Baseline Forecasting Report

HS2 Ltd

July 2013

Plan Design Enable

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This document has 24 pages including the cover.

Table of contents

Introduction

In 2009, Atkins was appointed to develop a demand forecasting framework for High Speed Two (HS2) Ltd to model and appraise options for a high speed rail link between London and the West Midlands. Outputs from that study were published in March 2010, along with a suite of technical documents describing the modelling approach[1]. During 2010, the modelling framework was updated and the outputs were used to deliver the analysis behind the February 2011 consultation[2]. Documentation describing model development was published as the Model Development and Baseline Report in April 2011[3].

Since then, further analysis and model development work has been undertaken to help inform the Secretary of State's decision in January 2012 on whether to take HS2 forward. This was published as the Model Development and Baseline Report in April 2012[4]. This additional work was undertaken to improve the robustness of the modelling and appraisal, and update assumptions underlying the forecasts to reflect political and economic changes.

In March 2012 the Office of Budgetary Responsibility (OBR) released updated growth forecasts for the UK economy. Economic growth plays a major part in the demand forecasts and the business case for HS2. Therefore, the growth forecasts and business case need to be revised to take account of this update whilst at the same time including some further amendments to the modelling framework.

The work has been undertaken using the PLANET framework model (PFMv3) model which has been developed as part of the assessment of the Leeds and Manchester extensions to HS2. This has expanded and updated the model to:

- provide greater detail on local rail services in the Midlands and the North of England by the integration of PLANET Midlands (PM) and PLANET North (PN) into the PFMv3; and
- expand the associated station choice model (SCM) to allow more detailed examination of the options for stations in these areas.

Section 2 of the report describes the changes to the base year matrices; section 3 discusses the development of the revised rail forecasts. Sections 3 and 4 detail the revised highway and air forecasts, respectively. Finally, Section 5 describes the revisions to the appraisal framework used for the January 2012 economic case, made in parallel to the model development for use in the results published in the August 2012 updated economic case document.

All the data and analysis in the report relates to work undertaken prior to August 2012.

[1] http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/pgr/rail/pi/highspeedrail/hs2ltd/demandandappraisal/

[2] http://webarchive.nationalarchives.gov.uk/20110720163056/http://highspeedrail.dft.gov.uk/library/documents/economic-case

[3] http://assets.hs2.org.uk/sites/default/files/inserts/hs2%20model%20development%20and%20baseline%20report%20-%20a%20report%20for%20hs2%20ltd%20by%20mva.pdf.

[4] http://assets.hs2.org.uk/sites/default/files/inserts/Model%20Development%20and%20Baseline%20Report_Jan2012.pdf.

1. Base Year Model

A number of refinements have been made to the base year model. These include revised rail, air and highway matrices, and changes to the Air Demand Model. These are described in the section below.

The naming convention for each of the models used in the report is:

- February 2011 model – Based on PFMv1 using a 2007/08 base year and forecasts generated using June 2010 OBR GDP assumptions. This model was used to inform the 2011 public consultation, with the results published in February 2011;
- January 2012 model – Based on PFMv1 using a 2010/11 base year and forecasts generated using July 2011 OBR GDP assumptions. This was used to inform the Government's response to the consultation with the results published in January 2012; and
- Current model – Based on PFMv3 using a 2010/11 base year and forecasts generated using March 2012 OBR GDP assumptions.

1.1. Base Year Matrices – Rail

The base year rail matrices from the January 2012 model have been revised in three areas. These changes are:

- the addition of trips from York, Wrexham, Worcestershire and the Wirral that were omitted during the development of the January 2012 matrices. As the PLD rail matrices were made symmetrical later in the matrix building process, this resulted in the final matrices having trips missing both to and from these zones;
- a small revision to the approach for dealing with the issue of new East London Line (ELL) stations being allocated to previously used National Location Codes (NLC) in the LENNON database. It had been noticed after the initial January 2012 matrices had been developed that historic NLC codes had been reused for the new ELL stations, whereas the matrix building process was still assuming the previous locations. Time constraints meant the matrices could be amended only by factoring the matrices (instead of rebuilding the matrices using the correct NLC code locations). The current revision now applies the change during the matrix building process; and
- Adjustment to the Non Car Available Leisure matrices to provide consistent purpose split with the 2007/08 matrices used in the original consultation model. The adjustment to reflect 2007/08 purpose splits had not been applied correctly to the January 2012 PLD matrices, so this was amended in the revised matrices.

These changes only needed to be incorporated into the PLD rail matrices, as these issues were not present in the other rail matrices within the regional models of PFMv3.

Table 1.1 shows the difference in the PLD matrices in the January 2012 and May 2012 matrices aggregated to Government Office Regions.

Table 1.1 - Change in PLD 2010 Base Year Rail Matrices Totals

Sector	Jan 2012 PLD Matrix	Current 2012 PLD Matrix	Difference
East Midlands	65,124	65,391	0.4%
East of England	6,168	6,234	1.1%
London	57,263	58,114	1.5%
North East	29,678	30,106	1.4%
North West	250,278	256,191	2.4%
Scotland	268,100	267,156	-0.4%
South East	10,421	10,520	0.9%
South West	12,630	12,688	0.5%

Sector	Jan 2012 PLD Matrix	Current 2012 PLD Matrix	Difference
Wales	77,088	78,924	2.4%
West Midlands	87,053	89,163	2.4%
Yorks & Humber	149,098	154,833	3.8%
Total	**1,012,899**	**1,029,319**	**1.6%**

The changes made to the rail matrices result in an overall increase in demand of 1.6%, with the Yorkshire and Humberside sector growing the most as a result of the changes made to the York demand. Table 1.2 shows the changes to key movements (at Government Office Region level) as a result of the updates to the base year matrices.

Table 1.2 - Changes in Key Movements (Base Rail Matrices)

	East Midlands	East of England	London	North East	North West	Scotland	South East	South West	Wales	West Midlands	Yorks & Humber	
East Midlands	0.1%											0.4%
East of England	-0.3%	-										1.1%
London	1.1%	-	-									1.5%
North East	0.4%	0.3%	0.3%	0.3%								1.4%
North West	-0.3%	-0.6%	-0.4%	0.6%	2.5%							2.4%
Scotland	0.6%	0.4%	0.4%	0.2%	0.4%	-0.4%						-0.4%
South East	0.1%	-	-	0.4%	0.4%	0.6%	-					0.9%
South West	0.4%	-0.1%	0.6%	0.4%	0.6%	-0.9%	-0.5%	-0.1%				0.5%
Wales	3.0%	1.6%	2.0%	3.4%	21.2%	6.8%	1.8%	0.3%	1.7%			2.4%
West Midlands	0.3%	-0.4%	1.3%	0.4%	-0.1%	0.6%	0.3%	0.3%	8.6%	3.4%		2.4%
Yorks & Humber	1.3%	7.2%	6.1%	10.1%	2.1%	13.1%	6.3%	5.6%	7.7%	4.3%	3.6%	3.8%
Total	0.4%	1.1%	1.5%	1.4%	2.4%	-0.4%	0.9%	0.5%	2.4%	2.4%	3.8%	1.6%

The largest percentage increase (21.2% or 949 trips) in sector to sector trips is the movement between Wales and the North West, reflecting the impact of the changes to the matrices for demand to/from Wrexham and the Wirral. Similarly, percentage changes of greater than 10% can be seen for movements between Yorkshire and Humberside and the North East (10.1% or 687 trips) and Scotland (13.1% or 307 trips), which are due to the changes in the matrices to demand to/from York.

