
	3,643	**3,779**	**26,269**	**5,554**	**2,529**	**8,640**	**5,528**	**2,598**	**2,818**	**14,306**	**1,670**	**77,334**

Percentage Change in 16Hr Daily Demand in the Second Forecast Year – PFMv6.1c (2036/37) vs PFMv5.2b (2037/38)

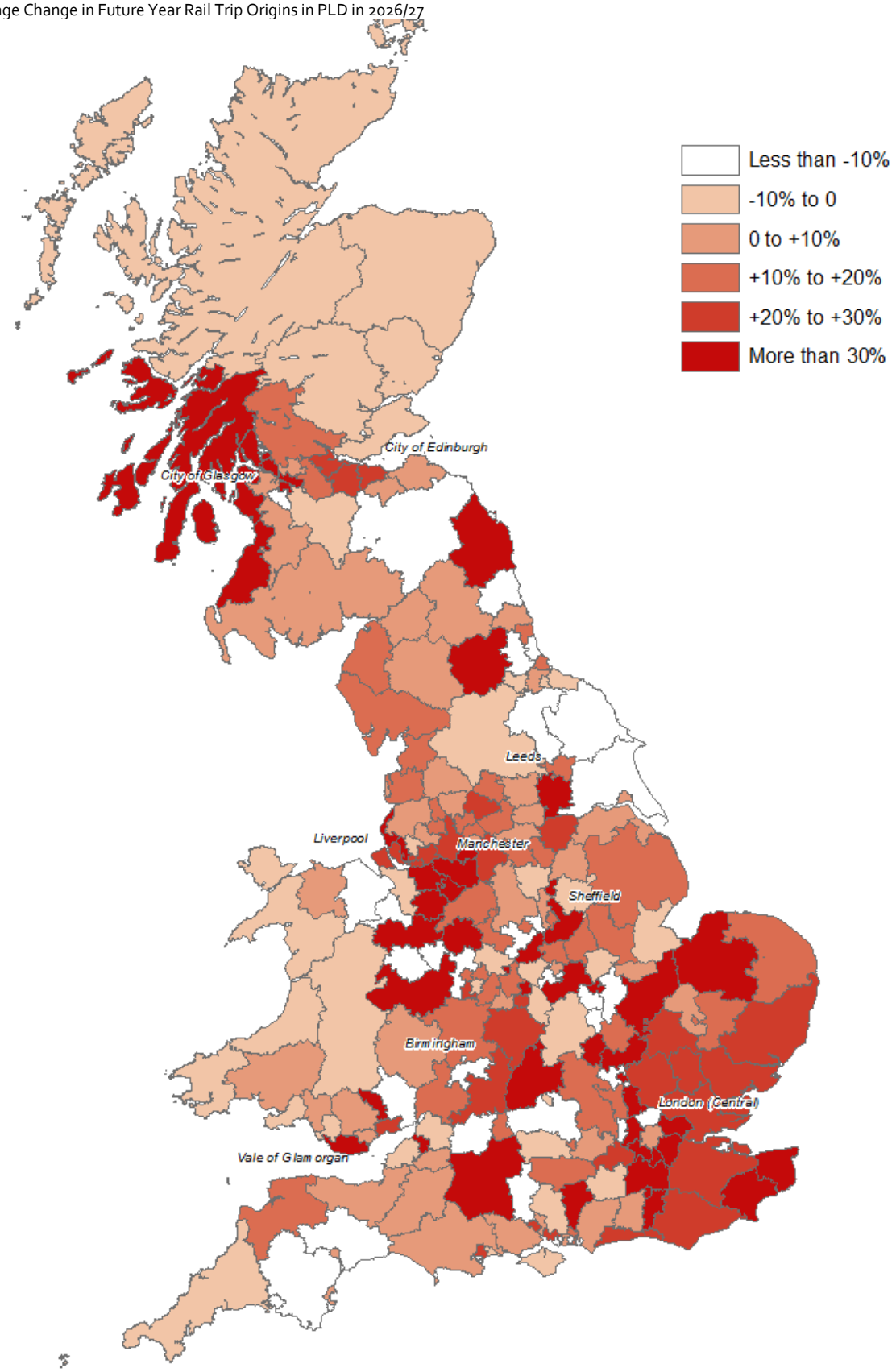
PFMv6 demand change from PFM52b second Forcast year	Scotland	North East	North West	Yorks & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (%)												
Scotland	-	28%	33%	18%	38%	15%	13%	-20%	14%	20%	2%	**23%**
North East	23%	-1%	16%	14%	-2%	0%	6%	1%	18%	21%	8%	**7%**
North West	33%	18%	33%	23%	11%	24%	17%	11%	21%	16%	27%	**25%**
Yorkshire & Humber	18%	20%	20%	-16%	13%	5%	22%	2%	23%	18%	28%	**7%**
Wales	25%	-5%	-5%	6%	-8%	5%	-3%	12%	8%	-2%	11%	**1%**
West Midlands	15%	4%	21%	6%	16%	-13%	4%	15%	16%	18%	20%	**11%**
East Midlands	9%	7%	12%	18%	2%	-3%	-2%	8%	15%	0%	9%	**3%**
South West	-24%	-1%	8%	-1%	21%	11%	7%	19%	30%	6%	18%	**14%**
South East	11%	19%	20%	23%	18%	16%	18%	41%	-	-	-	**18%**
London	18%	27%	17%	19%	7%	22%	10%	15%	-	-	-	**17%**
Eastern	3%	13%	27%	30%	19%	23%	15%	24%	-	-	-	**20%**
	20%	**9%**	**23%**	**7%**	**9%**	**11%**	**9%**	**13%**	**17%**	**12%**	**16%**	**13%**

Impact of reforecasting on zonal PLD rail forecasts

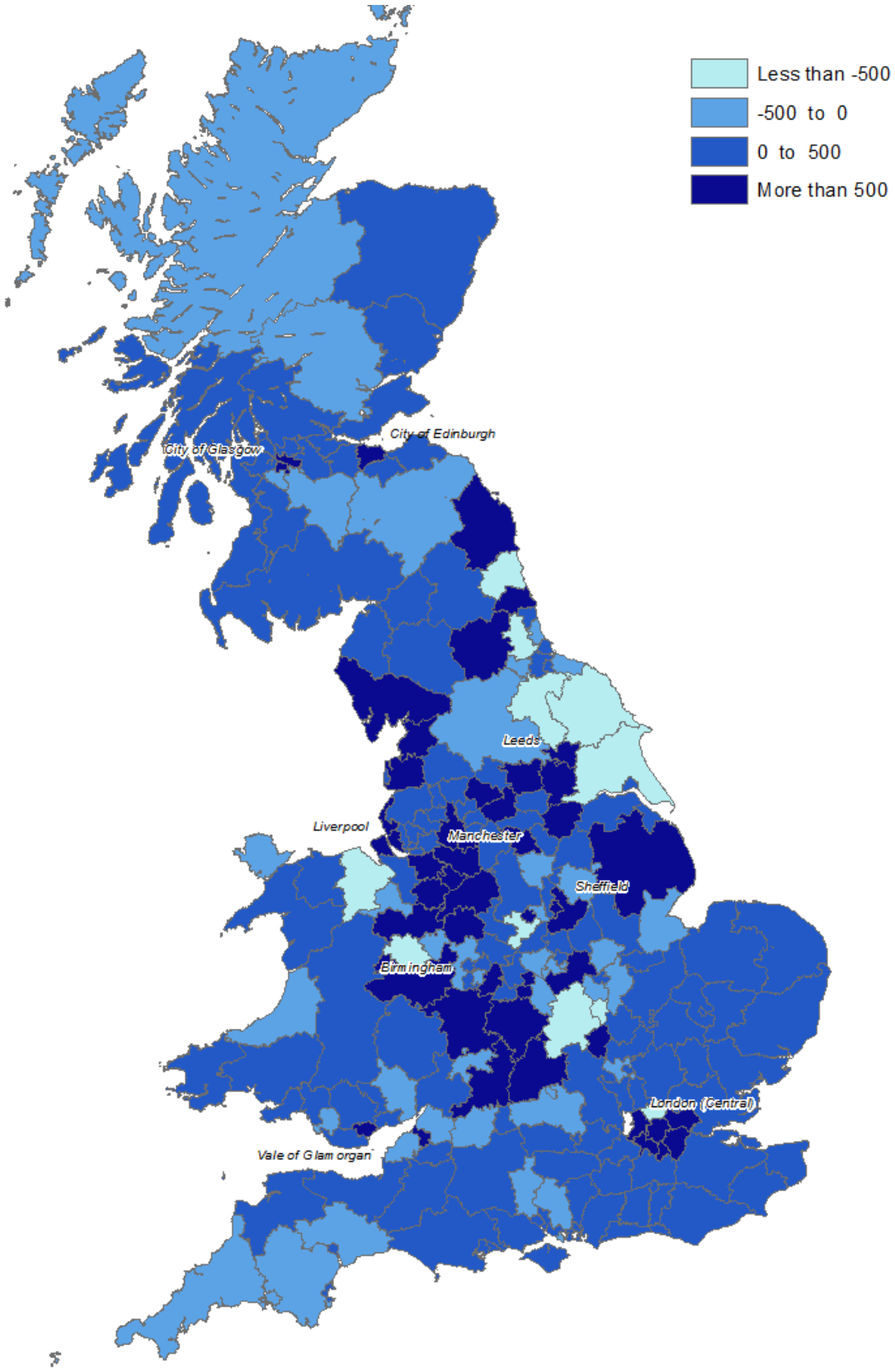
Change in Future Year Rail Trip Origins in PLD in 2026/27



