Appendix 10A Carbon and Other Greenhouse Gas Emissions Supporting Data

Introduction

This appendix should be read in conjunction with **Chapter 10: Carbon and other greenhouse gases** of the ES Addendum.

This appendix sets out further detail of the methodology for quantifying Greenhouse Gases (GHGs) and the complete results of the assessment.

The following information provided in **Appendix 17A Carbon and other greenhouse gases supporting data** of the original ES remains valid for the ES addendum:

- Table 17A.1 2017 Scope 1 and 2 emissions for Bristol Airport
- Table 17A.2 Energy use of buildings for 10 mppa operations
- Table 17A.3 Energy use of buildings for 12 mppa operation
- Table 17A.5 Embodied carbon associated with the construction materials by building for the Proposed Development
- Table 17A.6 Total vehicle movements required to transport the construction materials
- Table 17A.8 Current Baseline Vehicle movements and origins for employees access to Bristol Airport
- Table 17A.9 Current Baseline Vehicle movements and origins for passenger access to Bristol Airport

All other information in the original Appendix has been superseded by the information provided below.

Assessment methodology

Emissions Factors

Data on improvement factors under upper, central and lower emission scenarios have been collated from current government policy, Committee on Climate Change (CCC) advice and industry reports. The trend for each improvement factor out to 2050 are shown in **Table 10A.1** for each scenario.

Improvement factors are applied to all time period assessments with the exception of aircraft and engine efficiencies and sustainable aviation fuels (SAF) which are only applied to the 2050 time period.



Table 10A.1 Improvement factors (relative to 2020 data) used in the GHG assessment for the upper, central and lower emission scenario

Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario
Private vehicle splits by fuel type ł	33% petrol, 21% diesel, 46% electric (assumed to be plug-in hybrids) by 2050 Source: Department for Transport (DfT) Forecasts ²	2% petrol, 1% diesel, 97% battery electric vehicles by 2050 Source: National Grid Future Energy Scenarios ^{3*} Steady Progression	0% petrol, 0% diesel, 100% battery electric vehicles by 2050 Source: National Grid Future Energy Scenarios ³ * Leading the Way
Vehicle efficiency improvements ł	Efficiency facto	y 2050	
Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)	Efficiency factor 0.74 diesel, 0.	89 electric by 2050. Note the fleet mix is as Source: DfT forecast ²	ssumed to be all diesel
Rail efficiency improvements	Efficiency factor of 0.88 by 2050 <i>Source: DfT forecast²</i>	Efficiency factor of 0.59 by 2050 (median value)	3.82% annual improvement, equating to an efficiency factor of 0.30 by 2050 Source: historical data from the Office of Rail and Road (ORR) ^{4#}
Electricity generation efficiency improvements	Efficiency factor of 0.58 by 2050 Source: National Grid Future Energy Scenarios ³ Steady Progression	Efficiency factor of 0.30 by 2050 Source: Business, Energy and Industrial Strategy (BEIS) Energy and Emission Projections (EEP) 2019 projections ⁵ (assumed to flat line from 2040)	Efficiency factor of - 0.02 by 2050 Source: National Grid Future Energy Scenarios ³ Leading the Way
Aircraft and engine efficiency	0.8% (covers both aircraft and engine efficiency and air traffic	1.01% (median value)	1.22% Source: Sustainable Aviation ⁷
Air traffic management and operations	management and operations**) <i>Source: CCC, 2009</i> ⁶	0.115% (median value)	0.23% Source: Sustainable Aviation ⁷
Sustainable aviation fuel ^{##}	5% implementation at 50% life-cycle emission reduction	10% implementation at 30-47% life- cycle emission reduction	18% implementation at 60% life-cycle emission reduction Source: Sustainable Aviation ⁷

² Department for Transport (2020), TAG Data Book. Available at https://www.gov.uk/government/publications/tag-data-book [Accessed 21 October 2020].

⁷ Sustainable Aviation (2020). Sustainable Aviation Carbon Road-Map: A path to Net Zero. Available online at:

³ National Grid (2020), Future Energy Scenarios, FES 2020. Available at https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents [Accessed 21 October 2020].

⁴ ORR (2020), Table 6100 - Estimates of normalised passenger and freight carbon dioxide equivalent (CO2e) emissions. Available at https://dataportal.orr.gov.uk/statistics/infrastructure-and-emissions/rail-emissions/ [Accessed 12 November 2020].

⁵ BEIS (2019), Updated energy and emissions projections: 2019 [online]. Available at

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/931215/Web_figures_EEP2019_.ods [Accessed 12 November 2020].

⁶ Committee on Climate Change. (2009). Meeting the UK aviation target – options for reducing emissions to 2050. [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2009/12/CCC-Meeting-the-UK-Aviation-target-2009.pdf [Accessed 21 October 2020].

https://www.sustainableaviation.co.uk/wp-content/uploads/2020/02/SustainableAviation_CarbonReport_20200203.pdf [Accessed 21 October 2020].



Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario
	Source: DfT, 2017 ⁸	Source: CCC ^{6,9,10,11,12}	
Private vehicle splits are assumed	to apply to cars, taxis and LGV		

*Future energy scenarios provide data on electric vehicle percentage. Petrol/diesel percentages have been calculated based on the splits within the DfT forecasts (upper emission scenario).

[#] carbon emissions (gCO_{2e}/pass-km) were obtained from the Office of Rail and Road (ORR) for the period 2005-2019 for UK rail travel. These were used to extrapolate and efficiency factor for carbon emissions per rail passenger to 2050 assuming a constant average annual improvement rate.

**CCC advice provides a combined annual improvement rate for aircraft and engine efficiencies and air traffic management and operations. To calculate median values for the central emission scenario and for use in the upper emission scenario, air traffic management and operations has been assumed to result in no improvement (i.e. 0%) as the proportional improvement is unknown. ^{##} Sustainable aviation fuel uptake is dependent on fuel infrastructure being in place.

Improvement factors are applied to all time periods as described in Table 10A.2 for 2024, Table 10A.3 for 2030, Table 10A.4 for 2040 and Table 10A.5 for 2050.

Table 10A.2 Improvement factors (relative to 2020 data) used in the GHG assessment for the upper, central and lower emission scenario for the 2024 time period.

Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario		
Private vehicle splits by fuel type	Petrol 50% / Diesel 46% / Electric 4%	Petrol 51% / Diesel 47% / Electric 2%	Petrol 49% / Diesel 45% / Electric 6%		
Vehicle efficiency improvements	Ρ	98			
Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)		Bus / Coach (diesel) 0.91			
Rail efficiency improvements	0.90	0.86	0.82		
Electricity generation efficiency improvements	0.95	0.87	0.88		
Air traffic management and operations	1.00	0.99	0.98		

⁸ Department for Transport (2017), UK Aviation Forecasts, Moving Britain Ahead (Oct 2017) [online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/878705/uk-aviation-forecasts-2017.pdf [Accessed 21 October 2020].

⁹ Committee on Climate Change (2018), Biomass in a low-carbon economy, Committee on Climate Change Nov 2018. Available at https://d423d1558e1d71897434.b-cdn.net/wp-content/uploads/2018/11/Biomass-in-a-low-carbon-economy-CCC-2018.pdf

¹⁰ Committee on Climate Change (2012), Aviation – Fact Sheet. Available at https://www.theccc.org.uk/wpcontent/uploads/2013/04/Aviation-factsheet.pdf

¹¹ Committee on Climate Change (2019), "Letter: Aviation 2050 – The future of UK aviation", [online]. Available at https://www.theccc.org.uk/wp-content/uploads/2019/02/Aviation-Letter-from-Lord-Deben-to-Chris-Grayling.pdf

¹² Committee on Climate Change (2019), "Letter: International aviation and shipping and net zero", [online]. Available at: https://www.theccc.org.uk/wp-content/uploads/2019/09/Letter-from-Lord-Deben-to-Grant-Shapps-IAS.pdf [Accessed 21 October 2020].

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Table 10A.3 Improvement factors (relative to 2020 data) used in the GHG assessment for the upper, central and lower emission scenario for the 2030 time period.

Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario			
Private vehicle splits by fuel type	Petrol 49% / Diesel 37% / Electric 14%	Petrol 51% / Diesel 38% / Electric 11%	Petrol 36% / Diesel 28% / Electric 36%			
Vehicle efficiency improvements	Pe	etrol 0.83 / Diesel 0.89 / Electric 0.9	91			
Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)	Bus / Coach (diesel) 0.76					
Rail efficiency improvements	0.88	0.76	0.65			
Electricity generation efficiency improvements	0.87	0.61	0.69			
Air traffic management and operations	1.00	0.99	0.97			

Table 10A.4 Improvement factors (relative to 2020 data) used in the GHG assessment for the upper, central and lower emission scenario for the 2040 time period.

Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario				
Private vehicle splits by fuel type	Petrol 40% / Diesel 27% / Electric 33%	Petrol 23% / Diesel 15% / Electric 62%	Petrol 1% / Diesel 1% / Electric 99%				
Vehicle efficiency improvements	Petrol 0.80 / Diesel 0.88 / Electric 0.84						
Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)	Bus / Coach (diesel) 0.74						
Rail efficiency improvements	0.88	0.66	0.44				
Electricity generation efficiency improvements	0.73	0.45	0.29				
Air traffic management and operations	1.00	0.97	0.95				

Table 10A.5 Improvement factors (relative to 2020 data unless noted) used in the GHG assessment for the upper, central and lower emission scenario for the 2050 time period.

Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario		
Private vehicle splits by fuel type	Petrol 33% / Diesel 21% / Electric 46%	Petrol 2% / Diesel 1% / Electric 97%	Petrol 0% / Diesel 0% / Electric 100%		
Vehicle efficiency improvements	F	Petrol 0.80 / Diesel 0.87 / Electric 0.4	33		





Improvement factor	Upper emission scenario	Central emission scenario	Lower emission scenario
Vehicle efficiency improvements (Public Service Vehicles including buses and coaches)		Bus / Coach (diesel) 0.74	
Rail efficiency improvements	0.88	0.59	0.30
Electricity generation efficiency improvements	0.58	0.45	-0.02
Aircraft and engine efficiency (relative to 2040 data)	0.92	0.90	0.88
Air traffic management and operations	1.00	0.96	0.93
Sustainable aviation fuel	0.98	0.94	0.93

Methodology for quantifying aviation GHG emissions

This section updates information provided in **Section 17.9**, sub-section **Methodology for determining the effect of aviation emissions from operating the Proposed Development on the global climate** of the original ES. Changes to the methodology are noted below, all other information provided in the original ES remains valid.

The assessment methodology for quantifying and assessing the GHG emissions from aviation emissions associated with the Proposed Development has been supplemented with additional data, forecasting and scenarios for the ES addendum.

The majority of an airport's GHG emissions arise from the combustion of fuel by aircraft. Although research is being undertaken to introduce lower-carbon biofuels, it is likely that fuel will remain largely fossil-derived with only a small percentage of biofuel in the mix over the 2020s and 2030s and they are therefore not considered until 2040.

Aviation emissions sources are broken down into:

- Climb-Cruise-Descent (CCD) phase (departure only to avoid double-counting with other airports); and
- The Landing and Take Off (LTO) cycle.

Aircraft movement forecasts were developed for both the 'With Development' and 'Without Development' cases. A one-day forecast schedule was produced for 2030, with total movements per year by aircraft type and destination for 2040 and 2050. Real aircraft movement data for the 2017 baseline was also provided.

The impacts of non-CO₂ emissions from aviation are not considered in this assessment. This is based on the CCC 2020 Progress Report recommendation to the Department for Transport (DfT) that they "consider how best to tackle them [non-CO₂ emissions] alongside UK climate targets"¹³. The UK Government response to



¹³ Committee on Climate Change. (2020). Reducing UK emissions: 2020 Progress Report to Parliament, [online]. Available at: <u>https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/</u> [Accessed 21 October 2020].



the CCC 2020 Progress Report is to 'monitor non-CO₂ impacts of aviation [and shipping] and consider how best to tackle them alongside UK climate targets'¹⁴.

Emissions factors (see **Table 10A.1**) were applied to the aircraft movement forecasts from 2040 onwards. This is due to the substantial uncertainty over the emissions and technologies associated with 'next generation' aircraft beyond the current generation of Airbus NEOs and Boeing MAXs. The emissions factors incorporated are very likely to be conservative compared to the expected introduction of low carbon aircraft in the future (e.g. electric, hydrogen).

Both the 'With development' and 'Without development' cases are presented for 2024, 2030, 2040 and 2050.

It should be noted that the original ES contained an overprediction associated with the total number of kilometres flown in the CCD phase and this has since been corrected (see **Chapter 10** of the ES Addendum). Furthermore, the revised aircraft movement forecast used in the ES Addendum has reduced the average distance flown to an amount more in-line with the 2017 baseline recorded data.

Climb Cruise Descent (CCD) phase

The CCD phase of flights has only been considered for departing flights, following DfT guidance⁸. Arriving aircraft were not considered as part of the calculation of CCD emissions.

For the 'With Development' and 'Without Sevelopment' cases, a one-day forecast schedule was used for 2030 as well as total movements per year for 2040 and 2050 split by aircraft type. The daily schedule has been used to associate aircraft types with destinations, with an adjustment factor for each aircraft type to ensure that the total movements per year tallies with the forecast.

The schedules provide destination airports for departures. The coordinates (latitude/longitude) of each destination airport were obtained from publicly available databases¹⁵ and cross-checked^{16,17}. The great circle distance¹⁸ (GCD) from Bristol Airport to each airport was calculated from the coordinate pairs using standard trigonometric formulae.

Emission factors were derived from the EMEP/EEA guidebook¹⁹. The EEA and the United Nations (UN's) Long-Range Transboundary Air Pollution project (LRTAP) produce the guidebook to support the compilation of GHG inventories across Europe and across market sectors.

Because aircraft types, engines, flight trajectories etc. evolve over time, Eurocontrol's Advanced Emissions Model (AEM) and the EMEP/EEA spreadsheets are updated periodically. For the ES Addendum assessment, the latest available version of the EMEP/EEA spreadsheets was used, from 2019. However, it should be noted that the 2019 version does not incorporate any substantive updates over the 2016 version. The EMEP/EEA spreadsheets are based on the current contemporary (2015) aircraft fleet characteristics, so it is only able to calculate emissions for many of the most common existing aircraft types. It does not include newer types such as the Airbus 320neo series or the Boeing 737Max series, both of which feature in the Bristol Airport schedules. For these newer types, the Small Emitters Tool (SET), published by Eurocontrol²⁰, was used as a



¹⁴ HM Government (2020). The Government Response to the Committee on Climate Change's 2020 Progress Report to Parliament, [online]. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/928005/government-response-toccc-progress-report-2020.pdf [Accessed 21 October 2020].

¹⁵ GitHub (2018). JSON database of 28k+ airports with ICAO/IATA codes, names, cities, two-letter country identifiers, elevation, latitude & longitude, and a timezone identifier, [online]. Available at: <u>https://github.com/mwgg/Airports</u> [Accessed 21 October 2020].

¹⁶ OpenFlights (2018). Airport database, [online]. Available at: <u>https://openflights.org/data.html</u> [Accessed 21 October 2020].

¹⁷ Arash Partow (2018). The Global Airport Database, [online]. Available at: <u>http://www.partow.net/miscellaneous/airportdatabase/</u> [Accessed 21 October 2020].

¹⁸ Great Circle Distance is the shortest distance between two points on the surface of a sphere measured along the surface of the sphere. ¹⁹ EMEP/EEA air pollutant emission inventory guidebook (2019). Chapter 1.A.3.a Aviation, [online]. Available at:

https://www.eea.europa.eu/publications/emep-eea-guidebook-2019 [Accessed 21 October 2020]. ²⁰ Eurocontrol (2019). Small Emitters Tool. Available at: https://www.eurocontrol.int/tool/small-emitters-tool



supplementary source of information. SET is updated annually and includes emissions for these newer aircraft types, but it only provides whole-flight emissions, without separating out emissions from CCD and LTO. Therefore, for each of the newer aircraft types, a suitable surrogate aircraft type for which EMEP data is available was chosen, and an adjustment factor was calculated equal to the ratio of the whole-flight emissions for a typical 1500 km flight as calculated by SET. Surrogates and adjustment factors are given in **Table 10A.6.**

Aircraft type	Surrogate	Adjustment factor
A320NEO	A320	0.804
A321NEO	A321	0.786
A321NEO XLR	A321	0.786
Boeing 737 MAX 10	B739	0.854
Boeing 737 MAX8	B738	0.854
Embraer 195-E2	W195	1.139

Table 10A.6 Surrogate and adjustment factors for SET calculation

Landing and Take Off (LTO) cycle

The LTO cycle is considered for all Air Traffic Movements (ATM)s that occur as a result of the Proposed Development. As is common practice, emissions are calculated for all parts of the LTO at Bristol Airport, including the arrival elements (approach, landing roll and taxi-in).

As noted in paragraph 0, EMEP/EEA provides a spreadsheet for calculating emissions for the LTO phase, but this was not used for this assessment. A detailed emissions inventory was calculated using data specific to Bristol Airport, including detailed taxi-in and taxi-out times as described in **Chapter 7: Air Quality** of the ES Addendum. This inventory included fuel consumption as an integral part of the calculation. LTO emissions of CO_2 were calculated by multiplying the fuel consumption by a factor of 3.15^8 (or a reduced factor where efficiencies were added). This approach is considered to be more accurate than using a more generic approach such as the EMEP/EEA spreadsheet.

Methodology for quantifying surface access GHG emissions

This section supersedes information provided in Section 17.9, sub-section Methodology for determining the effect of non-aviation emissions from operating the Proposed Development on the global climate, sub-section Assessment methodology for calculating emissions from surface access of the original ES.