A small number of movements see a reduction in demand which is due to the adjustment made to the Non Car Available Leisure matrices.

1.2. Base Year Matrices – Air

The base year air matrices in the January 2012 model had been taken from the DfT's National Air Passenger Allocation Model (NAPALM) Aviation model, which had been developed from CAA survey data. These had been converted from the NAPALM zoning system to the PLD zoning system and then from annual values to the 16-hour PLD model base, using a factor of 365.

Further detailed examination of the matrices had shown that there were a number of counter-intuitive movements within the air matrices, particularly for leisure trips. In the ten largest leisure air flows from the NAPALM matrices, converted to PLD zone format, there were flows from Fife-Gwynedd, Fife-Preston, Fylde, Wyre, Denbigh, Flint-Fife, Gwynedd-Highland, and Birmingham-Peterborough (with the latter flow not served by any air service).

Revised NAPALM matrices were provided which showed a more realistic distribution of trips, with the majority of flows being Anglo-Scottish movements. As well as the provision of revised NAPALM matrices, further advice was provided regarding the factor to convert the demand from annual values to the 16-hour weekday demand in the PLD model. It was recommended that a factor of 313 be adopted, which replaced the previous value of 365. This change had the impact of increasing the number of trips in the PLD air matrices by 16.6%.

The changes in the total air matrix total are shown in Table 1.3 below. The overall change between the January 2012 version of the 2010 air matrix and the revised May 2012 version is an increase of just under 30%.

Table 1.3 - 2008, 2010 and 2011 Daily Air Demand

	2008 Consultation	Jan 2012 PLD Matrix	Current PLD Matrix	Change Jan 2012 - Current
Business	19,893	13,143	15,788	20.1%
Leisure	15,657	10,589	15,051	42.1%
Total	35,551	23,732	30,839	29.9%

1.3. Base Year Matrices – Highway

A modification was made to the highway matrices to accommodate Heathrow/Hillingdon demand. Highway trips to and from Hillingdon that previously used zone 90, the dedicated Heathrow zone, were moved to zone 123 (London West) to better represent the trip patterns. This ensured that all highway trips to and from zone 90 were taken from the Airport Demand Model and thus were not represented in the Heathrow zone in the PLD matrices.

Table 1.4 shows the number of trips previously using the Heathrow zone in the January 2012 matrices reallocated to zone 123 in the May 2012 base year highway matrices.

Table 1.4 - Hillingdon/Heathrow Demand Alterations

	2010 Matrices			
	Commuting	**Business**	**Leisure**	**Total**
Total	1,308,550	1,317,323	2,065,888	4,691,760
January 2012				
To London (exc LHR)	6,529	9,559	13,020	29,107
From London (exc LHR)	4,572	10,900	12,233	27,705
To Heathrow	658	1,215	2,711	4,584
From Heathrow	670	1,365	2,523	4,559
Current 2012				
To London (exc LHR)	7,187	10,774	15,730	33,691
From London (exc LHR)	5,242	12,265	14,756	32,264

1.4. Air Demand Model

The airport demand model in the results published in January 2012 had been updated to include revised mode share proportions for trips accessing Heathrow airport. These had been taken from 2009/10 CAA data which does not explicitly include ‘Air’ as it only contains surface access modes. There are some air related modes such as ‘Air Transfer’; however, these do not account for the level of air model share used in the previous model.

In the version of the air demand model used in the 2011 public consultation, a significant proportion use air as the main access mode to Heathrow. Although the source of this data was not known, it was decided to return the base year mode shares to the previous values to restore the original air proportion.

2. Rail Demand Forecasts and Fares

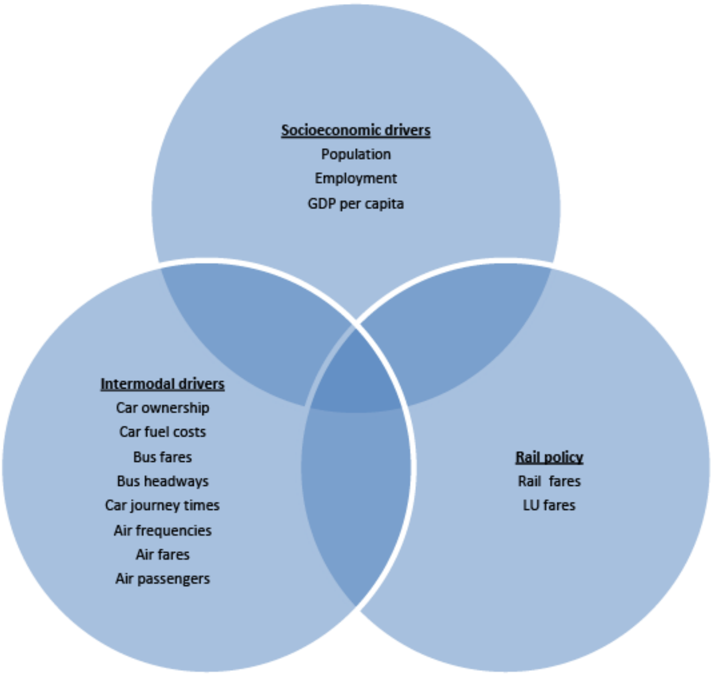
The forecast rail demand matrices were updated to include the revised growth forecasts for the UK economy, which were published on 21st March 2012 by the Office for Budget Responsibility (OBR). These forecasts replaced those in the January 2012 matrices, which had been based on OBR forecasts from July 2011, and have been used to derive the May 2012 forecast matrices. The November 2011 OBR forecasts were not used in HS2 modelling.

In addition to the revised GDP values, the DfT also provided updated data for other rail demand drivers for incorporation into their EDGE model. The changes to each of the rail demand drivers are discussed below.

2.1. Review of Rail Demand Drivers

The demand for rail is driven by a number of socio-economic and demographic factors, listed in Figure 2.1. Elasticities relating the change in these drivers to rail demand are derived from the Passenger Demand Forecasting Handbook 4.1 (PDFH) and are in accordance with the then DfT WebTAG guidance (TAG Unit 3.15.4).