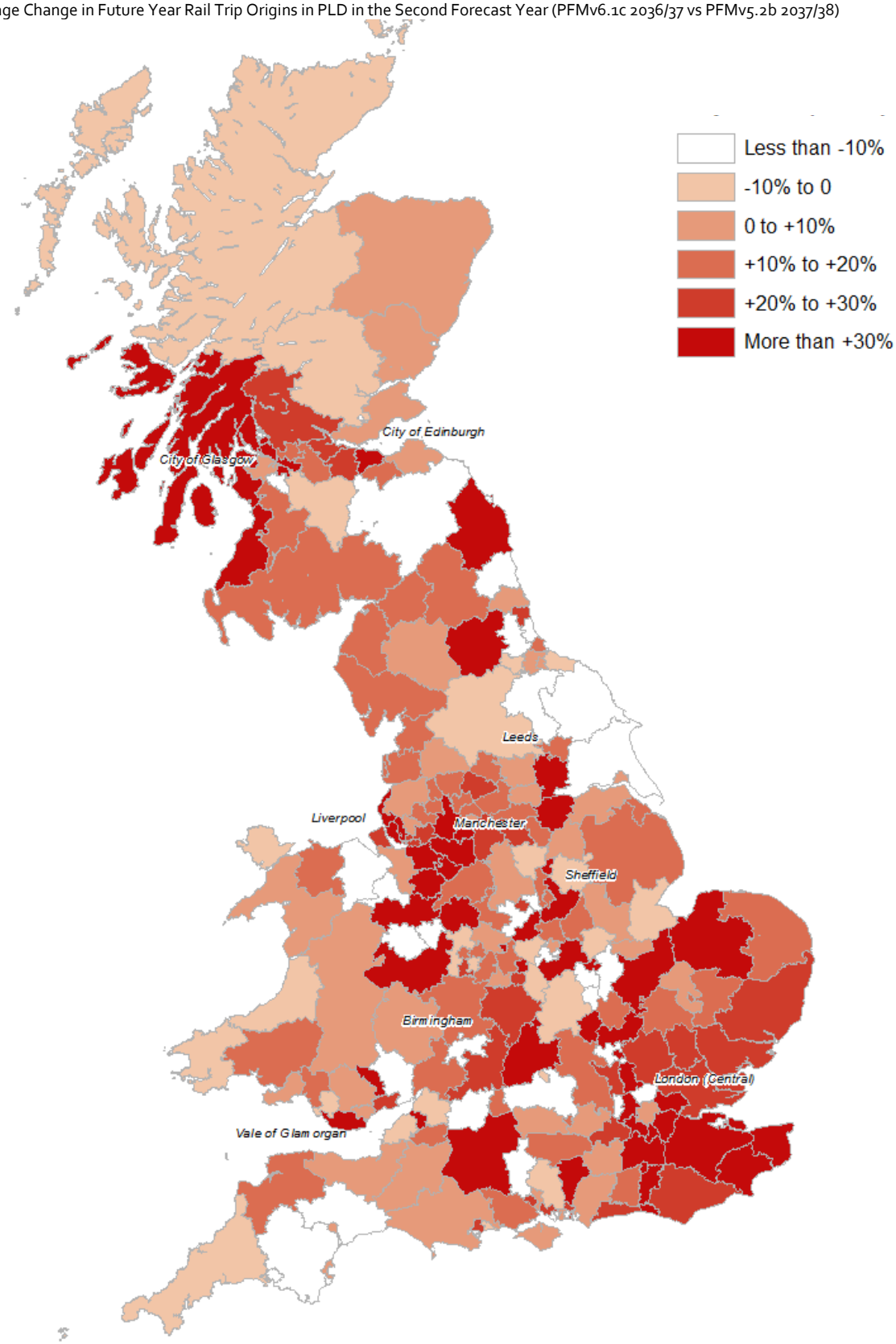
Percentage Change in Future Year Rail Trip Origins in PLD in 2026/27



Change in Future Year Rail Trip Origins in PLD in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



Percentage Change in Future Year Rail Trip Origins in PLD in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



The table below shows the largest absolute changes in the 16-hour daily demand in 2026/27 between PFMv5.2b and PFMv6.1c. These changes are for trips originating at each of the designated zones. The following table similarly shows the top ten zones for which the largest proportional change in demand has occurred in 2026/27.

Largest Absolute Changes in Demand by PLD Zone Origin in 2026/27

PLD Zone Number	PLD Zone Name	**PFMv5.2b Demand**	**PFMv6.1c Demand**	**Difference (Abs)**	**Difference (%)**
130	Manchester	29,008	37,445	8,437	29%
117	London Central	76,421	81,740	5,319	7%
41	County Durham West	549	4,066	3,517	641%
121	London South East	500	3,460	2,960	592%
122	London South West	609	3,142	2,532	416%
5	Birmingham	19,861	22,383	2,522	13%
116	Liverpool	8,790	11,139	2,349	27%
123	London West	1,593	3,738	2,145	135%
179	Sheffield	10,125	12,191	2,066	20%
42	Crewe	2,966	4,806	1,841	62%

Largest Percentage Changes in Demand by PLD Zone Origin in 2026/27

PLD Zone Number	PLD Zone Name	**PFMv5.2b Demand**	**PFMv6.1c Demand**	**Difference (Abs)**	**Difference (%)**
119	London North East	166	1,729	1,563	941%
41	County Durham West	549	4,066	3,517	641%
121	London South East	500	3,460	2,960	592%
120	London South/Croydon	285	1,920	1,636	574%
122	London South West	609	3,142	2,532	416%
124	Luton	99	373	273	276%
178	Selby	540	1,555	1,015	188%
28	Corby	82	194	112	136%
123	London West	1,593	3,738	2,145	135%
215	Vale Royal	698	1,627	929	133%

In 2026/27 in PFMv6.1c the largest absolute increases in demand from PFMv5.2b are for trips originating in Manchester, with an increase of 8,437 trips – an increase of 29%. London features significantly on this list with many regions generating more trips in PFMv6.1c – for London central, this is a relatively modest proportional increase, but significant for the other outer regions. Birmingham, Liverpool, Sheffield and Crewe – all feature within the HS2 scheme and are generating significantly more future year rail trips as previously.

Proportionally the highest increases in demand are for trips originating in London's outer regions, and also for County Durham West (641%). Other large increases by percentage are more modest in absolute change due to increase from relatively small demand totals in PFMv5.2b.

The tables below present the largest changes in demand for the second forecast year.

Largest Absolute Changes in Demand by PLD Zone Origin in the Second Forecast Year

PLD Zone Number	PLD Zone Name	**PFMv5.2b Demand (2037/38)**	**PFMv6.1c Demand (2036/37)**	**Difference (Abs)**	**Difference (%)**
130	Manchester	36,489	47,001	10,512	29%
117	London Central	104,512	110,043	5,531	5%
41	County Durham West	684	5,040	4,356	637%
121	London South East	668	4,678	4,010	600%
5	Birmingham	25,113	28,688	3,574	14%
122	London South West	805	4,248	3,443	428%
116	Liverpool	10,890	14,033	3,143	29%
123	London West	2,101	5,063	2,961	141%
179	Sheffield	12,809	15,370	2,561	20%
42	Crewe	3,774	6,036	2,262	60%

Largest Percentage Changes in Demand by PLD Zone Origin in the Second Forecast Year

PLD Zone Number	PLD Zone Name	**PFMv5.2b Demand (2037/38)**	**PFMv6.1c Demand (2036/37)**	**Difference (Abs)**	**Difference (%)**
119	London North East	221	2,340	2,119	958%
41	County Durham West	684	5,040	4,356	637%
121	London South East	668	4,678	4,010	600%
120	London South/Croydon	379	2,598	2,219	586%
122	London South West	805	4,248	3,443	428%
124	Luton	122	458	336	276%
178	Selby	701	1,967	1,265	180%
123	London West	2,101	5,063	2,961	141%
140	Nuneaton & Bedworth	373	876	503	135%
215	Vale Royal	902	2,064	1,161	129%

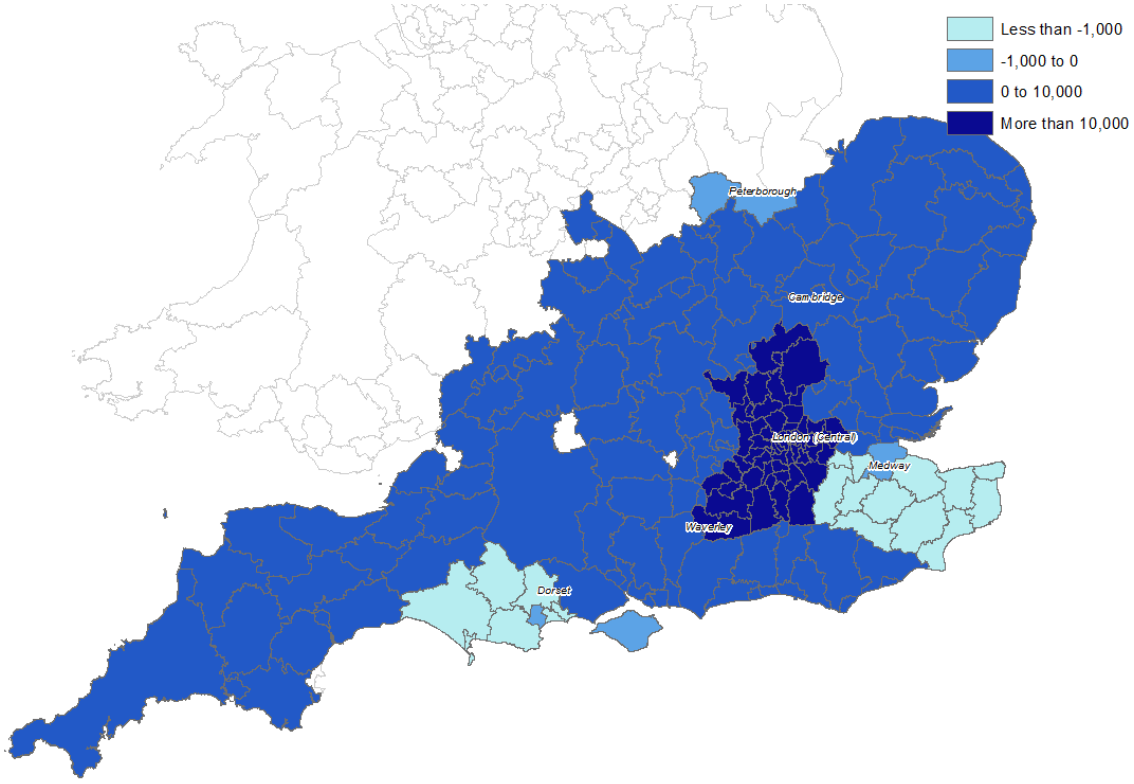
In the second forecast year in PFMv6.1c the largest absolute increases in demand from PFMv5.2b are for the same zones as in 2026/27. The majority of these zones are key destinations on the HS2 scheme.