Surface access emissions for both employees and passengers have been calculated based on transport modelling updated in 2020 provided by BAL. This includes details of origin locations and modal splits for the 'With Development' and 'Without Development' cases.

Employee distributions for 2024 are assumed to apply to both the 'With Development' and 'Without Development' cases. Employee data is also provided for both cases in 2030. Passenger data is provided for both the 'With Development' and 'Without Development' cases in 2024 and 2030. This is consistent with the approach used in **Chapter 8: Socio-economic** of the ES Addendum.

Surface access emissions have been calculated for upper, central and lower emission scenarios based on governmental policy and projections, CCC advice and industry projections (**Table 10A.2**). Data has been collated for all sources for 2024, 2030, 2040 and 2050.







Modal splits and passenger and employee distributions beyond 2030 (i.e. in the 2040 and 2050 assessment years) are assumed to remain constant due to uncertainties in projections. It is likely that changes to future modal splits and increased innovative technologies (such as autonomous vehicles or increases in car sharing schemes) would influence the surface access emissions, so the assessment approach taken can be considered to be worst-case for 2040 and 2050.

Both the 'With Development' and 'Without Development' cases are presented for 2024, 2030, 2040 and 2050.

Methodology for quantifying airport buildings and ground operations GHG emissions

This section supersedes information provided in Section 17.9, sub-section Methodology for determining the effect of non-aviation emissions from operating the Proposed Development on the global climate, sub-section Assessment methodology for calculating Scope 1 and Scope 2 emissions of the original ES.

The assessment methodology for non-aviation emissions associated with the Proposed Development has been updated to take into account new and updated data as described in **Section 10.3** of **Chapter 10** of the ES Addendum.

As in the original ES, the increase airport building and ground operations requirements has been calculated based on a linear increase proportionate to passenger numbers, relative to the 2017 baseline. Since two years of additional data is available from Bristol Airport's Annual Monitoring Report²¹, a linear increase in gas use, fleet vehicles, heating and refrigerants has been determined by scaling up the latest Scope 1 energy values from 2019 to incorporate the new features of the airport up to the 12 million passengers per annum (mppa) capacity at 2030. As in the original ES, there will not be any increase in fire training or company cars associated with the Proposed Development, so these remain unchanged.

Airport building and ground operation emissions beyond 2030 (i.e. in the 2040 and 2050 assessment years) are assumed to remain constant due to uncertainties in projections.

Where data is available, information on tenant emissions have also been included. Presently this data is available for gas use and electricity only.

Data on biofuel usage at Bristol Airport represents usage by both Bristol Airport and tenants across the airport. Data is not recorded on the proportionate split of use between different end-users. As a conservative approach, all biofuel has been attributed to Bristol Airport in this assessment. Future endeavours on carbon reporting in line with the ACC process will result in more detailed analysis being possible²².

Details on both landside (car parking vehicles; and engineering, IT and motor transport departmental vehicles) and airside (apron vehicles include stand bowsers; airport safety unit; rescue firefighting services; and snow vehicles) have been included in calculation of fleet vehicle emissions.

Bristol Airport has committed to securing electricity generated from renewable sources. In 2019, Bristol Airport committed to a 100% renewable electricity supply through purchasing agreements with Ørsted. In line with guidance from the GHG Protocol²³, a market-based Scope 2 electricity factor has been calculated to reflect the renewable energy tariff supported by Renewables Obligation Certificate (ROC). The emission factor

²¹ Bristol Airport Limited, (2020). Annual Monitoring Report 2019 [online]. Available at:



https://www.bristolairport.co.uk/~/media/files/brs/about-us/environment/annual-monitoring-report-2019.ashx?la=en [Accessed 21 October 2020].

²² Bristol Airport have committed to offset residual direct emissions within their control from 2025. However, presently data on the proportionate split of use is not available and therefore all biofuel emissions are attributed to Scope 1 sources and will be included in this offsetting commitment. Improved analysis on Scope 3 emissions in line with the ACC process will result in improved data collection and therefore can be expected to change the offsetting commitments suggested in this assessment.

²³ Greenhouse Gas Protocol. (2015). GHG Protocol Scope 2 Guidance. An amendment to the GHG Protocol Corporate Standard [online]. Available at <u>https://www.ghgprotocol.org/sites/default/files/ghgp/standards/Scope%202%20Guidance_Final_0.pdf</u> [Accessed 21 October 2020].



used in the market-based method is 0.0125 kgCO2e/kWh²⁴. The location-based emission for Scope 2 electricity, which reflects the average emission of the UK Electricity grid (0.2556 kgCO_{2e}/kWh²⁵), has also been presented.

Estimated energy use for new infrastructure required for the Proposed Development has been calculated as in the original ES. These are included in the 'With Development' case based on the first full year of operation in 2030 according to the construction timeline.

Data on engine testing is not available for Bristol Airport and has not been included in the GHG assessment. Based on the results of other airports, the emissions associated with engine testing are likely to be negligible.

Improvement factors for three scenarios as stated in **Table 10A.2** have been incorporated into the assessment for UK grid electricity generation. There is not sufficient information available to quantify anticipated changes in gas use, fleet vehicles or refrigerants for the future scenarios. These are therefore assumed to be constant, although expected changes such as improved building management processes, boiler upgrades and fleet upgrades to electric or alternative fuel technologies are anticipated.

Both the 'With development' and 'Without development' cases are presented for 2024, 2030, 2040 and 2050.

Methodology for quantifying construction GHG emissions

This section updates information provided in **Section 17.9**, sub-section **Methodology for determining the effect of aviation emissions from operating the Proposed Development on the global climate** of the original ES. Changes to the methodology are noted below, all other information provided in the original ES remains valid.

The methodology for quantifying and assessing GHG emissions from constructing the Proposed Development remains largely unchanged from that presented in the original ES with the exception of the following:

- Construction emissions have been calculated for all construction years (2022 2029) for the upper, central and lower emission scenario.
- The emissions factor used for the assessment for the construction vehicle movements is 0.8654 kgCO_{2e}/km. This represents an average diesel HGV with an average load²⁵. HGVs are assumed to remain powered by diesel during the construction period, as assumed in Road Traffic Forecasts 2019²⁶.
- For the construction employee vehicle movements, it has been assumed that employees travel in vans of average size. Future scenarios for vehicle splits by fuel type and efficiencies have been applied as per the surface access future scenarios. Emission factors of 0.2471 kgCO_{2e}/km for diesel, 0.21962 kgCO_{2e}/km for petrol and 0.05547 kgCO_{2e}/km for battery electric vehicles have been applied²⁵.
- Energy use from on-site construction processes has been estimated as 5.3% of the emissions from embodied carbon, based on the average emissions of recent studies compiled through a



²⁴ Pehl et al (2017). Understanding future emissions form low-carbon power systems by integration of life-cycle assessment and integrated energy modelling. Naturel energy, Volume 2 December 2017 939-945.

 $^{^{\}rm 25}$ BEIS (2020), Greenhouse gas reporting: conversion factors 2020 [online]. Available at

https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020 [Accessed 21 October 2020]. ²⁶ Department for Transport (2018). Road Traffic Forecasts 2018. Available online at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873929/road-traffic-forecasts-2018document.pdf





literature search^{27,28,29,30}. Case studies have been identified that are of comparable complexity to that required for the Proposed Development. This is in lieu of more detailed recent information for construction processes on site or in the UK aviation sector.

Quantification of GHGs

This section sets out further quantifications of GHG emissions that are not presented in **Section 9.7** of **Chapter 10** of the ES Addendum.

Total emissions

A breakdown of total projected GHG emissions by source for the upper emission scenario is shown in **Figure 00A.1**. The lower emission scenario is presented in **Figure 10A.2** (note the central emission scenario is shown in **Chapter 10** of the ES Addendum).



Figure 00A.1 Total GHG emissions for the 2017 baseline, and 'Without Development' and 'With Development' cases for the upper emission scenario when offsetting commitments are not considered

Note: 2017 baseline data on airport buildings and ground operations only includes emissions within Bristol Airport's direct control. Tenant information is included in the 'Without Development' and 'With Development' case in the future assessment years. Aviation emissions are by convention reported as CO_2 emissions³¹. This reflects the uncertainties associated with non-CO₂ emissions (see **Section 10.6** of the ES Addendum). All other emissions sources are reported in CO_{2e} which is defined as the sum of all GHG

²⁸ Department for Business Innovation and Skills (2010). Estimating the amount of CO2 emissions that the construction industry can influence. Supporting material for the low carbon construction IGT report. Autumn 2010. [online]. Available at: <u>https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/31737/10-1316-estimating-co2-</u> <u>emissions-supporting-low-carbon-igt-report.pdf</u>



²⁷ Seo et al. (2016). On-Site Measurements of CO2 Emissions during the Construction Phase of a Building Complex. Energies 2016, 9(599), pp. 10-12.

²⁹ Marzouk, M. and Abdelakder, E. M. (2020). A hybrid fuzzy-optimization method for modeling construction emissions. Decision Science Letters, 9, 1-20.