Figure 2.1: Rail Demand Drivers Considered in the Forecasting



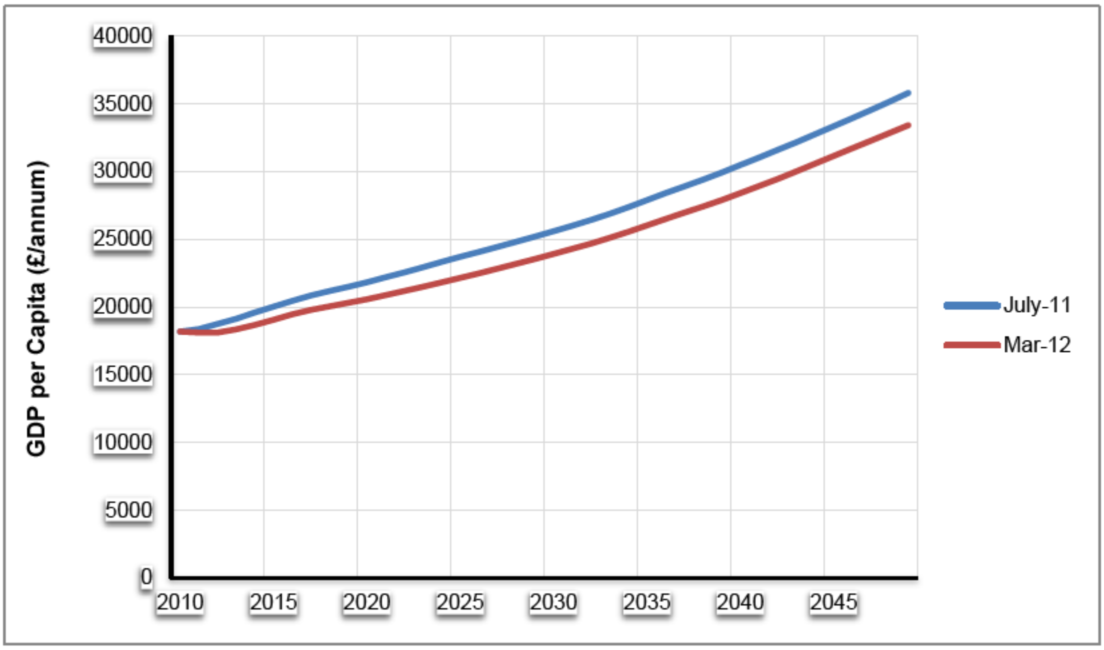
2.1.1. Socio-economic Drivers

2.1.1.1. GDP per Capita

GDP per capita is the most significant driver affecting rail demand on long distance services. The March 2012 budget forecasts a slower recovery from the UK's economic stagnation, with growth not expected until 2015. Figure 2.2 presents a comparison of the overall UK forecast compared with the July 2011 OBR forecasts (January 2012 matrices) used in the previous HS2 business case.

The GDP forecasts used in EDGE are consistent with the OBR March 2012 forecasts. However, the forecasts of real growth in GDP are inconsistent with the published values. This is because the published values are based on the ONS's recently revised approach to calculating real growth, which uses the geometric mean rather than the arithmetic mean, resulting in annual changes that are more closely aligned with CPI than the RPI previously used. The elasticities in EDGE were derived on the basis of the old approach to calculating GDP growth (RPI-related). Therefore, for consistency with the elasticities, the TASM department of DfT calculated a series of real GDP growth forecasts consistent with the March 2012 budget forecasts, but using the old (RPI-related) approach to calculating real growth. These figures formed the input to EDGE.

Figure 2.2: UK GDP per capita



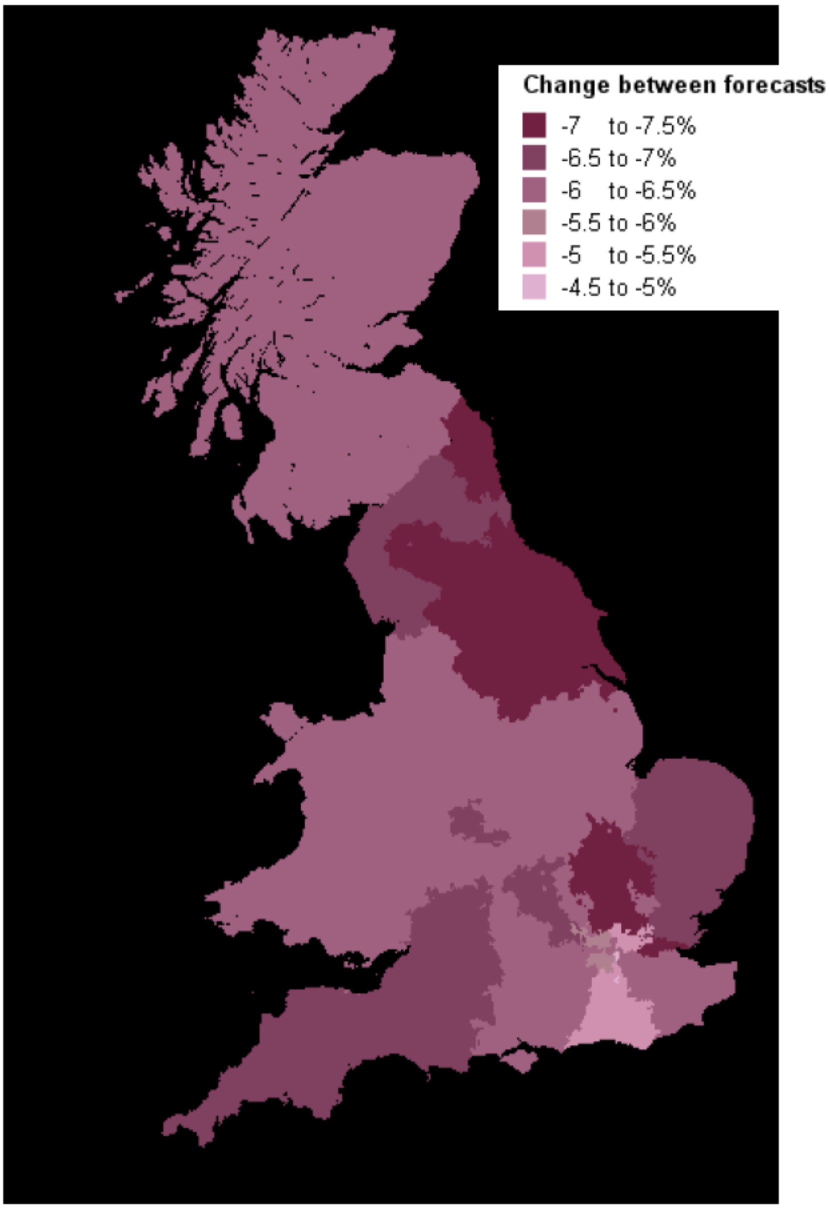
Overall growth to 2037 is 6.5% lower in the March 2012 budget prediction than the July 2011 OBR forecasts. This would reduce rail demand growth significantly, particularly for long distance journeys to and from London. The change in GDP per capita forecast is driven by virtually zero economic growth in the current financial year, and slower growth in subsequent years as shown in Table 2.1.

Table 2.1 - Annual UK GDP per Capita Growth

	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020
July-11	1.01%	2.05%	2.04%	2.46%	2.17%	2.14%	1.96%	1.51%	1.51%
Mar-12	-0.47%	0.00%	1.29%	1.79%	2.11%	2.03%	1.75%	1.29%	1.30%
Cumulative effect	1.48%	3.53%	4.28%	4.94%	4.99%	5.11%	5.31%	5.54%	5.75%

The range of difference in the change in GDP per capita forecast for 2036 between the forecasts is 4.9% (South Central) to 7.5% (Northumberland). However, nationally the variation is fairly homogenous between regions, as can be seen in Figure 2.3.