Proportionally the list of largest increases in demand are similar as for 2026/27, again particularly for London outer regions.

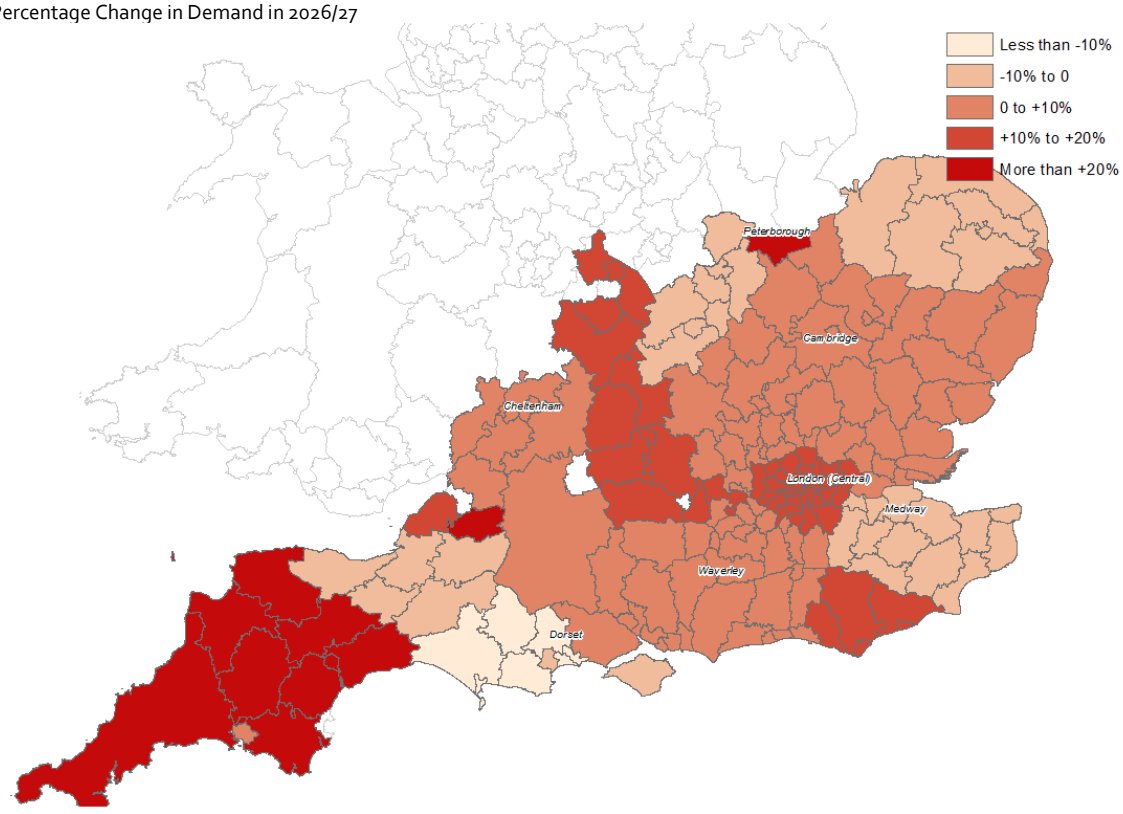
Impact of reforecasting on regional PS rail forecasts

The regional variation in growth in relative and absolute terms for demand originating at PS zones is presented in the figures on the following pages for 2026/27 and the second forecast year.

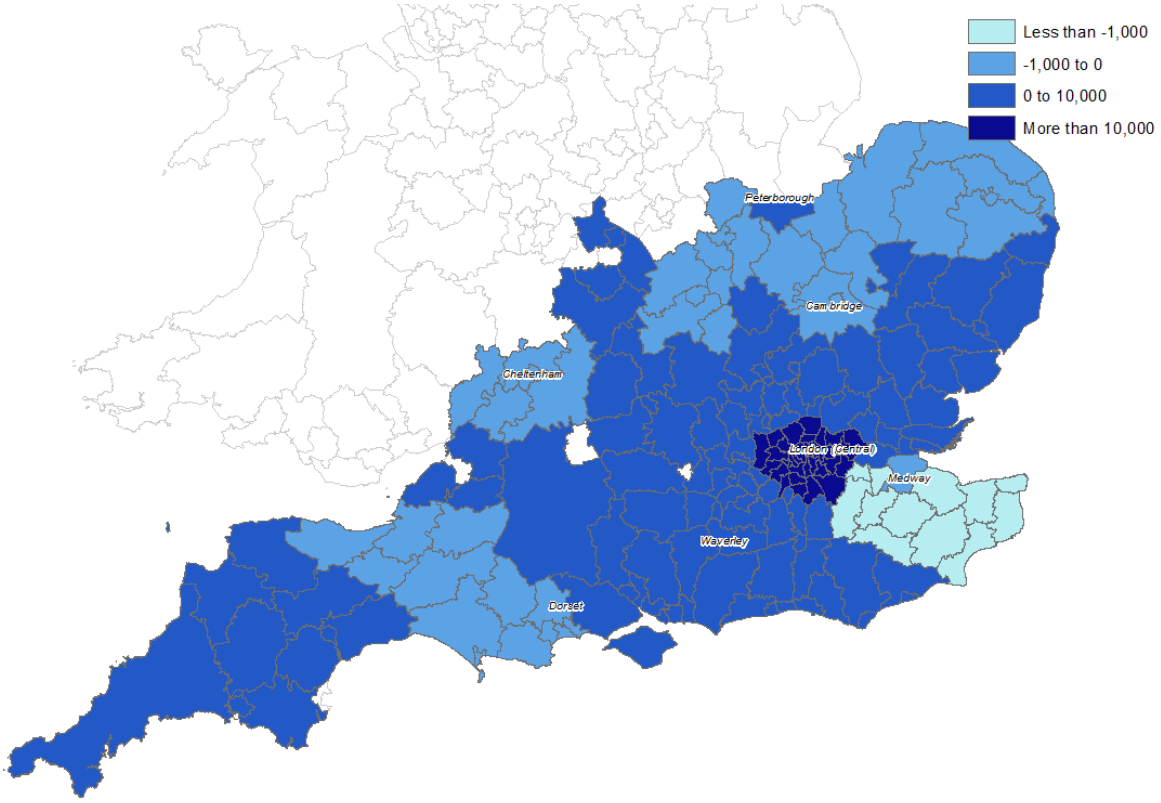
PS Absolute Change in Demand in 2026/27



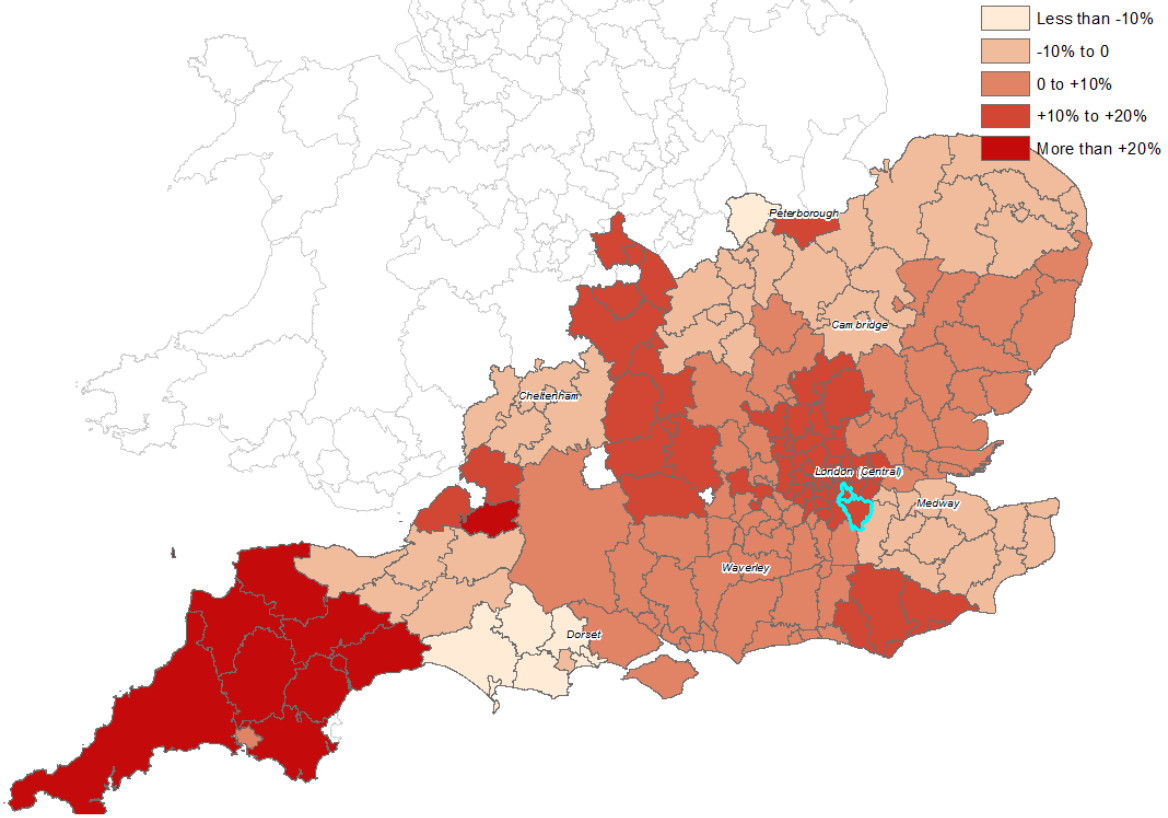
PS Percentage Change in Demand in 2026/27



PS Absolute Change in Demand in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



PS Percentage Change in Demand in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



The tables below present the largest changes in PS in 2026/27 for trips originating at zonal level. These have been aggregated to county level as the zone system in PS is fine, largest changes between PFMv5.2b and PFMv6.1c are presented in absolute and relative terms.