³⁰ Cho, S.-H. and Chae, C.-U., (2016). A Study on Life Cycle CO2 Emissions of Low-Carbon Building in South Korea. Sustainability, 8(6), 579.

³¹ ICAO (2010), ICAO Environment Report, Chapter 1, Aviation's Contribution to Climate Change [online]. Available at: https://www.icao.int/environmental-protection/Documents/EnvironmentReport-2010/ICAO_EnvReport10-Ch1_en.pdf [Accessed 21 October 2020].





emissions multiplied by their global warming potential. For aviation, since only CO_2 is reported with a global warming potential of one, 1 ton of CO_2 is equal to 1 ton of CO_{2e} and hence no conversion is needed to sum together these emission sources. Note a location-based approach is used to quantify emission sources.



Figure 10A.2 Total GHG emissions for the 2017 baseline, and 'Without Development' and 'With Development' cases for the upper emission scenario using a location-based approach

Note: 2017 baseline data on airport buildings and ground operations only includes emissions within Bristol Airport's direct control. Tenant information is included in the 'Without Development' and 'With Development' case in the future assessment years. Aviation emissions are by convention reported as CO_2 emissions³¹. This reflects the uncertainties associated with non- CO_2 emissions (see **Section 10.6** of the ES Addendum). All other emissions sources are reported in CO_{2e} which is defined as the sum of all GHG emissions multiplied by their global warming potential. For aviation, since only CO_2 is reported with a global warming potential of one, 1 ton of CO_2 is equal to 1 ton of CO_{2e} and hence no conversion is needed to sum together these emission sources. Note a location-based approach is used to guantify emission sources.

Bristol Airport's offsetting commitment

A breakdown of residual GHG emissions, once offsetting has been considered, by source is shown for the upper and lower emission scenarios in **Figure 10A.3** and **Figure 10A.4** respectively (note the central emission scenario is shown in **Chapter 10** of the ES Addendum).







Figure 10A.3 Residual GHG emissions for the 2017 baseline, and the 'With Development' and 'Without Development' cases for the upper emission scenario once offsetting commitments have been accounted for.

Note this is based on a location-based approach to calculating emissions.



Figure 10A.4 Residual GHG emissions for the 2017 baseline, and the 'With Development' and 'Without Development' cases for the lower emission scenario once offsetting commitments have been accounted for.

Note this is based on a location-based approach to calculating emissions.

Aviation emissions

Total projected aviation GHG emissions from Bristol Airport for the baseline, 'Without Development' and 'With Development' cases for the assessment years 2024, 2030, 2040 and 2050 in three future improvement scenarios (upper, central and lower emissions scenarios) are shown **Table 10A.7**.



Table 10A.7 Aviation GHG emissions (ktCO₂/yr) for domestic and international sources in the 2017 baseline, 'Without Development' and 'With Development' cases in the upper, central and lower emission scenarios.

		20	24	20	30	20	40			2050	
	2017 baseline*	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development		
				Up	oper emiss	sion scena	rio				
Domestic	46.76	46.55	49.66	44.38	48.17	41.97	44.20	37.76			39.76
International	425.69	428.95	463.62	420.18	504.10	414.44	498.50	372.89			448.52
Upper emission scenario total	472.45	475.50	513.28	464.56	552.27	456.41	542.69	410.65			488.29
				Cer	ntral emis	sion scena	ario				
Domestic	46.76	46.18	49.26	43.72	47.45	40.87	43.04	34.26			36.08
International	425.69	425.51	459.91	413.94	496.61	403.61	485.48	338.31			406.93
Central emission scenario total	472.45	471.69	509.16	457.67	544.07	444.49	528.52	372.57			443.01
				Lo	wer emiss	sion scena	rio				
Domestic	46.76	46.02	48.86	43.07	46.75	39.80	41.92	31.93			33.62
International	425.69	418.88	456.21	407.79	489.23	393.06	472.78	315.28			379.23
Lower emission scenario total	472.45	464.90	505.07	450.86	535.98	432.86	514.70	347.21			412.85

*2017 baseline is based on actual data and therefore no future scenarios were applied to the data, the same data is repeated in this table.

Surface access emissions

Projected surface access GHG emissions for the 2017 baseline, 'Without Development' and 'With Development' cases for the assessment years 2024, 2030, 2040 and 2050 in three future improvement scenarios (upper emission, central emission and lower emission scenarios) are shown in **Table 10A.8**. Emissions with and without consideration for Bristol Airport's offsetting commitments are presented.





Table 10A.8 Surface access GHG emissions (ktCO₂e/yr) associated with Bristol Airport (including offsetting commitment)

		20	24	20	30	20	40	2050	
	2017 baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
			Upper em	ission scen	ario				
Passengers	184.45	192.2	198.9	165.5	201.4	144.6	176.2	132.5	161.5
Employees	7.44	9.0	9.0	7.9	9.2	7.1	8.2	6.7	7.7
Offsetting commitment		-189.4	-196.0	-162.9	-197.6	-142.0	-172.3	-129.9	-157.6
Upper emission scenario residual total	191.89	11.8	11.9	10.5	13.1	9.7	12.1	9.3	11.6
			Central em	nission scer	ario				
Passengers	184.45	192.2	198.9	161.0	195.9	78.7	96.2	25.1	31.3
Employees	7.44	9.0	9.0	7.8	9.0	4.6	5.2	2.5	2.7
Offsetting commitment		-189.5	-196.1	-158.7	-192.5	-76.7	-93.3	-23.4	-28.7
Central emission scenario residual total	191.89	11.7	11.8	10.1	12.4	6.6	8.1	4.3	5.3
			Lower em	ission scen	ario				
Passengers	184.45	187.2	193.7	128.0	155.8	22.0	27.3	4.1	5.6
Employees	7.44	8.9	8.9	6.5	7.5	2.4	2.6	1.7	1.8
Offsetting commitment		-184.6	-191.0	-126.0	-153.0	-20.7	-25.4	-3.2	-4.3
Lower emission scenario residual total	191.89	11.4	11.5	8.5	10.4	3.7	4.5	2.6	3.1

Airport buildings and ground operations

In line with the GHG protocol guidance23, both location-based and market-based carbon reporting methods have been used to calculate emissions associated with Scope 2 electricity. Data is presented for the location-based approach for all three emission scenarios in **Table 10A.9** to **Table 10A.11**. Data is presented for the market-based approach for all three emission scenarios in Table **10A.12** to Table **10A.14**.





Table 10A.9 Airport building and ground operation emissions ($ktCO_2e/yr$) for upper emission scenario – using a location-based method for reporting of grid electricity

			20	24	2030		2040		2050	
		2017 baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
		I	Upper em	ission Sce	enario					
Grid electricity	Bristol Airport Ltd.	4.63	3.92	4.04	3.57	4.28	3.01	3.62	2.37	2.84
	Tenant	n/a*	0.95	0.98	0.87	1.04	0.73	0.88	0.58	0.69
Gas use	Bristol Airport Ltd.	1.79#	0.74	0.76	0.74	0.89	0.74	0.89	0.74	0.89
	Tenant	n/a*	0.14	0.14	0.14	0.16	0.14	0.16	0.14	0.16
Company car		#	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fleet vehicles	Biodiesel	#	1.13	1.16	1.13	1.35	1.13	1.35	1.13	1.35
Heating / red diesel	Gas oil	#	0.33	0.34	0.33	0.39	0.33	0.39	0.33	0.39
Refrigerants		#	0.16	0.17	0.16	0.19	0.16	0.19	0.16	0.19
Fire training		#	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Additional infrastruc	ture (electricity)	0.00	0.85	1.04	0.77	1.66	0.65	1.40	0.51	1.10
Total airport building operation emissions	g and ground	6.42	8.24	8.64	7.72	9.99	6.91	8.90	5.96	7.64
Offsetting through correduction credits	ertified carbon	0.00	0	0	-6.72	-8.79	-6.04	-7.86	-5.25	-6.78
Overall residual emis	sion	6.42	8.24	8.64	1.00	1.20	0.87	1.04	0.71	0.85

Note negative values represent offsetting of emissions through certified carbon reduction credits. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.

All Scope 1 emissions are included in this total. Note that this data differs from that stated in the Operations Monitoring Report 2018. The Scope 1 figures are taken from an audit completed during 2018 and reflect the correct values for Scope 1 emissions.

*Tenant information is not available for 2017 baseline data.