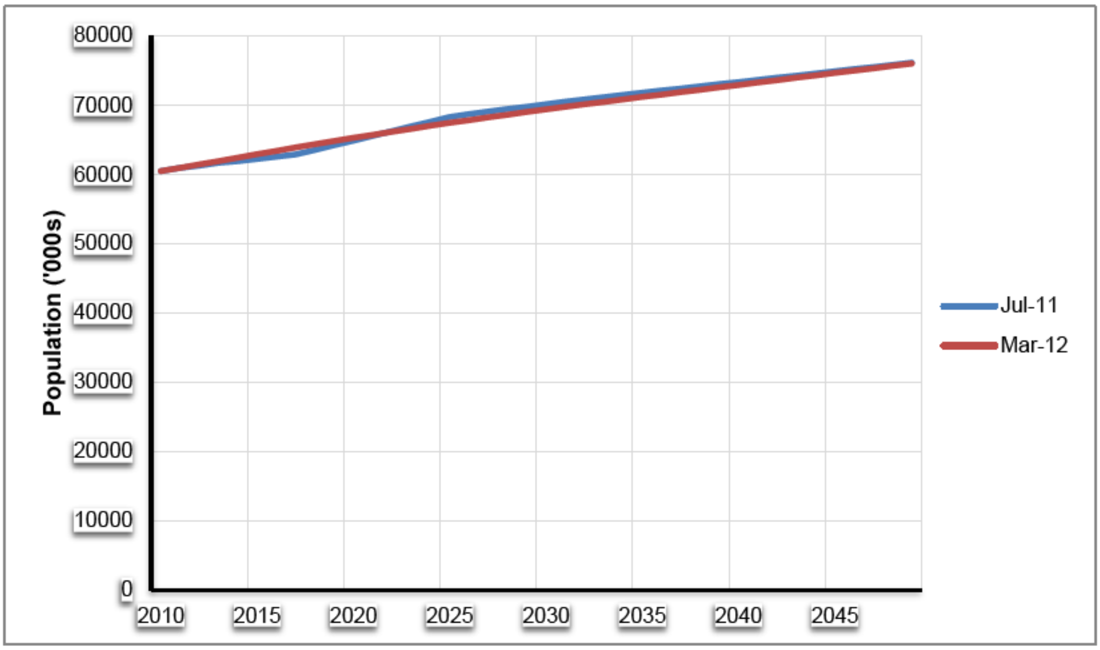
Figure 2.3: Variation in GDP per capita forecast for 2037



2.1.1.2. Population

The March 2012 OBR population forecasts for the UK are very similar to those used in the January 2012 forecasts (July 2011 OBR forecasts), as shown in Figure 2.4. However, there are some slight changes in some cities that may be served by HS2.

Figure 2.4: UK Population Growth



The population of Birmingham is shown to rise faster than previously forecast (Figure 2.5), whereas the population of Leeds grows more slowly (Figure 2.6). The latest population figures for Leeds show a flatter growth curve, without the previous rise around 2023.

Figure 2.5: Birmingham Population Growth

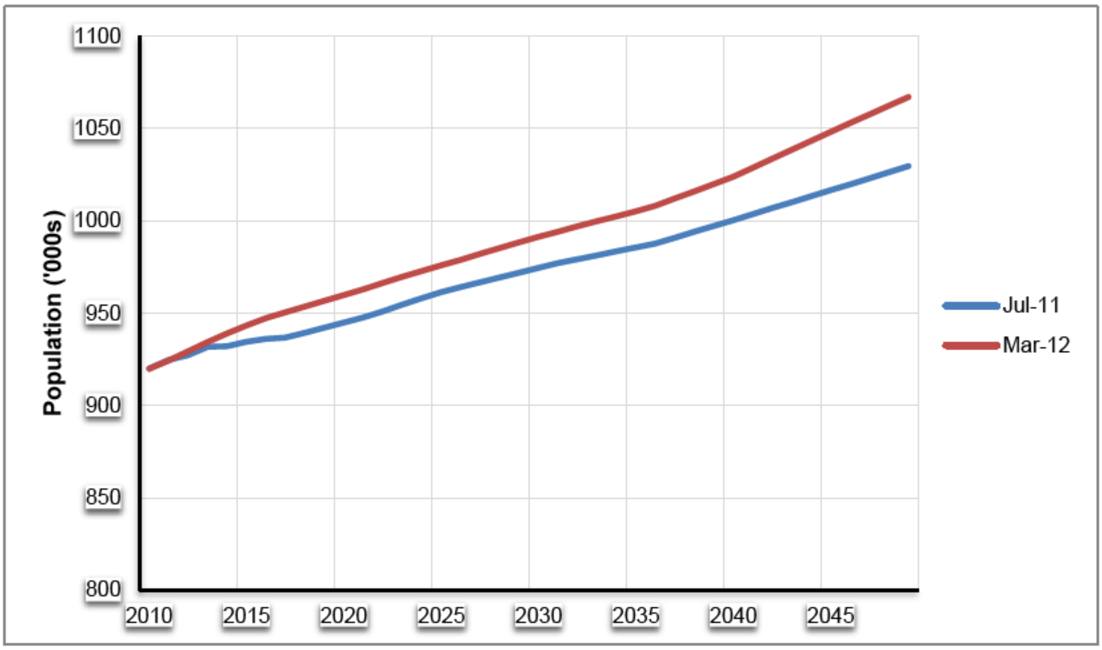
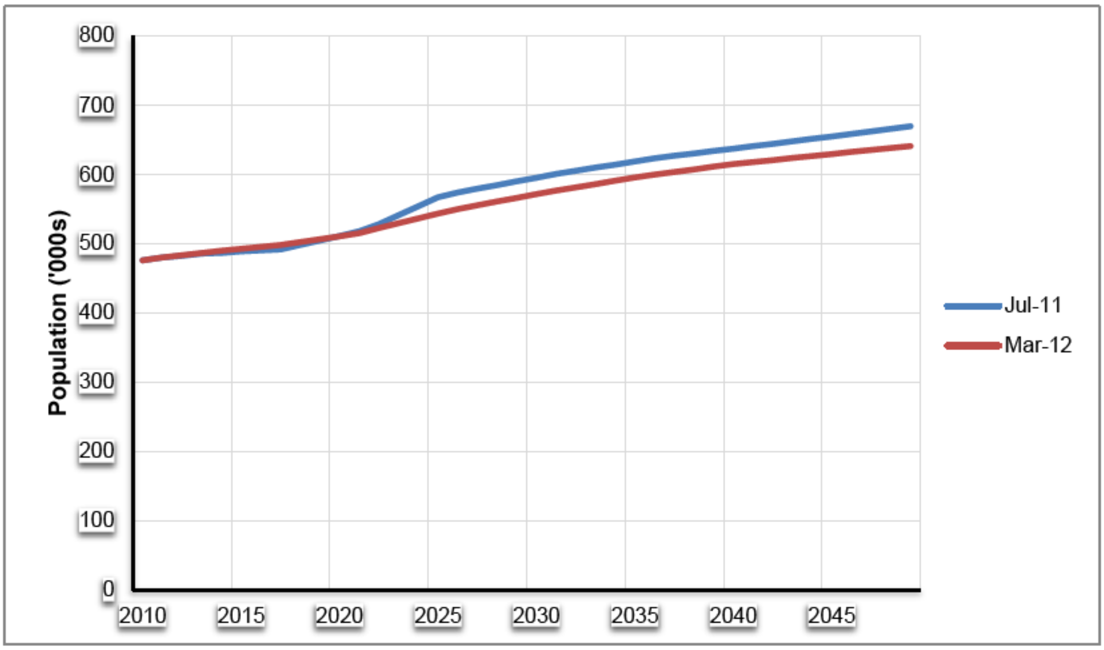
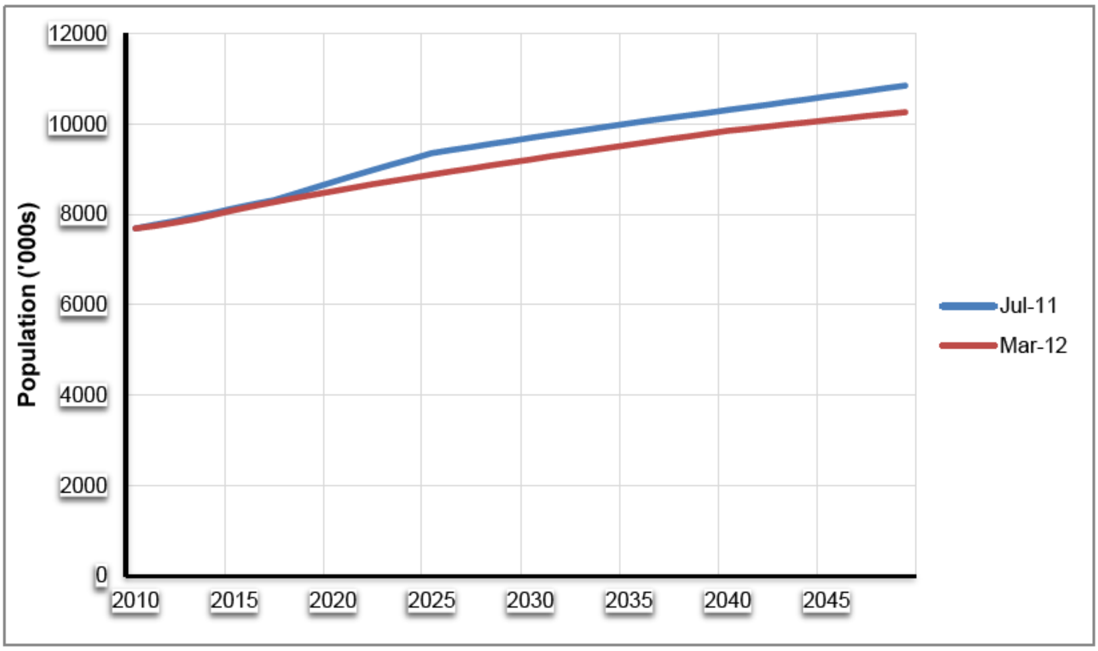