Due to its size and granularity of zones, Greater London shows the most absolute demand in PS, which is expected. North and South of London, Hertfordshire and Sussex, also see large demand changes while East of London into Kent, trip origins have reduced.

The South West of England features highly in the most percentage change in demand, with Devon and Bath & North East Somerset both seeing over +30% growth between models. Greater London experiences 11% increase in demand – the 9th highest proportional change.

Largest Absolute Change in Demand in 2026/27

County	PFMv5.2b Demand	PFMv6.1c Demand	Difference (Abs)	Difference (%)
Greater London	1,553,411	1,728,837	175,426	11%
Hertfordshire	41,982	45,541	3,559	8%
West Sussex	41,957	44,666	2,709	6%
Wokingham	20,929	23,073	2,144	10%
Thurrock	30,970	33,006	2,036	7%
East Sussex	14,769	16,327	1,558	11%
Oxfordshire	12,144	13,654	1,510	12%
Central Bedfordshire	18,001	19,469	1,469	8%
Surrey	54,024	55,338	1,314	2%
Windsor & Maidenhead	11,877	13,186	1,308	11%

Largest Percentage Change in Demand in 2026/27

County	PFMv5.2b Demand	PFMv6.1c Demand	Difference (Abs)	Difference (%)
Devon	2,290	3,123	833	36%
Bath & North East Somerset	300	393	93	31%
Cornwall	15	20	4	26%
Peterborough	378	460	82	22%
Warwickshire	1,317	1,547	230	17%
North Somerset	894	1,046	151	17%
Oxfordshire	12,144	13,654	1,510	12%
West Berkshire	7,620	8,530	909	12%
Greater London	1,553,411	1,728,837	175,426	11%
Windsor & Maidenhead	11,877	13,186	1,308	11%

The tables below present the largest changes in PS in the second forecast year for trips originating at zonal level. These have been aggregated to county level as the zone system in PS is fine, largest changes between PFMv5.2b and PFMv6.1c are presented in absolute and relative terms.

As per 2026/27, Greater London sees the largest absolute change with surrounding counties also in the most absolute change. The percentage of growth in these regions appears to be similar to the 2026/27 as well.

South West England (Devon and further) again see the biggest percentage change.

Largest Absolute Change in Demand in 2nd Forecast Year

County	**PFMv5.2b Demand (2037/38)**	**PFMv6.1c Demand (2036/37)**	**Difference (Abs)**	**Difference (%)**
Greater London	1,756,540	1,944,167	187,627	11%
Hertfordshire	46,863	51,855	4,992	11%
West Sussex	47,800	51,718	3,917	8%
Wokingham	24,573	26,894	2,321	9%
Surrey	61,289	63,423	2,135	3%
East Sussex	16,837	18,961	2,124	13%
Central Bedfordshire	20,319	22,128	1,809	9%
Oxfordshire	13,990	15,764	1,774	13%
Windsor & Maidenhead	13,597	15,215	1,618	12%
Thurrock	35,804	37,291	1,488	4%

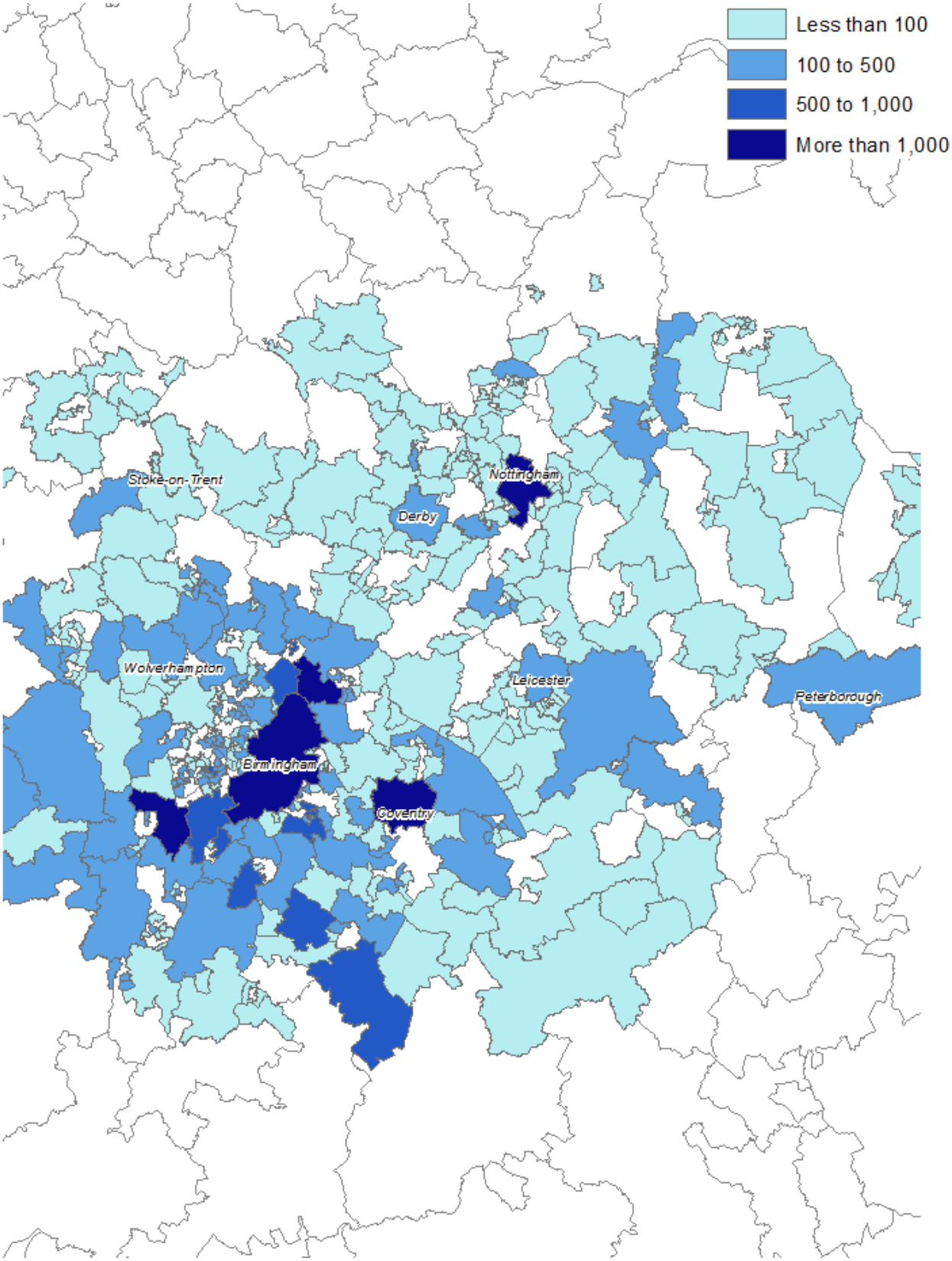
Largest Percentage Change in Demand in 2nd Forecast Year

County	**PFMv5.2b Demand (2037/38)**	**PFMv6.1c Demand (2036/37)**	**Difference (Abs)**	**Difference (%)**
Devon	2,839	3,774	935	33%
Bath & North East Somerset	406	524	118	29%
Cornwall	19	24	5	27%
Warwickshire	1,523	1,800	277	18%
Peterborough	492	579	87	18%
North Somerset	1,162	1,349	187	16%
West Berkshire	8,804	9,945	1,142	13%
Oxfordshire	13,990	15,764	1,774	13%
East Sussex	16,837	18,961	2,124	13%
Windsor & Maidenhead	13,597	15,215	1,618	12%