Table 10A.10Airport building and ground operation GHG emissions ($ktCO_2e/yr$) for the 'WithDevelopment' and 'Without Development' cases under the central emission scenario, using a location-basedmethod for reporting of grid electricity

			20	24	20	2030		40	2050	
		2017 baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
		C	entral em	ission sce	nario					
Grid electricity	Bristol Airport Ltd.	4.63	3.59	3.70	2.50	3.00	1.87	2.24	1.87	2.24
	Tenant	n/a*	0.87	0.90	0.61	0.73	0.45	0.55	0.45	0.55
Gas use	Bristol Airport Ltd.	1.79#	0.74	0.76	0.74	0.89	0.74	0.89	0.74	0.89
	Tenant	n/a*	0.14	0.14	0.14	0.16	0.14	0.16	0.14	0.16
Company car		#	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fleet vehicles	Biodiesel	#	1.13	1.16	1.13	1.35	1.13	1.35	1.13	1.35
Heating / red diesel	Gas oil	#	0.33	0.34	0.33	0.39	0.33	0.39	0.33	0.39
Refrigerants		#	0.16	0.17	0.16	0.19	0.16	0.19	0.16	0.19
Fire training		#	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Additional infrastruc	ture (electricity)	0.00	0.78	0.95	0.54	1.17	0.41	0.87	0.41	0.87
Total airport building operation emissions	g and ground	6.42	7.75	8.13	6.16	7.90	5.24	6.66	5.24	6.66
Offsetting through correduction credits	ertified carbon	0.00	0.00	0.00	-5.41	-7.01	-4.65	-5.96	-4.65	-5.96
Overall residual emis	sion	6.42	7.75	8.13	0.74	0.89	0.59	0.71	0.59	0.71

Note negative values represent offsetting of emissions through certified carbon reduction credits. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.

#All Scope 1 emissions are included in this total. Note that this data differs from that stated in the Operations Monitoring Report 2018. The Scope 1 figures are taken from an audit completed during 2018 and reflect the correct values for Scope 1 emissions.

*Tenant information is not available for 2017 baseline data.

Table 10A.11	Airport building and	ground operation	emissions	(ktCO ₂ e/yr)	for the lowe	er emission	scenario
 using a locatic 	on-based method for	reporting of grid e	electricity				

			202	24	20	30	2040		2050	
		2017 baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
		ļ	Lower em	ission sce	enario					
Grid electricity	Bristol Airport Ltd.	4.63	3.63	3.74	2.84	3.41	1.17	1.41	-0.09	-0.11
	Tenant	n/a*	0.88	0.91	0.69	0.83	0.29	0.34	-0.02	-0.03
Gas use	Bristol Airport Ltd.	1.79#	0.74	0.76	0.74	0.89	0.74	0.89	0.74	0.89
	Tenant	n/a*	0.14	0.14	0.14	0.16	0.14	0.16	0.14	0.16
Company car		#		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fleet vehicles	Biodiesel	#	1.13	1.16	1.13	1.35	1.13	1.35	1.13	1.35
Heating / red diesel	Gas oil	#	0.33	0.34	0.33	0.39	0.33	0.39	0.33	0.39
Refrigerants		#	0.16	0.17	0.16	0.19	0.16	0.19	0.16	0.19
Fire training		#	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Additional infrastruc	ture (electricity)	0.00	0.79	0.96	0.62	1.33	0.25	0.55	-0.02	-0.04
Total airport building operation emissions	g and ground	6.42	7.81	8.19	6.66	8.57	4.22	5.30	2.37	2.83
Offsetting through correduction credits	ertified carbon	0.00	0	0	-5.83	-7.58	-3.80	-4.80	-2.26	-2.69
Overall residual emis	sion	6.42	7.81	8.19	0.83	0.99	0.42	0.51	0.11	0.14

Note negative values represent offsetting of emissions through certified carbon reduction credits. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.

#All Scope 1 emissions are included in this total. Note that this data differs from that stated in the Operations Monitoring Report 2018. The figures were taken from an audit completed during 2018 and reflect the correct values for the emissions in 2019.

*Tenant information is not available for 2017 baseline data.

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Table 10A.12	Airport building and ground operation emissions (ktCO2e/yr) for upper emission scenario -
using a market-	based method for reporting of renewable electricity supply through the grid

			20	24	20	30	30 204		40 2050	
		2017 baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
			Upper em	ission sce	enario					
Grid electricity	Bristol Airport Ltd.	4.63	0.20	0.21	0.20	0.24	0.20	0.24	0.20	0.24
	Tenant	n/a*	0.05	0.05	0.05	0.06	0.05	0.06	0.05	0.06
Gas use	Bristol Airport Ltd.	1.79#	0.74	0.76	0.74	0.89	0.74	0.89	0.74	0.89
	Tenant	n/a*	0.14	0.14	0.14	0.16	0.14	0.16	0.14	0.16
Company car		#		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fleet vehicles	Biodiesel	#	1.13	1.16	1.13	1.35	1.13	1.35	1.13	1.35
Heating / red diesel	Gas oil	#	0.33	0.34	0.33	0.39	0.33	0.39	0.33	0.39
Refrigerants		#	0.16	0.17	0.16	0.19	0.16	0.19	0.16	0.19
Fire training		#	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Additional infrastruc	ture (electricity)	0.00	0.04	0.05	0.04	0.09	0.04	0.09	0.04	0.09
Total airport building and ground operation emissions		6.42	2.80	2.89	2.80	3.40	2.80	3.40	2.80	3.40
Offsetting through c reduction credits*	ertified carbon	0.00	0	0	-2.37	-2.84	-2.37	-2.84	-2.37	-2.84
Overall residual emis	sion	6.42	2.80	2.89	0.43	0.56	0.43	0.56	0.43	0.56

Note negative values represent offsetting of emissions through certified carbon reduction credits. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.

*This excludes the offsetting of UK grid electricity for renewable sources which has been included in the market-based methodology for GHG accounting.

#All Scope 1 emissions are included in this total. Note that this data differs from that stated in the Operations Monitoring Report 2018. The figures were taken from an audit completed during 2018 and reflect the correct values for the emissions in 2019.



Table 10A.13Airport building and ground operation GHG emissions (ktCO2e/yr) for the 'WithDevelopment' and 'Without Development' cases under the central emission scenario, using a market-basedmethod for reporting of renewable electricity supply through the grid

			2024	1	20	30	2040		2050	
		2017 Baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
		Ce	entral emiss	sion scer	nario					
Grid electricity	Bristol Airport Ltd.	4.63	0.20	0.21	0.20	0.24	0.20	0.24	0.20	0.24
	Tenant	n/a*	0.05	0.05	0.05	0.06	0.05	0.06	0.05	0.06
Gas use	Bristol Airport Ltd.	1.79#	0.74	0.76	0.74	0.89	0.74	0.89	0.74	0.89
	Tenant	n/a*	0.14	0.14	0.14	0.16	0.14	0.16	0.14	0.16
Company car		#	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fleet vehicles	Biodiesel	#	1.13	1.16	1.13	1.35	1.13	1.35	1.13	1.35
Heating / red diesel	Gas oil	#	0.33	0.34	0.33	0.39	0.33	0.39	0.33	0.39
Refrigerants		#	0.16	0.17	0.16	0.19		0.16	0.19	0.16
Fire training		#	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Additional infrastruc	ture (electricity)	0.00	0.04	0.05	0.04	0.09	0.04	0.09	0.04	0.09
Total airport building and ground operation emissions		6.42	2.80	2.89	2.80	3.40	2.80	3.40	2.80	3.40
Offsetting through certified carbon reduction credits*		0.00	0	0	-2.37	-2.84	-2.37	-2.84	-2.37	-2.84
Overall residual GHG	emissions	6.42	2.80	2.89	0.43	0.56	0.43	0.56	0.43	0.56

Note negative values represent offsetting of emissions through certified carbon reduction credits. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.

*This excludes the offsetting of UK grid electricity for renewable sources which has been included in the market-based methodology for GHG accounting.

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Table 10A.14	Airport building and ground operation emissions (ktCO2e/yr) for lower emission scenario -
using a market-	based method for reporting of renewable electricity supply through the grid

			20	24	20	30	2040		2050	
		2017 baseline	Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
			Lower em	ission sce	enario					
Grid electricity	Bristol Airport Ltd.	4.63	0.20	0.21	0.20	0.24	0.20	0.24	0.20	0.24
	Tenant	n/a*	0.05	0.05	0.05	0.06	0.05	0.06	0.05	0.06
Gas use	Bristol Airport Ltd.	1.79#	0.74	0.76	0.74	0.89	0.74	0.89	0.74	0.89
	Tenant	n/a*	0.14	0.14	0.14	0.16	0.14	0.16	0.14	0.16
Company car		#	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fleet vehicles	Biodiesel	#	1.13	1.16	1.13	1.35	1.13	1.35	1.13	1.35
Heating / red diesel	Gas oil	#	0.33	0.34	0.33	0.39	0.33	0.39	0.33	0.39
Refrigerants		#	0.16	0.16	0.16	0.17	0.16	0.19	0.16	0.19
Fire training		#	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Additional infrastruc	ture (electricity)	0.00	0.04	0.79	0.04	0.05	0.04	0.09	0.04	0.09
Total airport building operation emissions	g and ground	6.42	2.80	2.89	2.80	3.40	2.80	3.40	2.80	3.40
Offsetting through correduction credits*	ertified carbon	0.00	0	0	0	-2.37	-2.84	-2.37	-2.84	-2.37
Overall residual emis	sion	6.42	2.80	7.81	2.80	2.89	0.43	0.56	0.43	0.56

Note negative values represent offsetting of emissions through certified carbon reduction credits. The direction of magnitude for these emission sources is beneficial in terms of impact on the global climate.