Figure 2.6: Leeds Population Growth



A similar change in the rate of population growth is shown for London in Figure 2.7.

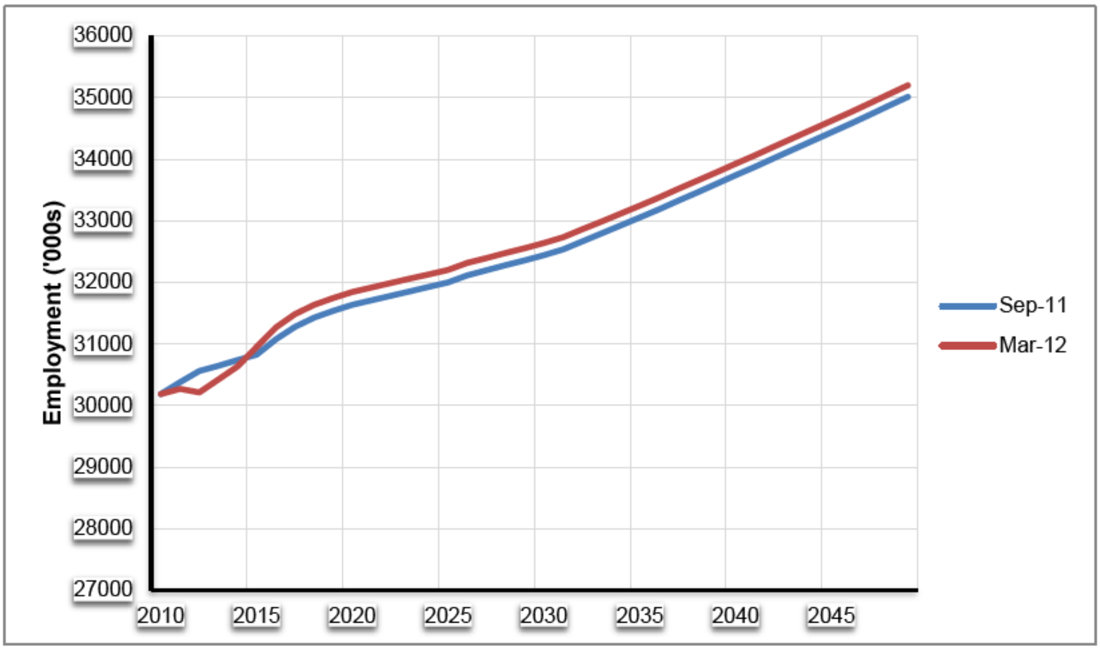
Figure 2.7: London Population Growth



2.1.1.3. Employment

The employment demand driver affects only those commuting flows which, while generally outside the scope of direct HS2 services, will be important in areas where enhanced services are introduced using the capacity released by the introduction of HS2. GDP per capita tends to mirror employment levels; Figure 2.8 shows a similar lag to growth as seen in Figure 2.2.

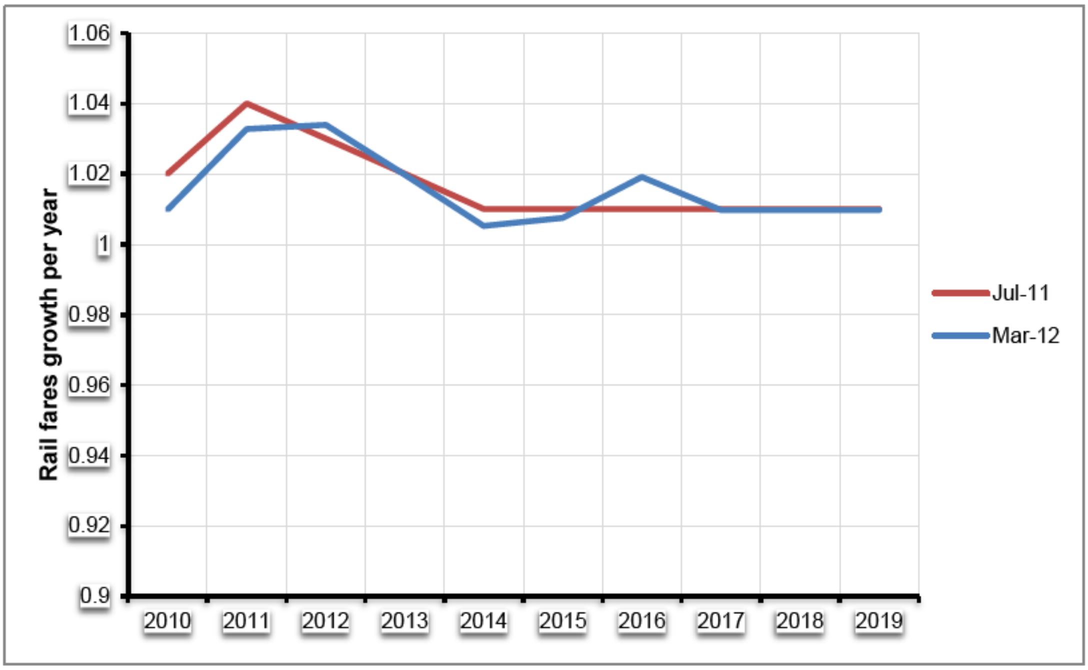
Figure 2.8: UK Employment Growth



2.1.2. Rail Fares

Since the January 2012 matrices were developed, the Government has announced a change in fares policy, which has resulted in regulated fares increasing by RPI+1% in 2012 as opposed to the previous policy of RPI+3%. Figure 2.9 presents the change in fares change per year above RPI.

Figure 2.9: Rail Fares Growth Above RPI per annum



The March 2012 forecasts supplied by the DfT also contain a small increase in fares above the trend in 2017, because before 2017/2018 the assumptions include RPI forecasts from the OBR and Oxford Economics Forecasts – these fluctuate and thus have an impact on the real fare, as the nominal fare increases in January are based on the previous September's RPI increase.