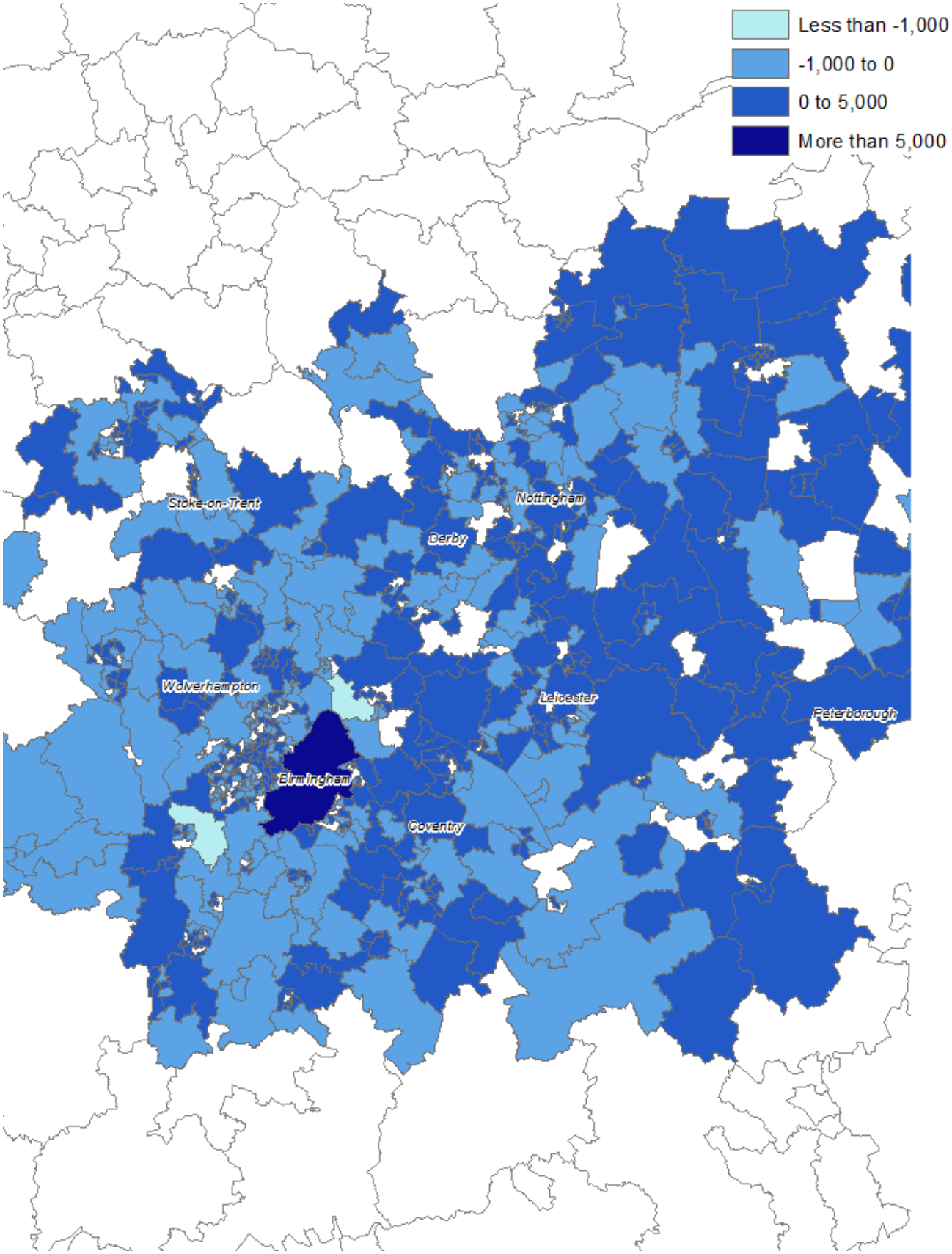
Impact of reforecasting on regional PM rail forecasts

The regional variation in growth in relative and absolute terms for demand originating at PM zones is presented in the figures on the following pages for 2026/27 and the second forecast year.

PM Absolute Change in Demand in 2026/27



PM Absolute Change in Demand in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



The figures are presented only for absolute changes in demand change as the distribution of demand in the PM matrices has changed significantly, which makes calculating the proportional change possible only for a small subset of zones.

In both years there is a significant increase in the demand originating at Birmingham, Nottingham, Derby – all of which are impacted by the HS2 scheme. There are also large increases for other densely populated areas of Peterborough, Leicester, Coventry and Wolverhampton.

The tables below present the largest changes in PM in 2026/27 for trips originating at zonal level. This analysis has been focused for major districts and cities as the changes in the demand distribution has made comparison difficult. The largest changes between PFMv5.2b and PFMv6.1c are presented in absolute and relative terms.

Birmingham District has the largest absolute growth from PFMv5.2b to PFMv6.1c with over 10,000 trips. Nottingham has also grown significantly.

Peterborough, Derby and Nottingham all see very large (over +80%) percentage change growth, with only Stoke-on-Trent and Wolverhampton contracting in this sample of cities.

Absolute Change in Demand in 2026/27, Major Cities in Planet Midland

County	PFMv5.2b Demand	PFMv6.1c Demand	Difference (Abs)	Difference (%)
Birmingham District	26,967	37,404	10,437	39%
Coventry District	3,550	4,965	1,414	40%
Nottingham District	1,214	2,228	1,014	84%
City of Derby	435	921	486	112%
City of Leicester	1,080	1,517	437	40%
City of Peterborough	92	243	151	165%
City of Stoke-on-Trent	384	324	-60	-16%
Wolverhampton District	3,544	3,340	-203	-6%

Percentage Change in Demand in 2026/27, Major Cities in Planet Midland

County	PFMv5.2b Demand	PFMv6.1c Demand	Difference (Abs)	Difference (%)
City of Peterborough	92	243	151	165%
City of Derby	435	921	486	112%
Nottingham District	1,214	2,228	1,014	84%
City of Leicester	1,080	1,517	437	40%
Coventry District	3,550	4,965	1,414	40%
Birmingham District	26,967	37,404	10,437	39%
Wolverhampton District	3,544	3,340	-203	-6%
City of Stoke-on-Trent	384	324	-60	-16%

The tables below present the largest changes in PM in the second forecast year for trips originating at zonal level. In line with the PS analysis zonal demand has been aggregated to county level, largest changes between PFMv5.2b and PFMv6.1c are presented in absolute and relative terms.

Birmingham District has the largest absolute growth from PFMv5.2b to PFMv6.1c with 13,467. The next is Coventry with 1,748; this highlights the large and high-demand nature of Birmingham, such as London in PS. Stoke-on-Trent and Wolverhampton are large metropolitan areas that see a demand reduction in this new PFMv6.1c model.

Peterborough, Derby and Nottingham all see very large (+85%) percentage change.

Absolute Change in Demand in 2nd Forecast Year, Major Cities in Planet Midland

County	PFMv5.2b Demand (2037/38)	PFMv6.1c Demand (2036/37)	Difference (Abs)	Difference (%)
Birmingham District	32,425	45,892	13,467	42%
Coventry District	4,368	6,117	1,748	40%
Nottingham District	1,405	2,601	1,196	85%
City of Derby	504	1,090	586	116%
City of Leicester	1,273	1,789	516	41%
City of Peterborough	115	293	178	155%
City of Stoke-on-Trent	454	387	-67	-15%
Wolverhampton District	4,335	4,095	-240	-6%

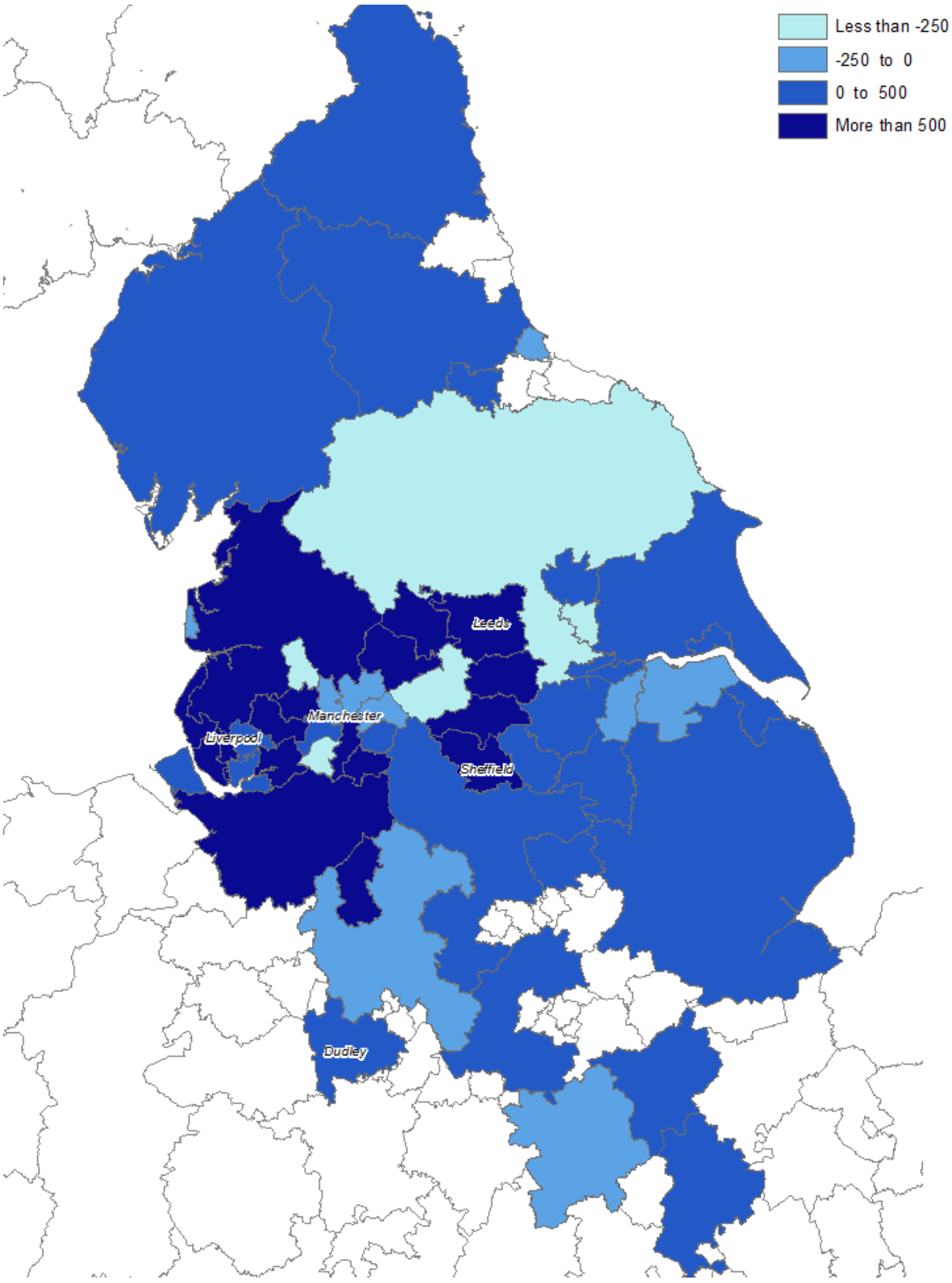
Percentage Change in Demand in 2nd Forecast Year, Major Cities in Planet Midland

County	PFMv5.2b Demand (2037/38)	PFMv6.1c Demand (2036/37)	Difference (Abs)	Difference (%)
City of Peterborough	115	293	178	155%
City of Derby	504	1,090	586	116%
Nottingham District	1,405	2,601	1,196	85%
Birmingham District	32,425	45,892	13,467	42%
City of Leicester	1,273	1,789	516	41%
Coventry District	4,368	6,117	1,748	40%
Wolverhampton District	4,335	4,095	-240	-6%
City of Stoke-on-Trent	454	387	-67	-15%