*This excludes the offsetting of UK grid electricity for renewable sources which has been included in the market-based methodology for GHG accounting.

#All Scope 1 emissions are included in this total. Note that this data differs from that stated in the Operations Monitoring Report 2018. The figures were taken from an audit completed during 2018 and reflect the correct values for the emissions in 2019.

Overall predicted effect of GHG emissions associated with the Proposed Development

The magnitude of the GHG emissions from the Proposed Development is assessed in **Chapter 10, Section 10.8** of the ES addendum. The magnitude of GHG emissions in the 'With Development' scenario against these tests are described below.

International aviation

At their peak in 2030, international aviation GHG emissions from Bristol Airport in the 'With Development' case account for 0.489 to 0.504 MtCO₂/yr depending on the scenario used. In 2050, this reduces to 0.379 to 0.449 MtCO₂/yr dependent on the scenario used.

International aviation emissions were 36.5 MtCO₂/yr in the 2017 baseline¹², of which, Bristol Airport's share was 1.17%. In the 2050 forecast, Bristol Airport's share of total UK aviation emissions is estimated to be 1.01 - 1.20% of the 37.5 MtCO₂/yr planning assumption⁶ (**Table 10A.155**).

Table 10A.165 International aviation GHG emissions from the 'With Development' case as a proportion of the 37.5 MtCO₂/yr planning assumption

	2024		20	2030		40	20	50
	MtCO ₂ /yr	%						
Upper emission scenario	0.03	0.09%	0.50	1.34%	0.50	1.33%	0.45	1.20%
Central emission scenario	0.46	1.23%	0.50	1.32%	0.49	1.29%	0.41	1.09%
Lower emission scenario	0.46	1.22%	0.49	1.30%	0.47	1.26%	0.38	1.01%

UK Carbon Budgets and Net Zero Target

Figure 10A.5 shows the GHG emissions associated with the 'With Development' case that are considered in the UK Carbon Budget³² and Net Zero Target³³. This represents all activities at Bristol Airport that are considered in the UK Carbon Budget and Net Zero Target, including emissions form the Proposed Development. Both the total emissions and residual emissions following offsetting commitments are shown.

GHG emissions for this magnitude test peak in 2030 under the upper emission scenario at 275.0 ktCO_{2e}/yr. The central and lower emission scenario peak in 2024 at 271.6 and 265.8 ktCO_{2e}/yr respectively. When offsetting is considered, GHG emissions peak in 2030 in all scenarios at at 79.9 – 86.9 ktCO_{2e}/yr.

³² The UK Government. (2016). Carbon Budgets. [online]. Available at: https://www.gov.uk/guidance/carbon-budgets [Accessed 21 October 2020].

³³ The UK Government. (2008). Climate Change Act 2008. [online]. Available at: http://www.legislation.gov.uk/ukpga/2008/27/contents [Accessed 21 October 2020].



Figure 10A.5 Total GHG emissions (solid line) and residual GHG emissions once offsetting commitments are considered (dashed line) which contribute to the UK Carbon Target and UK Carbon Budgets from the 'With Development' case.



In 2050, GHG emissions from the 'With Development' case that are considered in the UK Net Zero 2050 Target are $43.8 - 216.6 \text{ ktCO}_{2e}/\text{yr}$, dependent on the future improvement scenario used. Residual GHG emissions once offsetting commitments have been considered reduce to $41.8 - 66.0 \text{ ktCO}_{2e}/\text{yr}$, dependent on the scenario used.

The North Somerset Climate Emergency Strategy aims for a carbon neutral area by 2030. To date, this is an aim rather than a policy and the scope of this aim has not yet been defined. To provide an indication, GHG emissions from surface access, airport building and operations and construction GHG emissions from the Proposed Development case have been considered in line with the target year of this aim.

GHG emissions that are assumed to be indicative of the scope of the North Somerset Climate Emergency Strategy aim are shown for the Proposed Development in **Figure 10A.6**. Both the total emissions and residual emissions following offsetting commitments are shown.





Figure 10A.6 Total GHG emissions (solid line) and residual GHG emissions once offsetting commitments are considered (dashed line) which are assumed to be indicative of the scope of the North Somerset Climate Emergency Strategy aim from the Proposed Development only.



GHG emissions that are assumed to be indicative of the scope of the North Somerset Climate Emergency Strategy aim are shown for the 'With Development' case in **Figure 10A.7**. This represents all activities at Bristol Airport that are considered indicative of the scope of the North Somerset Climate Emergency Strategy aim, including emissions form the Proposed Development. Both the total emissions and residual emissions following offsetting commitments are shown.

Figure 10A.7 Total GHG emissions (solid line) and residual GHG emissions once offsetting commitments are considered (dashed line) which are assumed to be indicative of the scope of the North Somerset Climate Emergency Strategy aim from the 'With Development' case.



In 2030, GHG emissions from the 'With Development' case that are considered indicative of the scope of the North Somerset Climate Emergency Strategy aim are $178.1 - 226.8 \text{ ktCO}_{2e}/\text{yr}$, dependent on the future improvement scenario used. Residual GHG emissions once offsetting commitments have been considered reduce to $33.1 - 38.7 \text{ ktCO}_{2e}/\text{yr}$, dependent on the scenario used. GHG emissions then fall in all future





scenarios, primarily due to a decrease in surface access emissions due to the increased uptake of electric vehicles and shift in modal splits.

Supporting Data

The section sets out details of supporting data that has been used to quantify GHG emissions in the **Section 10.7** of **Chapter 10** of the ES Addendum.

Note that all relevant supporting data for the Airport buildings and ground operations assessment can be found in the Bristol Airport 2019 Annual Monitoring Report²¹ or in **Section 10.7** of the ES Addendum.

Construction emissions

Table 10A.16Number of Full-Time Equivalent (FTE) jobs associated with construction of the 12 mppainfrastructure in North Somerset, West of England and South West and South Wales.

Construction Year	Direct FTE jobs
2022	60
2023	180
2024	95
2025	15
2026	20
2027	210
2028	370
2029	155

Note: In the original ES the construction period was assumed to be from 2019-2026 (i.e. an 8 year period). No change is anticipated in construction activities except the dates which are now assumed to be from 2022 – 2029. Employee numbers have been updated accordingly.







Aviation emissions

Table 10A.17 Aviation movements and destination information

Aircraft type code	Destination	20	24	20	30	2040			2050	
		Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development	
Airbus A321NEO	Agadir Almassira, Morocco	0.00	0.00	0.00	294.34	0.00	294.34	0.00	294.34	
Airbus A320, Airbus A320NEO	Aldergrove International Airport, United Kingdom	890.67	894.33	933.62	930.91	1271.38	1228.64	1271.38	1228.64	
Airbus A320, Airbus A320NEO, Boeing 737 MAX 8, Boeing 737-800W	Alicante El Altet, Spain	1152.35	1156.29	1181.58	1162.83	1537.59	1477.98	1537.59	1477.98	
Airbus A321NEO	Ataturk, Turkey	0.00	0.00	0.00	294.34	0.00	294.34	0.00	294.34	
Airbus A320	Barajas, Spain	296.89	298.11	272.50	285.22	0.00	0.00	0.00	0.00	
Boeing 737 MAX 8, Boeing 737-800W	Bellegarde, France	282.00	283.70	279.58	271.11	345.00	329.44	345.00	329.44	
Airbus A320, Airbus A321NEO	Berlin-Schoenefeld, Germany	296.89	298.11	287.71	294.34	287.71	294.34	287.71	294.34	
Boeing 737-800W	Beziers Vias, France	282.00	283.70	298.75	300.00	0.00	0.00	0.00	0.00	
Airbus A321NEO	Blagnac, France	293.57	295.00	287.71	294.34	287.71	294.34	287.71	294.34	
Boeing 737 MAX 8, Boeing 737-800W	Bourgas, Bulgaria	282.00	283.70	279.58	271.11	345.00	329.44	345.00	329.44	
Boeing 737 MAX 10	Capodichino, Italy	127.50	127.50	128.13	128.13	128.13	128.13	128.13	128.13	
Boeing 737 MAX 8	Charleroi Brussels South, Belgium	0.00	0.00	0.00	135.56	0.00	164.72	0.00	164.72	
Airbus A320, Airbus A320NEO	Charles De Gaulle, France	593.78	596.22	622.41	620.61	847.59	819.09	847.59	819.09	
Boeing 737 Max 8	Cologne/bonn, Germany	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44	
ATR 72-600	Cork, Ireland	375.83	375.83	406.15	375.83	406.15	375.83	406.15	375.83	
Airbus A320	Cote D'azur International Airport, France	296.89	298.11	272.50	285.22	0.00	0.00	0.00	0.00	
Airbus A320NEO	Dalaman, Turkey	293.50	294.62	311.21	310.30	423.79	409.55	423.79	409.55	