2.1.3. Intermodal Competition Drivers

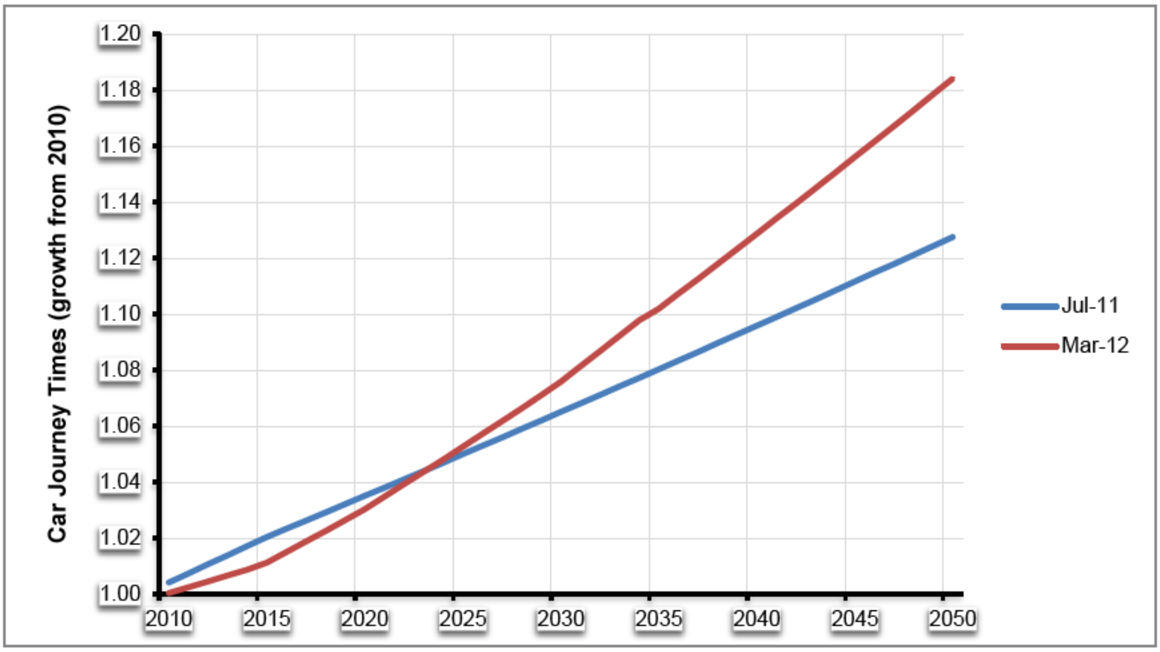
2.1.3.1. Car Ownership

On a national average, car ownership forecasts for March 2012 are similar to those for July 2011. However, the distribution of growth varies across the country, with the rate of car ownership growth in London generally forecast to be lower than previously; although, this is balanced by a higher forecast for rural areas. East London shows the highest variation, with the latest forecasts suggesting that fewer East London households will be buying cars than previously expected (7% less by 2037).

2.1.3.2. Car Journey Times

Congestion on the road network reduces the attractiveness of car journeys, increasing demand for rail. The change in car journey times from 2010 for long-distance trips from London is shown in Figure 2.10. Although road congestion is forecast to be slightly lower initially (due to slower economic growth), the long term trend is for faster growth. In the absence of data after 2035, the March 2012 forecasts have been extrapolated from 2035 to 2050 using the average annual growth rate between 2030 and 2035.

Figure 2.10: Change in Car Journey Times for London to Rest of Country Trips from 2010

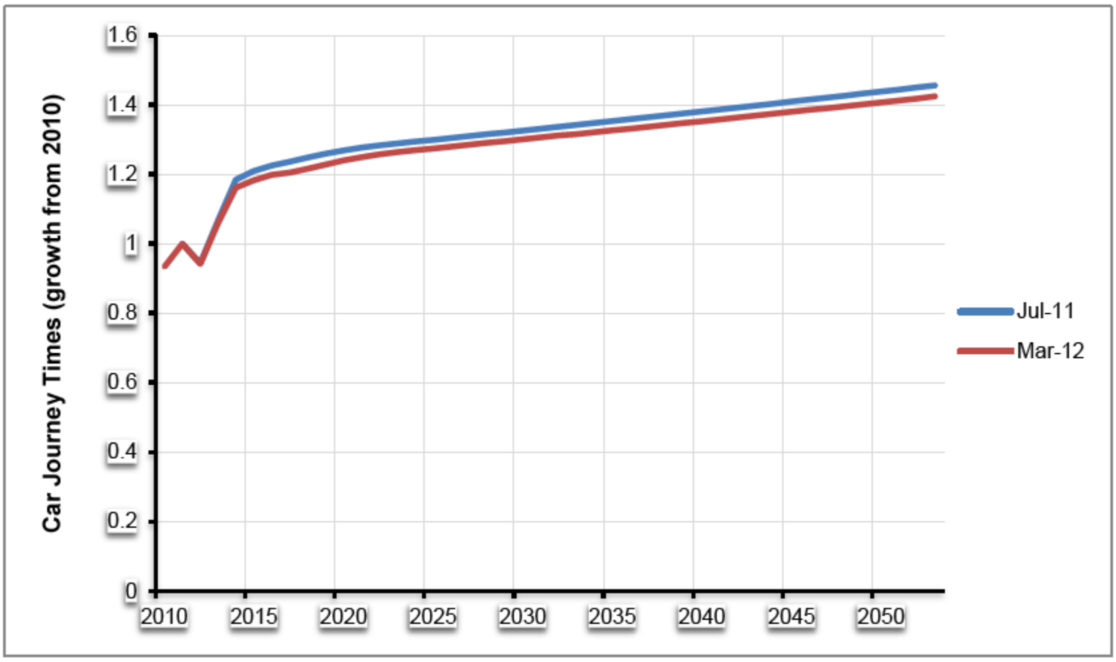


Rail demand has a small elasticity to car journey times and within the forecast periods the difference between the forecasts is small, so the impact of these changes would be expected to be modest.

2.1.3.3. Fuel Cost

The cost of fuel can be another deterrent for road use, and can have some impact on rail demand. Figure 2.11 shows that fuel prices are forecast to increase at an almost identical rate to the previous forecast.

Figure 2.11: Change in Fuel Price from 2010



2.1.3.4. Bus Journey Times

The January 2012 matrices were developed on the assumption of no change in bus journey times over the appraisal period, except in London and urban areas. The March 2012 dataset provided by the DfT included revised bus journey times, which showed a 15.7% increase in journey times by 2035 (with no further growth for subsequent years) for long-distance flows. It was subsequently agreed that bus journey times should revert to the previous values, due to concerns over the accuracy of the new forecasts.

2.1.3.5. Bus Fares

As shown above for bus journey times, the January 2012 matrices also assumed no change in bus fares, except in London and urban areas. The March 2012 dataset provided by the DfT included revised bus fares which showed an increase of 81.4% in bus fares by 2035 for long-distance flows. It was subsequently agreed that bus fares should revert to the previous values, due to concerns over the accuracy of the new forecasts.

2.1.3.6. Air Passengers

No additional forecasts were received for air drivers, so the previous forecasts from July 2011 were retained.

2.1.3.7. Air Fares

No additional forecasts were received for air drivers, so the previous forecasts from July 2011 were retained.