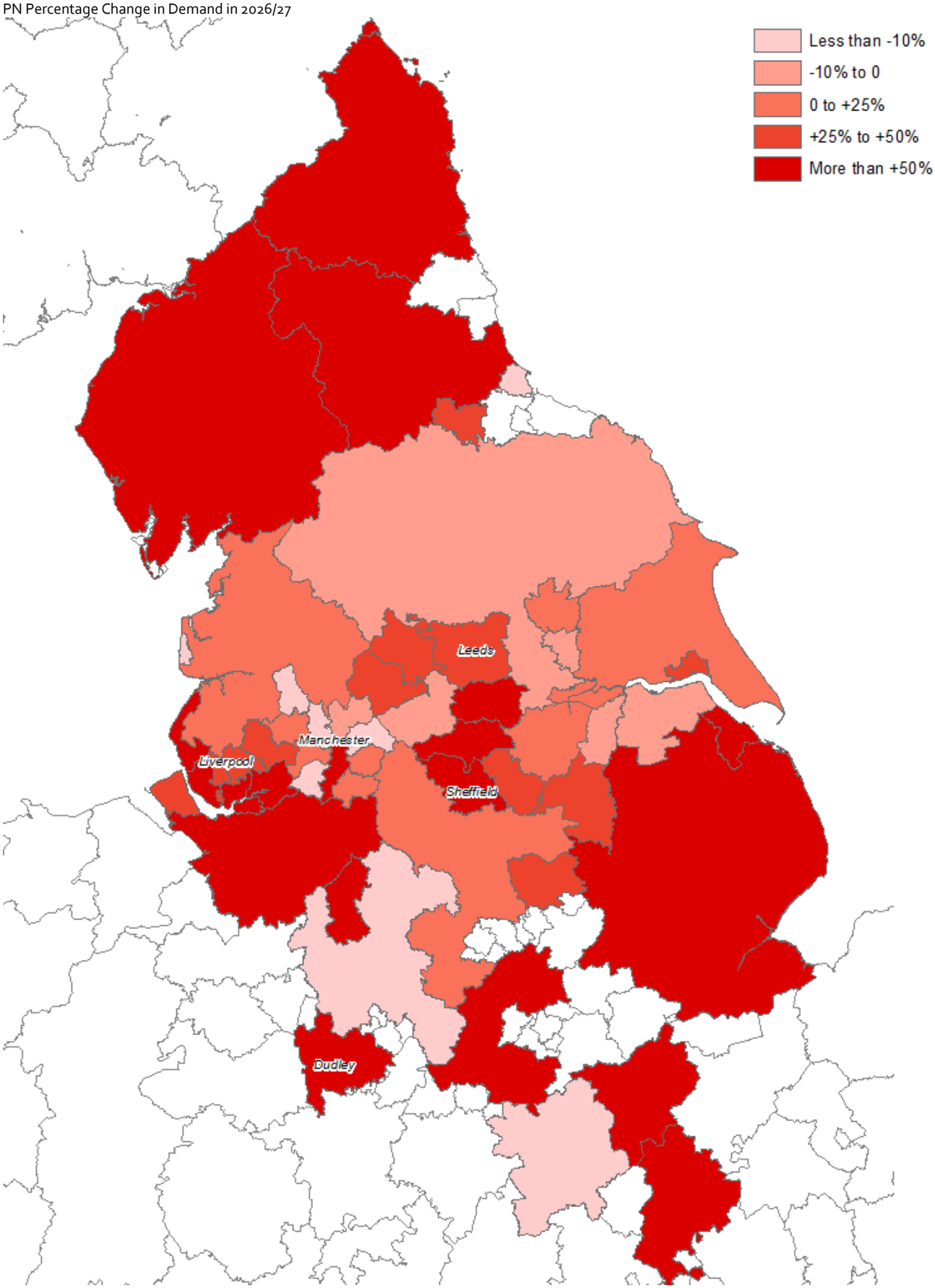
Impact of reforecasting on regional PN rail forecasts

The regional variation in growth in relative and absolute terms for demand originating at PN zones is presented in the figures on the following pages for 2026/27 and the second forecast year.