Aircraft type code	Destination	20	24	203	30	2040		2050	
		Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
Boeing 737 MAX 8	Diagoras, Greece	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
ATR 72-600, Boeing 737 MAX 8	Dublin International, Ireland	2333.05	2332.42	2463.37	2316.67	2659.62	2491.67	2659.62	2491.67
Airbus A320, Airbus A320NEO	Dubrovnik, Croatia	296.89	298.11	311.21	310.30	423.79	409.55	423.79	409.55
Airbus A320, Airbus A320NEO	Düsseldorf International Airport (rhein-ruhr), Germany	296.89	298.11	311.21	310.30	423.79	409.55	423.79	409.55
ATR 72-500, Embraer RJ145	Dyce, United Kingdom	385.00	385.00	308.00	1155.00	308.00	1155.00	308.00	1155.00
Airbus A320, Airbus A320NEO	Edinburgh, United Kingdom	1484.44	1490.56	1517.33	1526.43	1695.17	1638.18	1695.17	1638.18
Airbus A320, Airbus A320NEO	El Prat De Llobregat, Spain	593.78	596.22	447.46	620.61	423.79	819.09	423.79	819.09
Airbus A320, Airbus A321NEO	Eleftherios Venizelos, Greece	296.89	298.11	287.71	294.34	287.71	294.34	287.71	294.34
Airbus A320, Airbus A320NEO	Euroairport Basel Mulhouse Freiburg, Switzerland	296.89	298.11	0.00	310.30	0.00	409.55	0.00	409.55
Airbus A320, Airbus A320NEO, Airbus A321NEO, Boeing 737 Max 8	Faro, Portugal	867.03	869.47	567.30	875.75	632.71	1033.33	632.71	1033.33
Boeing 737 MAX 8	Fertilia, Italy	0.00	0.00	0.00	135.56	0.00	164.72	0.00	164.72
Airbus A320, Airbus A321NEO	Fontanarossa, Italy	296.89	298.11	287.71	294.34	287.71	294.34	287.71	294.34
Embraer 190	Frankfurt International Airport (rhein- main), Germany	750.00	750.00	750.00	1120.00	750.00	1120.00	750.00	1120.00
Airbus A321NEO	Frederic Chopin, Poland	0.00	0.00	0.00	294.34	0.00	294.34	0.00	294.34
Airbus A320, Airbus A321NEO	Galileo Galilei, Italy	296.89	298.11	287.71	294.34	287.71	294.34	287.71	294.34
Airbus A320, Airbus A320NEO	Geneve-cointrin, Switzerland	593.78	596.22	583.71	595.52	423.79	409.55	423.79	409.55





Aircraft type code	Destination	20	24	20	30	2040		2050	
		Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
Boeing 737 Max 8	Girona-Costa Brava, Spain	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
Airbus A320, Airbus A320NEO, Airbus A321NEO	Glasgow International, United Kingdom	887.35	891.22	871.42	889.86	711.51	703.89	711.51	703.89
Boeing 737 MAX 10, Boeing 737 MAX 8	Gran Canaria, Spain	404.07	403.86	407.71	399.24	473.13	457.57	473.13	457.57
ATR 72-600	Guernsey, Channel Islands	375.83	375.83	406.15	375.83	406.15	375.83	406.15	375.83
Airbus A321NEO	Henri Coanda, Romania	0.00	0.00	0.00	294.34	0.00	294.34	0.00	294.34
Airbus A320Neo	Hurghada, Egypt	0.00	0.00	311.21	0.00	423.79	0.00	423.79	0.00
Airbus A320NEO, Airbus A321NEO, Boeing 737-800W	Ibiza, Spain	282.00	578.32	298.75	594.34	0.00	294.34	0.00	294.34
Boeing 737 MAX 8	International, Cyprus	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
Airbus A320	Inverness, United Kingdom	296.89	298.11	272.50	285.22	0.00	0.00	0.00	0.00
Airbus A320NEO, Boeing 737 MAX 8	loannis Kapodistrias, Greece	716.82	718.29	746.39	736.57	980.69	943.76	980.69	943.76
Boeing 737 MAX 8	Ireland West Airport Knock, Ireland	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
Boeing 737 MAX 8	Jasionka, Poland	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
ATR 42-300, ATR 72-500, ATR 72-600	Jersey, Channel Islands	770.00	770.00	665.08	770.00	665.08	770.00	665.08	770.00
Airbus A321NEO XLR	John F Kennedy International, United States	0.00	0.00	0.00	60.00	0.00	60.00	0.00	60.00
Airbus A320, Boeing 737-800W	John Paul II Balice International, Poland	578.89	581.81	571.25	585.22	0.00	0.00	0.00	0.00
Airbus A320	Kastrup, Denmark	296.89	298.11	272.50	285.22	0.00	0.00	0.00	0.00
Boeing 737 MAX 8, Boeing 737-800W	Lanzarote, Spain	141.00	141.85	139.79	135.56	172.50	164.72	172.50	164.72





Aircraft type code	Destination	2024		20	30	20	2040		2050	
		Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development	
Boeing 787-8	Larnaca, Cyprus	127.50	127.50	127.50	127.50	127.50	127.50	127.50	127.50	
Airbus A321NEO, Boeing 737 MAX 8, Boeing 737-800W	Lech Walesa, Poland	282.00	283.70	279.58	565.45	345.00	623.78	345.00	623.78	
Airbus A321NEO	Leonardo da Vinci International (Fiumicino), Italy	293.57	295.00	287.71	294.34	287.71	294.34	287.71	294.34	
Airbus A320NEO, Boeing 737 MAX 10, Boeing 737 MAX 8, Boeing 737-800W	Mahon, Spain	852.07	854.68	847.04	837.66	1025.04	995.24	1025.04	995.24	
Airbus A320NEO, Airbus A321NEO, Boeing 737 MAX 8, Boeing 737-800W	Malpensa, Italy	570.07	578.32	567.30	565.45	632.71	623.78	632.71	623.78	
Airbus A320, Airbus A320NEO	Marco Polo, Italy	296.89	298.11	311.21	310.30	423.79	409.55	423.79	409.55	
Airbus A320, Airbus A320NEO	Mérignac, France	296.89	298.11	311.21	310.30	423.79	409.55	423.79	409.55	
Airbus A320NEO, Airbus A321NEO	Milas, Turkey	146.75	147.31	143.86	147.17	143.86	147.17	143.86	147.17	
Airbus A320, Airbus A321NEO	Murcia-Corvera, Spain	296.89	298.11	287.71	294.34	287.71	294.34	287.71	294.34	
Airbus A320, Airbus A320NEO	Newcastle Airport, United Kingdom	883.89	887.34	894.91	905.82	847.59	819.09	847.59	819.09	
Boeing 737 MAX 8	Nikos Kazantzakis Airport, Greece	138.29	138.18	139.79	135.56	172.50	164.72	172.50	164.72	
Boeing 787-8	Orlando Sanford Intl, United States	127.50	127.50	127.50	127.50	127.50	127.50	127.50	127.50	
Boeing 737 MAX 8	Oslo (Gardermoen), Norway	0.00	0.00	0.00	271.11	0.00	329.44	0.00	329.44	
Airbus A320, Airbus A320NEO, Boeing 737 MAX 8, Boeing 737-800W	Pablo Ruiz Picasso, Spain	875.78	879.93	843.94	854.09	556.90	534.22	556.90	534.22	
Airbus A320NEO, Airbus A321NEO	Palese, Italy	0.00	294.62	0.00	294.34	0.00	294.34	0.00	294.34	
Airbus A320NEO	Portela, Portugal	293.50	294.62	311.21	310.30	423.79	409.55	423.79	409.55	





Aircraft type code	Destination	20	24	2030		2040		2050	
		Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
Airbus A320, Airbus A321NEO	Prague - Ruzyne International, Czech Republic	296.89	298.11	287.71	294.34	287.71	294.34	287.71	294.34
Airbus A320, Airbus A320NEO, Airbus A321NEO	Punta Raisi, Italy	296.89	298.11	0.00	604.64	0.00	703.89	0.00	703.89
Boeing 737 MAX 8	Riga International, Latvia	0.00	0.00	0.00	271.11	0.00	329.44	0.00	329.44
Airbus A320, Airbus A320NEO	Ronaldsway, Isle of Man	296.89	298.11	311.21	310.30	423.79	409.55	423.79	409.55
Boeing 737 MAX 8	Roumanieres, France	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
Airbus A321NEO, Boeing 737-700W, Embraer 195-E2	Schiphol, Netherlands	2082.14	2085.00	2070.43	2083.68	1695.43	1708.68	1695.43	1708.68
Airbus A320, Airbus A321NEO	Schwechat International, Austria	593.78	596.22	560.21	579.56	287.71	294.34	287.71	294.34
Airbus A320, Airbus A320NEO, Airbus A321NEO, Boeing 737 MAX 8, Boeing 737-800W	Son Sant Joan Airport, Spain	1447.96	1455.13	1464.97	1470.09	1344.22	1327.67	1344.22	1327.67
Airbus A320, Airbus A320NEO	St-Exupéry, France	296.89	298.11	311.21	310.30	423.79	409.55	423.79	409.55
Airbus A320, Airbus A320NEO	Stuttgart Echterdingen, Germany	296.89	298.11	0.00	310.30	0.00	409.55	0.00	409.55
Airbus A320NEO, Airbus A321NEO, Boeing 737 MAX 10	Sur Reina Sofia, Spain	548.50	549.62	543.96	550.59	543.96	550.59	543.96	550.59
Boeing 737 MAX 8	Valencia, Spain	276.57	276.36	279.58	271.11	345.00	329.44	345.00	329.44
Boeing 737 MAX 10, Boeing 737-800W	Zakinthos International Airport, Greece	282.00	283.70	256.25	256.25	256.25	256.25	256.25	256.25
Airbus A320NEO, Airbus A321NEO	Zürich-Kloten, Switzerland	0.00	294.62	0.00	294.34	0.00	294.34	0.00	294.34
Airbus A400M, AS365 Dauphin 2,	Other	5020.00	5020.00	5020.00	5020.00	5020.00	5020.00	5020.00	5020.00