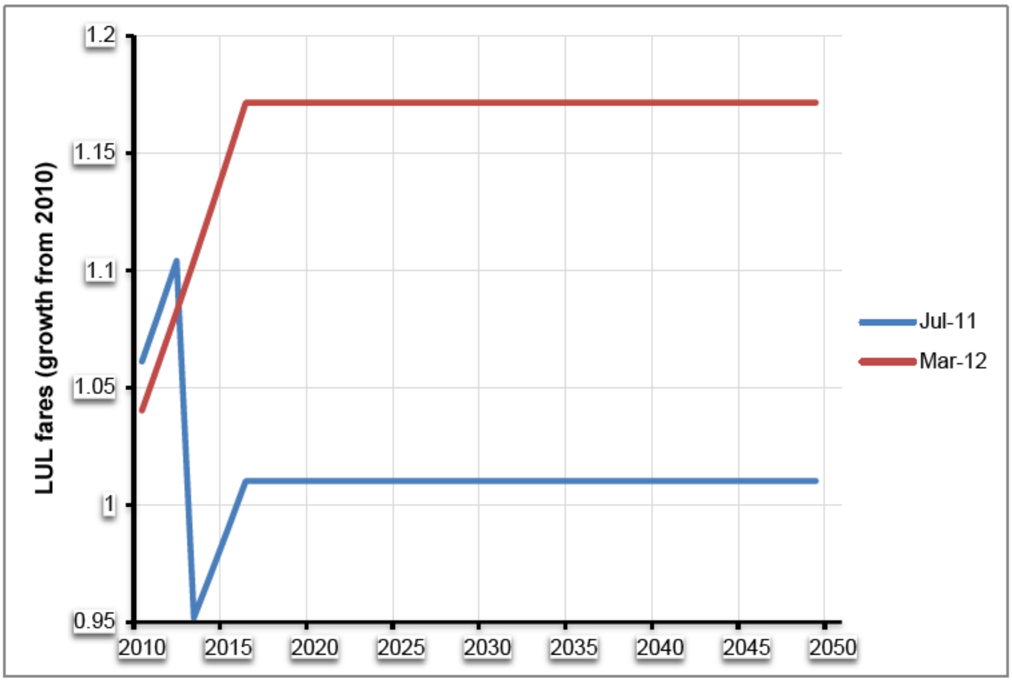
2.1.3.8. Air Frequencies

No additional forecasts were received for air drivers, so the previous forecasts from July 2011 were retained.

2.1.3.9. London Underground Fares

The March 2012 London Underground fares forecast were significantly different from the July 2011 forecast, although these will have little impact on HS2 demand. A comparison can be seen in Figure 2.12.

Figure 2.12: LUL Fares Growth from 2010



2.2. Summary of Drivers

Table 2.2 shows each of the demand drivers released in March 2012, compared with the previous drivers used to develop the January 2012 forecasts, which were based on the OBR forecasts from July 2011, and the expected impact on HS2 demand.

Table 2.2 - Summary of Demand Driver and Expected Impacts

Demand driver	Comparison with July 2011	Expected impact on HS2 demand
GDP per capita	Average 6% lower growth forecast by 2036	▼High GDP per capita elasticity will amplify the reduced growth, especially on the long-distance trips using HS2; may result in around10% dampening of demand
Population	National population forecast remains as before, but with some local variations	■Birmingham demand higher but other destinations lower
Employment	Employment reduced in a similar fashion to income due to delay in economic recovery	▼Impact focused on commuting demand (local models)
Rail fares	Rail fares in 2012 1% lower than previously forecast due to change in government policy	▲ 1% lower fares will increase rail demand by between 0.6% and 0.9%
Car ownership	Lower than previously forecast in the main conurbations served by HS2	▲Lower car availability at HS2 destinations will increase rail demand
Car journey times	Long term congestion is forecast to be higher than previously thought, but in the short term lower due to slower economic growth	■ In 2036 levels are similar between forecasts, so the effect on HS2 demand will be small
Fuel cost	Very little change in forecast	■
Bus journey times	*Forecasts introduced on long distance services*	▲ *DfT advised not to incorporate revised driver in EDGE so not included in current forecasts*

Demand driver	Comparison with July 2011	Expected impact on HS2 demand
Bus fares	*Bus fares increase now included for long-distance services*	▲ *DfT advised not to incorporate revised driver in EDGE so not included in current forecasts*
Air passenger	*No change*	■
Air fares	*No change*	■
Air frequencies	*No change*	■
London Underground fares	LU fares forecast to be higher than previously thought	■ No impact on long distance rail demand. Rail demand may increase in PLANET South.

Note: July 2011 values were used for those demand drivers shown in italics.

The changes in the demand drivers would be expected to have a negative effect on forecast rail demand as GDP per capita elasticity is high and there is slower economic growth forecast. The change to the fares policy and car ownership levels (reduced possibly due to lower incomes) would be expected to balance this to some degree.

2.3. Rail Demand Forecasts

2.3.1. Derivation of the Cap Year

The second forecast year is referred to as the cap year. This represents the year at which long-distance rail demand is deemed to reach a saturation point, beyond which no further demand growth occurs. The concept of a cap year is an artificial construct and there is no standard methodology for its calculation.

The methodology followed to derive the cap year was to match long-distance rail trips over 100 miles (within PLD) to the level predicted in the February 2011 consultation model. This approach was adopted for the January 2012 model and so was retained in the current model forecasts.

The January 2012 demand cap was calculated incorrectly due to a corrupt data file being extracted from the model. The corrupted file under-represented the level of demand in the model. Demand was allowed to grow for longer than it should have been and was therefore too high. Rather than capping demand in 2037, the cap should therefore have been 2035 (or 2034, if the other base year matrix changes described in section 1.1 are included).

PLD matrices were produced from EDGE model runs for the forecast years of 2026, 2031, 2036 and 2041 and the number of trips over 100 miles was calculated based on skimmed rail travel distances. From these totals, intermediate years were interpolated assuming a linear compound growth rate between EDGE forecast years.

Table 2.3 shows the matrix totals. Interpolation indicated that the target figure of 290,146 trips lay between 2037 and 2038, though being around 1,600 trips nearer 2037 than 2038. Thus, matrices were produced for 2037 and this was confirmed as the new cap year.

Table 2.3 - Derivation of Cap Year for Current Forecasts

Year	Total Demand	>100 Miles	% of Total
EDGE Forecast Years:			
2026	1,229,023	218,147	18%
2031	1,315,657	244,837	19%
2036	1,424,600	279,316	20%
2041	1,549,194	320,058	21%
Target (2043)	**1,562,615**	**290,146**	**19%**
Final Demand 2037	**1,449,519**	**287,464**	**20%**

2.3.2. Growth in PLANET matrices (2010 to 2026 and 2037)

Table 2.4 shows the growth in trips in the PLD rail matrices for key rail zone to zone movements. These show total trips with both directions added together. Note that the zone boundaries do not necessarily correspond with Local Authority boundaries.

Table 2.4 - PLANET Long Distance: Growth in Total Weekday Trips (without HS2)

Key HS2 zone to zone movements	2010 Demand	2026 Demand	% Growth 2010 – 2026	2037 Demand	% Growth 2010 - 2037
Birmingham - Central London	7,500	10,700	42%	14,600	95%
Manchester - Central London	7,400	10,800	46%	15,000	102%
Leeds - Central London	4,300	6,300	44%	8,900	105%
Glasgow - Central London	1,300	1,900	46%	2,600	103%
Liverpool - Central London	2,900	4,100	40%	5,500	88%
Newcastle - Central London	2,300	3,400	46%	4,900	110%
Edinburgh - Central London	2,200	3,400	50%	4,800	116%

2.3.3. Future Rail Fares

From 2010, rail fares (average yield) are assumed to increase up to the cap year. The assumption from the January 2012 model – that the level of regulation was a reasonable proxy for the likely future change in rail fares – was retained.