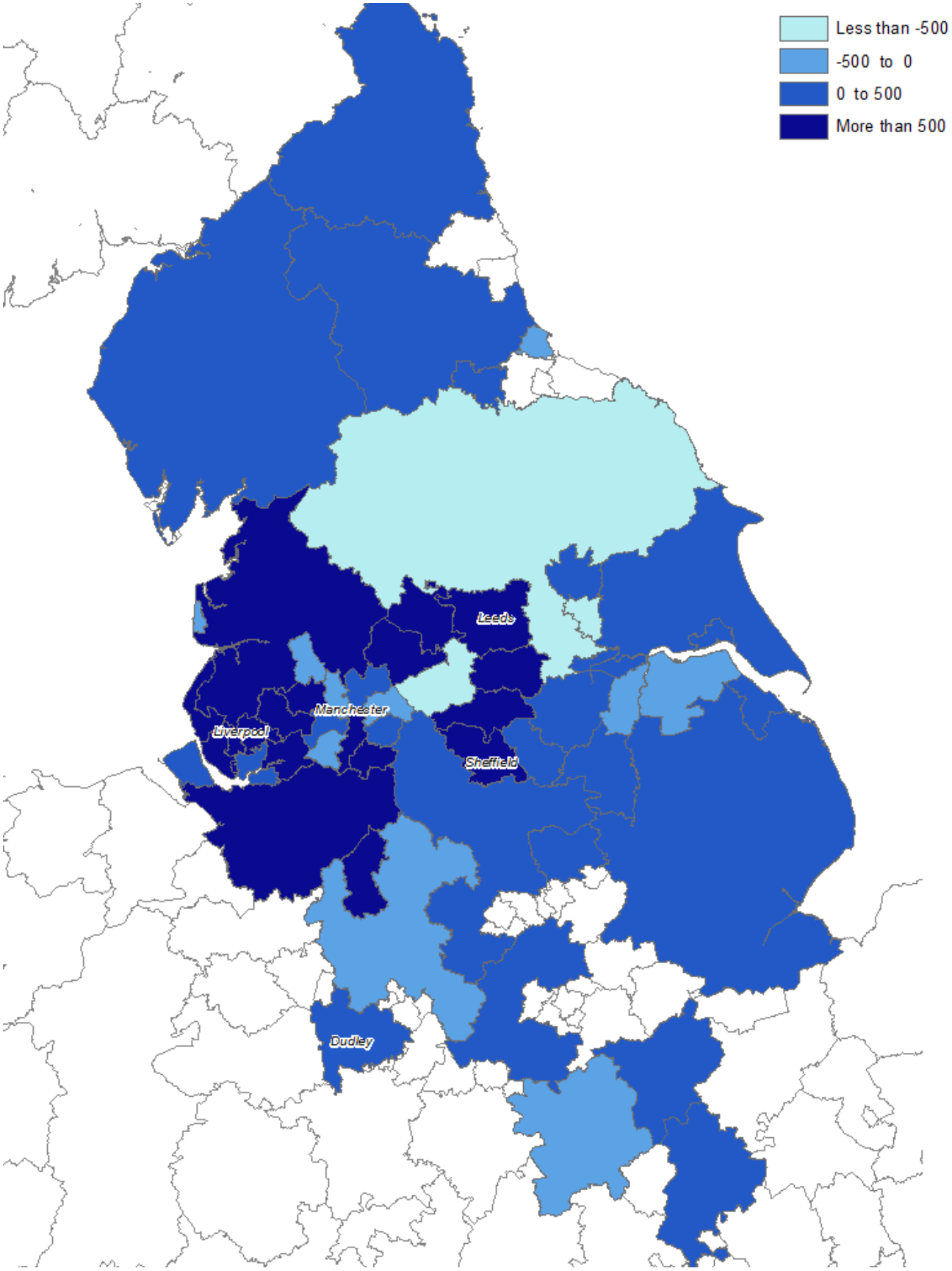
PN Absolute Change in Demand in 2026/27



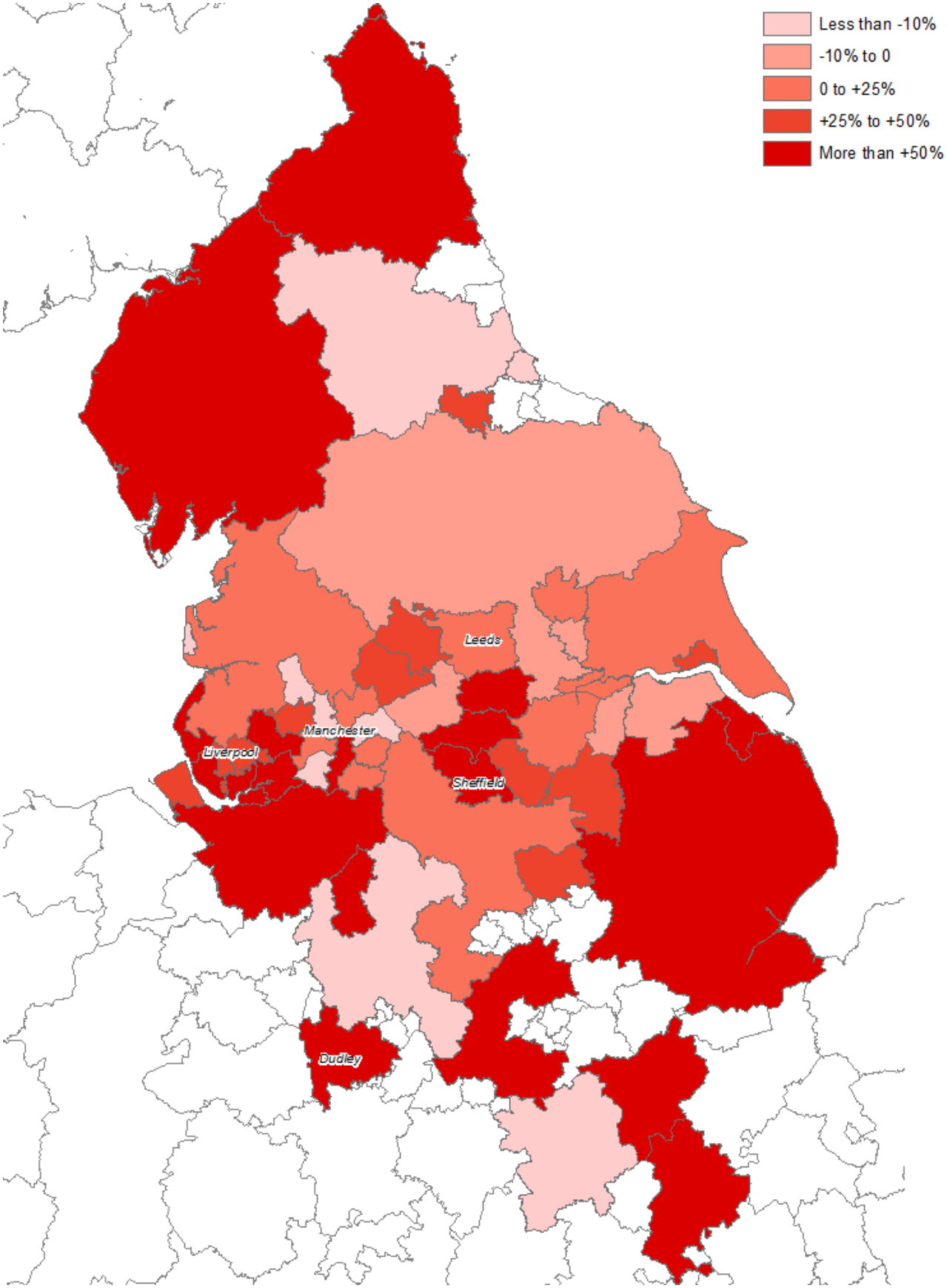
PN Percentage Change in Demand in 2026/27



PN Absolute Change in Demand in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



PN Percentage Change in Demand in the Second Forecast Year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)



The tables below present the largest changes in PN in 2026/27 for trips originating at zonal level. In line with the PS analysis zonal demand has been aggregated to county level, largest changes between PFMv5.2b and PFMv6.1c are presented in absolute and relative terms.

Liverpool and Cheshire have the largest growth in the PN sub-model, with the other major cities of Manchester, Leeds and Sheffield all being in the top ten absolute change differences in the move to PFMv6.1c.

Bedford has seen the highest percentage change (+571%) in the new model version; this is due to the demand being very small in comparison (30) previously. Liverpool and Barnsley see differences of over +800 and percentage increases of over +100%.

Largest Absolute Change in Demand in 2026/27

County	PFMv5.2b Demand	PFMv6.1c Demand	Difference (Abs)	Difference (%)
Liverpool	6,915	15,812	8,897	129%
Cheshire	7,704	14,951	7,247	94%
Sefton	4,469	8,252	3,782	85%
Bradford	8,687	12,317	3,630	42%
Manchester	5,041	8,612	3,571	71%
Leeds	12,125	15,349	3,223	27%
Wakefield	2,905	4,783	1,878	65%
Wigan	2,628	3,915	1,287	49%
Sheffield	1,740	3,018	1,279	73%
Stoke-on-Trent	1,333	2,552	1,219	91%

Largest Percentage Change in Demand in 2026/27

County	PFMv5.2b Demand	PFMv6.1c Demand	Difference (Abs)	Difference (%)
Bedfordshire	30	201	171	571%
Northumberland	51	143	92	178%
Dudley	16	38	22	139%
Liverpool	6,915	15,812	8,897	129%
Barnsley	847	1,706	859	101%
Leicestershire	19	37	18	94%
Cheshire	7,704	14,951	7,247	94%
Stoke-on-Trent	1,333	2,552	1,219	91%
North-East Lincolnshire	147	278	131	89%
Warrington	1,236	2,283	1,047	85%

The tables below present the largest changes in PN in the second forecast year for trips originating at zonal level. In line with the PS analysis zonal demand has been aggregated to county level, largest changes between PFMv5.2b and PFMv6.1c are presented in absolute and relative terms.

The top three in terms of absolute change difference have not changed from the 2026/27 rankings. The growth has stayed similar in the comparison of the second forecast year.

As per 2026/27, Bedford has seen the highest percentage change (+603%) but is a small region in terms of overall demand.

Largest Absolute Change in Demand in 2nd Forecast Year

County	**PFMv5.2b Demand (2037/38)**	**PFMv6.1c Demand (2036/37)**	**Difference (Abs)**	**Difference (%)**
Liverpool	7,881	18,240	10,359	131%
Cheshire	8,800	17,329	8,529	97%
Sefton	4,904	9,452	4,549	93%
Manchester	6,266	10,207	3,942	63%
Bradford	11,015	14,849	3,834	35%
Leeds	15,327	18,343	3,016	20%
Wakefield	3,569	5,759	2,190	61%
Wigan	3,053	4,618	1,565	51%
Sheffield	2,065	3,544	1,480	72%
Stoke-on-Trent	1,528	2,970	1,441	94%

Largest Percentage Change in Demand in 2nd Forecast Year

County	**PFMv5.2b Demand (2037/38)**	**PFMv6.1c Demand (2036/37)**	**Difference (Abs)**	**Difference (%)**
Bedfordshire	33	233	200	603%
Northumberland	60	169	108	180%
Dudley	19	44	26	139%
Liverpool	7,881	18,240	10,359	131%
Barnsley	996	2,014	1,018	102%
Cheshire	8,800	17,329	8,529	97%
Stoke-on-Trent	1,528	2,970	1,441	94%
Sefton	4,904	9,452	4,549	93%
Leicestershire	23	44	21	92%
North East Lincolnshire	174	324	150	87%

Appendix C: Future year highway forecasts

Impact of reforecasting on regional highway forecasts

The change in total highway demand at GOR is presented in the following tables for 2026/27 and 2036/37.

Trips have altered at a regional level more significantly than at aggregate level, generally trips to/from Scotland, South West, South East and Eastern have increased most significantly. Longer distance trips between Scotland and southern regions and Yorkshire & Humber and southern regions have increased the greatest proportionally, though for some of these, the increase in the number of trips is small. Trips within northern regions and between the North and Midlands have decreased.

Regional Change in Highway Demand in 2026/27 (PFMv6.1c vs PFMv5.2b)

	Scotland	North East	North West	Yorkshire & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (Abs)												
Scotland	-	71	287	162	36	62	35	49	41	31	22	**797**
North East	178	-128	90	209	-8	-20	-50	12	10	13	-8	**300**
North West	406	18	-508	621	87	-339	-39	98	99	79	55	**576**
Yorkshire & Humber	294	289	729	-1,323	19	48	224	102	329	146	146	**1,003**
Wales	72	-5	176	38	132	97	-13	506	93	210	71	**1,377**
West Midlands	143	-15	-105	99	86	130	-14	515	360	265	99	**1,562**
East Midlands	93	-35	133	512	-8	-33	-304	48	254	89	92	**840**
South West	82	11	151	79	617	661	58	391	-49	49	-24	**2,026**
South East	76	33	181	422	138	625	372	3	-	-	-	**1,850**
London	27	-10	38	102	38	-28	-38	19	-	-	-	**149**
Eastern	69	39	208	374	232	433	733	26	-	-	-	**2,114**
	1,440	**268**	**1,380**	**1,295**	**1,369**	**1,637**	**964**	**1,769**	**1,138**	**882**	**453**	**12,595**
Difference (%)												
Scotland	-	1%	3%	3%	3%	2%	1%	5%	3%	4%	2%	**2%**
North East	1%	-3%	1%	1%	-1%	-1%	-1%	1%	0%	1%	-1%	**1%**
North West	4%	0%	-1%	1%	0%	-1%	0%	2%	2%	3%	1%	**0%**
Yorkshire & Humber	4%	1%	2%	-1%	0%	1%	1%	4%	4%	4%	2%	**0%**
Wales	4%	0%	1%	1%	1%	0%	0%	2%	2%	3%	1%	**1%**
West Midlands	4%	-1%	0%	1%	0%	1%	0%	2%	1%	2%	1%	**1%**
East Midlands	3%	-1%	1%	2%	0%	0%	-1%	1%	1%	1%	0%	**0%**
South West	7%	2%	3%	4%	3%	2%	2%	3%	-1%	2%	-2%	**2%**
South East	6%	2%	3%	6%	3%	2%	2%	0%	-	-	-	**3%**
London	3%	-1%	1%	3%	0%	0%	0%	1%	-	-	-	**0%**
Eastern	6%	3%	4%	6%	4%	3%	2%	2%	-	-	-	**3%**
	3%	**0%**	**1%**	**1%**	**1%**	**1%**	**0%**	**2%**	**2%**	**2%**	**1%**	**1%**

Regional Change in Highway Demand in the second forecast year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)

	Scotland	North East	North West	Yorkshire & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (Abs)												
Scotland	-	2	371	217	43	78	32	73	60	41	25	**943**
North East	195	- 241	66	210	- 20	- 35	- 95	16	10	7	- 24	**88**
North West	557	- 61	- 1,273	678	30	- 735	- 177	121	112	83	34	**- 632**
Yorkshire & Humber	444	314	882	- 2,708	- 3	17	186	146	485	181	155	**98**
Wales	96	- 18	128	12	167	- 85	- 64	648	92	212	42	**1,231**
West Midlands	203	- 31	- 373	81	- 70	84	- 163	636	338	244	- 32	**918**
East Midlands	122	- 81	82	659	- 49	- 135	- 665	49	283	45	- 150	**160**
South West	124	13	190	108	790	858	65	596	- 109	53	- 56	**2,633**
South East	106	34	218	600	161	644	381	- 50	-	-	-	**2,094**
London	37	- 31	31	120	- 43	- 175	- 148	14	-	-	-	**- 195**
Eastern	100	48	286	536	307	517	924	26	-	-	-	**2,743**
	1,985	**- 51**	**608**	**511**	**1,313**	**1,033**	**274**	**2,277**	**1,271**	**866**	**- 4**	**10,082**
Difference (%)												
Scotland	-	0%	4%	4%	3%	3%	1%	7%	4%	4%	2%	**2%**
North East	2%	-6%	1%	1%	-2%	-2%	-3%	2%	0%	0%	-2%	**0%**
North West	5%	0%	-1%	1%	0%	-2%	-1%	3%	2%	2%	1%	**0%**
Yorkshire & Humber	6%	1%	2%	-3%	0%	0%	1%	5%	6%	4%	2%	**0%**
Wales	6%	-1%	1%	0%	1%	0%	-1%	3%	2%	3%	1%	**1%**
West Midlands	5%	-2%	-1%	1%	0%	0%	-1%	2%	1%	2%	0%	**0%**
East Midlands	4%	-2%	0%	2%	-1%	0%	-2%	1%	1%	1%	0%	**0%**
South West	11%	2%	3%	5%	3%	3%	2%	4%	-2%	2%	-3%	**3%**
South East	8%	2%	3%	7%	3%	2%	2%	-1%	-	-	-	**3%**
London	4%	-2%	1%	3%	-1%	-1%	-2%	1%	-	-	-	**0%**
Eastern	8%	3%	5%	7%	5%	4%	3%	2%	-	-	-	**4%**
	5%	**0%**	**0%**	**0%**	**1%**	**0%**	**0%**	**3%**	**2%**	**2%**	**0%**	**1%**

Appendix D: Future year air forecasts

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.

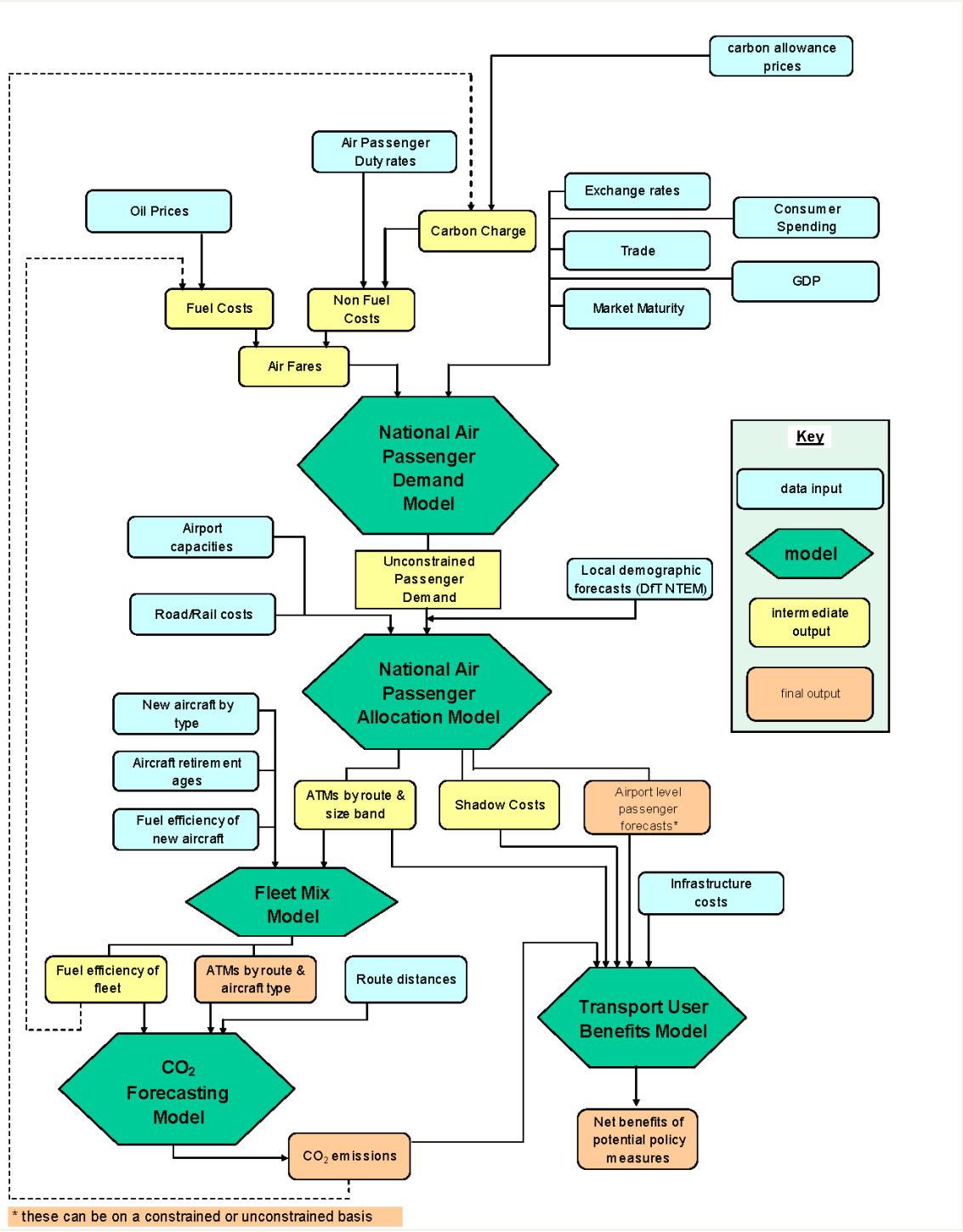
Passenger forecasts are generated for each forecast year in two steps:

- 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.

The figure below provides an overview of the framework used by the DfT Aviation Model to produce forecasts of UK air passengers.

DfT Aviation Model Forecasting Framework (Source UK Aviation Forecasts, DfT, January 2013)



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.

The unconstrained demand forecasts from the National Air Passenger Demand Model provide an input to the National Air Passenger Allocation Model.

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.

Impact of reforecasting on regional air forecasts

The comparison for 2026/27 showed no change in demand at regional GOR level. The 2026/27 air demand in PFMv6.1c is very similar to that in PFMv5.2b however there are some small changes at PLD zone level, these have been checked against the data provided by the DfT to ensure their validity.

The change in total air demand at regional GOR sector level is presented in the table below for the second forecast year.

Regional variation in Air Demand in the second forecast year (PFMv6.1c 2036/37 vs PFMv5.2b 2037/38)

	Scotland	North East	North West	Yorkshire & Humber	Wales	West Midlands	East Midlands	South West	South East	London	Eastern	
Difference (Abs)												
Scotland	- 1	- 9	- 55	- 10	- 5	- 32	- 20	- 33	- 77	- 237	- 32	**- 511**
North East	3	-	-	-	- 4	- 2	- 0	- 10	- 15	- 17	- 5	**- 50**
North West	43	-	-	-	0	- 0	-	10	5	- 0	5	**63**
Yorkshire & Humber	- 3	-	-	-	- 0	-	-	- 0	- 5	- 8	- 1	**- 16**
Wales	- 11	- 1	- 0	- 0	-	- 0	- 0	- 0	- 0	0	0	**- 12**
West Midlands	- 15	1	- 0	-	0	-	-	0	- 0	- 0	- 0	**- 15**
East Midlands	- 15	- 0	-	-	- 0	-	-	0	- 0	- 0	- 0	**- 15**
South West	- 65	- 14	- 12	- 2	- 0	- 0	- 0	- 1	- 3	- 2	1	**- 99**
South East	- 116	- 8	- 18	- 0	- 0	- 0	- 0	1	-	-	-	**- 141**
London	- 63	3	- 15	5	- 1	0	- 0	- 0	-	-	-	**- 70**
Eastern	- 95	- 7	- 11	- 0	- 0	- 0	- 0	- 0	-	-	-	**- 113**
	- 336	**- 36**	**- 112**	**- 7**	**- 10**	**- 34**	**- 21**	**- 35**	**- 95**	**- 264**	**- 32**	**- 981**
Difference (%)												
Scotland	-2%	-5%	-14%	-3%	-1%	-3%	-3%	-2%	-2%	-3%	-1%	**-3%**
North East	2%	-	-	-	-3%	-6%	0%	-2%	-3%	-5%	-2%	**-2%**
North West	14%	-	-	-	19%	-1%	-	5%	2%	0%	6%	**5%**
Yorkshire & Humber	-1%	-	-	-	-2%	-	-	0%	-4%	-12%	-3%	**-3%**
Wales	-2%	-1%	-16%	-2%	-	-4%	-3%	-1%	-1%	0%	1%	**-2%**
West Midlands	-1%	2%	-1%	-	5%	-	-	0%	-16%	-17%	-2%	**-1%**
East Midlands	-2%	-3%	-	-	-2%	-	-	3%	-6%	-1%	-2%	**-2%**
South West	-4%	-2%	-6%	-2%	-3%	-2%	-6%	-2%	-4%	-4%	1%	**-4%**
South East	-3%	-2%	-7%	0%	-4%	-8%	-2%	2%	-	-	-	**-3%**
London	-1%	1%	-4%	11%	-4%	21%	-2%	0%	-	-	-	**-1%**
Eastern	-3%	-2%	-12%	-1%	-5%	-1%	-1%	0%	-	-	-	**-4%**
	-2%	**-2%**	**-8%**	**-1%**	**-2%**	**-3%**	**-3%**	**-1%**	**-2%**	**-3%**	**-1%**	**-2%**

The table above shows that the most significant reductions in demand are for trips to and from Scotland, in particular between Scotland and London and the South East. These changes are the largest in magnitude terms but only represent a reduction of around 3% - though this is larger than the overall decrease in trips of 2%; these are key flows that switch to HS2.