Accordingly, future rail fares were assumed to increase by RPI+1% in 2011 and 2012, then two years of RPI+3%, followed by RPI+1% thereafter up to the cap year. After the cap year, no change is assumed in rail fares. This is consistent with the assumption that after the cap year, no change is made to any element within the demand modelling. (The only change is the growth in value of time for appraisal purposes.)

This assumption differed from that in the January 2012 model, which assumed that fares in 2012 increased by RPI+3% instead of RPI+1%. All other rail fare assumptions were consistent between models.

3. Highway Forecasts

3.1. Future Year Highway Matrices

Highway demand is included in the PLD model in two ways:

- Long-distance (>30km) road passenger demand (predominantly car) is provided in matrix format in a similar manner to rail and air (any demand within a single zone is excluded); and
- In addition, a pre-load representing traffic that travels less than 50 miles (<80km) is added to the highway network, to enable congestion on the road network to be modelled.

The long-distance matrices were grown from the 2010 base year to 2037 forecast year using the latest TEMPRO 6.2 dataset. Forecast numbers of highway person trips (car driver plus car passenger) to and from each TEMPRO zone in the base year and future years were extracted from the TEMPRO dataset by origin and destination. The pre-existing look-up table matching PLD zones to TEMPRO zones was used to transfer these to the required zoning system. The growth in the number of trips by PLD zone was then calculated for 'Business', 'Commuting' and 'Other' purposes using the same process as for the February 2011 Consultation, but based on the updated TEMPRO data.

The pre-loaded short-distance demand was grown from the 2010 pre-loads using the same NTM traffic level forecast data used for the January 2011 work (NTM 2009, revised May 2010) National Road Traffic Forecasts (NRTF)[5] from the DfT:

- Average Annual Daily Flow (AADF) traffic levels for a 2003 base year and forecast years 2015, 2025, 2035 derived from NTM model forecasts using TEMPRO v5.4 trip ends; and
- traffic levels by region and road type derived from the NTM Fitting On of Road Growth (FORGE) v2.0 constraint mechanism.

The flows for 2037 were derived using linear extrapolation from the expected growth between 2025 and 2035 flows. Whilst this will not include the downturn in base demand (as the base year 2010 NRTF growth factors from 2003 were derived by linear interpolation assuming uniform growth over the years 2003-2015), the growth rates from 2010-2035 were taken directly as derived from these NTM figures. As before, the link pre-loads were uplifted based on regional growth factors from the constrained National Transport Model (NTM).

Table 3.1 shows the matrix totals for the highway demand matrix totals for 2026 and 2037. The 2026 matrices change due to the base year highway matrix having been updated to include changes for the Heathrow/Hillingdon zones, as detailed above. The difference between the 2037 matrices can also be explained by the changes to the Heathrow/Hillingdon zones. In addition, the 2037 January 2012 matrices only included demand growth up to 2036, with no growth being included for 2036 to 2037.

Table 3.1 - Change in Forecast Highway Totals

Journey Purpose	2026 January 2012 Demand	2026 Current Demand	2037 January 2012 Demand	2037 Current Demand
Business	1,457,839	1,459,263	1,527,503	1,538,539
Leisure	2,326,493	2,329,489	2,445,551	2,462,068
Commuting	1,418,605	1,419,337	1,470,782	1,478,768
Total	5,202,937	5,208,089	5,443,836	5,479,375

[5] www.dft.gov.uk/publications/road-transport-forecast-dft-ntm-results-2009

4. Air Forecasts

4.1. Air Demand Matrices

Growth factors for domestic air demand were developed for the DfT's UK Aviation Forecasts (August 2011) and supplied by URS Scott Wilson. Domestic growth factors were provided for each year between 2010 and 2045 and were stored in the NAPALM 455 zone system.

The base matrices for 2010 (revised from the 2008 matrices using CAA data to account for the impact of the recession on air demand), previously used to forecast future demand, were updated in February 2012 to remove some short-distance and spurious trips, and were also uplifted to reflect observed changes in demand between 2008 and 2010. The updated 2010 matrices contained daily demand, segregated by business and leisure travel. These demand matrices were consistent with the 235 zone PLD zoning system.

In order to uplift the demand matrices to reflect growth in air demand in future years, the DfT growth factors were converted from NAPALM format to the 235 zone structure used in PLD. This was achieved by first creating a set of growth factors (weighted by the associated business and leisure demand of the corresponding NAPALM zones) for the 406 DfT Long Distance Model (LDM) zones, and then using a further correspondence list to convert these growth factors from LDM to PLD format.

The matrices were created for future years of 2026 and 2037, the latter reflecting the year in which the demand cap was assumed to be reached. An average of the growth factors of the origin and destination PLD zones was used for each year, to ensure that the matrix remained symmetrical in demand between origins and destinations. Base demand was multiplied by the average growth factor of the two zones to provide domestic air demand for the future year matrices.

The growth in the air demand matrices is summarised in Table 4.1 below.

Table 4.1 - Growth in Air Demand

Purpose	2010 Demand	2026 Demand	2037 Demand	2010-2026 %	2010-2037 %
Business	15,788	25,461	33,420	61.3%	111.7%
Leisure	15,051	24,291	31,954	61.4%	112.3%
Total	30,839	49,752	65,374	61.3%	112.0%

4.2. Air Fares

Forecast air fares in the PLD model had been previously set to reflect a 2036 cap year. These were adjusted using a factor of 1.001 to move to the 2037 cap year. The growth in air fares was provided by the DfT.

5. Appraisal Updates

5.1. Background

The HS2 appraisal was revised in May 2012 to incorporate two updates to the appraisal parameters. These were:

- revised GDP (and therefore value of time) growth forecasts to reflect the March 2012 OBR forecasts; and
- the introduction of revised methodology to calculate and forecast real GDP growth.

5.2. Revised GDP Assumptions

The impact of the change in forecast GDP growth rates (reflecting the March 2012 OBR forecast) on the appraisal is through revised growth in the value of time.

The changed growth forecasts result in values of time that are 5% lower than in the previous appraisal at the beginning of the appraisal period (2026), steadily increasing to be equivalent to previous values in 2060 and then continuing to grow, ending up at values 1% greater than the previous values by 2075 at the end of the appraisal period.

5.3. Revised Approach to Calculating and Forecasting GDP

The Office for National Statistics (ONS) has revised the methodology used for calculating real GDP growth. This has resulted in adjustments to the estimated growth over recent years and a revision to the method for forecasting future growth, linking it to changes in the Consumer Prices Index (CPI), rather than the Retail Prices Index (RPI), as the index of inflation.

The effect on HS2 appraisal results is to:

- alter the GDP deflator, which is used as the uplift factor to convert between price bases in the HS2 spreadsheet; and
- change the forecast growth in values of time.

The change in deflator reduces the price base uplift from 2002 to 2011 prices by about 1.5%, affecting all user benefits and revenue.

This change in deflator also reduces the scale of indirect taxes lost by government as a result of the increased expenditure on rail fares (which do not incur indirect taxation) by a similar proportion. The value of this loss is calculated by identifying the proportion of the total spend on fares that would have been spent on indirect tax if the same amount of money had been spent in the general economy (with its average indirect taxation rate), rather than on fares. As the revenue total has fallen, the value of this tax loss has also reduced.

In contrast, the revised approach has increased the forecast rate of GDP growth and therefore value of time growth, meaning that, over time, the values attributed to time savings in the new approach grow larger than the values estimated in the previous approach. Values are 4% greater for business time in 2026 (3% for non-business) with the differential rising to 15% and 12% greater, respectively, by 2075.

Atkins
Euston Tower
286 Euston Road
London
NW1 3AT