Aircraft type code	Destination	202	24	2030		2040		2050	
		Without Development	With Development	Without Development	With Development	Without Development	With Development	Without Development	With Development
Augusta AW139, Beech King Air 200, Cessna 172, Cessna Citation 525, Cessna Mustang 510, Cirrus SR22, Citation Excel 560XL, Embraer E145, Embraer Legacy 500, Eurocopter EC135, Falcon 2000, Gulfstream 550, Learjet 45, Piper PA28, Socata Tobago 10									

Surface access emissions

	Number of car	Number of car drop off	Number of taxi	Number of bus passengers	Number of rail passengers	Number of motorcycle
District	Journeys	Journeys	Journeys			journeys
Basingstoke and Deane District	1935.74	1136.19	168.32	94.18	753.42	42.08
Bracknell Forest	410.42	240.90	35.69	19.97	159.74	8.92
Cherwell District	836.07	490.74	72.70	40.68	325.41	18.18
City of Portsmouth	1038.34	609.46	90.29	50.52	404.13	22.57
City of Southampton	1340.55	786.85	116.57	65.22	521.76	29.14
East Hampshire District	305.49	179.31	26.56	14.86	118.90	6.64
Eastleigh District	410.34	240.85	35.68	19.96	159.71	8.92
Fareham District	636.69	373.71	55.36	30.98	247.81	13.84
Gosport District	772.99	453.71	67.22	37.61	300.86	16.80
Hampshire County Unspecified	4.19	2.46	0.36	0.20	1.63	0.09
Hart District	408.54	239.80	35.53	19.88	159.01	8.88
Havant District	555.06	325.80	48.27	27.00	216.04	12.07

Table 10A.18Passenger modal splits under the 'Without Development' case in 2024





	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						· ·
New Forest District	1936.47	1136.62	168.39	94.21	753.70	42.10
Oxford District	4544.56	2667.46	395.18	221.10	1768.80	98.79
Oxfordshire County Unspecified	61.36	36.02	5.34	2.99	23.88	1.33
Reading	2055.44	1206.46	178.73	100.00	800.01	44.68
Rushmoor District	116.36	68.30	10.12	5.66	45.29	2.53
Slough	176.92	103.84	15.38	8.61	68.86	3.85
South Oxfordshire District	404.56	237.46	35.18	19.68	157.46	8.79
Test Valley District	1387.17	814.21	120.62	67.49	539.90	30.16
Vale of White Horse District	3857.75	2264.33	335.46	187.69	1501.49	83.86
West Berkshire	2686.48	1576.85	233.61	130.70	1045.62	58.40
West Oxfordshire District	1972.70	1157.89	171.54	95.98	767.80	42.88
Winchester District	1159.58	680.62	100.83	56.42	451.33	25.21
Windsor and Maidenhead	406.05	238.33	35.31	19.76	158.04	8.83
Wokingham	1108.72	650.77	96.41	53.94	431.53	24.10
Bath and North East Somerset	64818.26	88214.20	39121.08	105880.99	19952.45	0.00
Bournemouth	2254.43	1007.57	226.70	48.42	387.34	0.00
Bournemouth Airport	10.06	4.49	1.01	0.22	1.73	0.00
Bristol Airport	8559.85	2139.96	5349.91	832.81	0.00	0.00
Cheltenham District	20764.97	16958.77	7189.50	3118.01	5464.56	84.58
Christchurch District	254.66	113.81	25.61	5.47	43.75	0.00
City of Bristol	193225.70	360962.06	333417.12	417016.62	14056.74	822.24
City of Plymouth	101472.70	44686.20	6156.29	26629.79	20782.30	0.00
Cornwall	209954.44	54964.49	4951.76	10256.87	27731.55	0.00
Cotswold District	11719.64	9571.44	4057.72	1759.79	3084.17	47.74
Devon County Unspecified	2502.87	1102.21	151.85	656.84	512.60	0.00
Dorset County Unspecified	607.53	271.52	61.09	13.05	104.38	0.00
East Devon District	87442.15	38507.47	5305.07	22947.71	17908.75	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
East Darsat District	2521 17	1121 25	254 52	54.26	121 88	0.00
Exeter Airport	109.00	07.62	12.07	52.22	40.76	0.00
Exeter Airport	02740.20	41290.00	EC07 17	24600 52	10109 62	0.00
Exeter District	14002 46	41200.99	5156 50	24000.55	2010 20	0.00
Forest of Dean District	14893.46	12163.49	5156.59	2236.36	3919.39	60.67
Gloucester District	23526.33	19213.96	8145.57	3532.65	6191.24	95.83
Gloucestershire County Unspecified	131.05	107.03	45.37	19.68	34.49	0.53
Mendip District	44949.67	58718.04	14983.22	9378.06	1563.01	404.95
Mid Devon District	34026.48	14984.46	2064.37	8929.67	6968.86	0.00
North Devon District	46313.71	20395.47	2809.83	12154.25	9485.36	0.00
North Dorset District	2766.16	1236.27	278.16	59.41	475.26	0.00
North Somerset	91985.36	185623.16	102450.76	64907.93	2093.80	0.00
Poole	2455.64	1097.49	246.94	52.74	421.90	0.00
Purbeck District	1446.89	646.65	145.50	31.07	248.59	0.00
Sedgemoor District	72732.61	85857.29	13124.68	5109.70	3406.47	546.86
Somerset County Unspecified	1226.14	1839.21	0.00	0.00	0.00	0.00
South Gloucestershire	125459.21	102462.61	43438.01	18838.61	33016.12	511.04
South Hams District	44309.44	19512.84	2688.23	11628.26	9074.88	0.00
South Somerset District	110240.54	75243.54	7582.68	7241.30	6788.72	583.28
Stroud District	35195.69	28744.34	12185.88	5284.89	9262.17	143.36
Swindon	41613.64	35090.42	5960.87	1785.08	16320.69	0.00
Taunton Deane District	66696.64	47938.21	7816.01	14964.37	11026.38	0.00
Teignbridge District	53978.56	23770.89	3274.85	14165.76	11055.18	0.00
Tewkesbury District	9122.36	7450.23	3158.45	1369.79	2400.66	37.16
Torbay	54202.04	23869.31	3288.41	14224.41	11100.95	0.00
Torridge District	16863.16	7426.14	1023.08	4425.45	3453.69	0.00
West Devon District	15493.41	6822.93	939.98	4065.98	3173.16	0.00
West Dorset District	45797.63	20468.22	4605.35	983.57	7868.52	0.00
West Somerset District	14489.84	9398.82	1174.85	2953.81	2953.81	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						
Weymouth and Portland District	11187.92	5000.19	1125.04	240.28	1922.20	0.00
Wiltshire	120151.38	101316.84	17210.87	5154.06	47122.85	0.00
Abertawe - Swansea	55395.19	22289.19	3277.82	18709.21	10205.03	0.00
Blaenau Gwent - Blaenau Gwent	19202.38	9601.19	1440.18	1125.05	0.00	0.00
Bro Morgannwg - the Vale of Glamorgan	28241.05	14120.52	1283.68	13003.68	0.00	0.00
Caerdydd - Cardiff	137945.33	75290.77	20533.85	132191.75	0.00	0.00
Caerffili - Caerphilly	48673.91	31711.79	3687.42	24804.28	0.00	0.00
Cardiff Airport	489.26	267.04	72.83	468.86	0.00	0.00
Casnewydd - Newport	68250.00	44270.27	11682.43	28331.82	0.00	0.00
Castell-nedd Port Talbot - Neath Port Talbot	29802.21	7071.71	3535.85	8851.29	0.00	0.00
Conwy - Conwy	0.00	39.60	0.00	0.00	0.00	0.00
Gwynedd - Gwynedd	123.13	0.00	0.00	0.00	0.00	0.00
Merthyr Tudful - Merthyr Tydfil	10441.08	6044.84	4945.77	0.00	0.00	0.00
Pen-y-bont ar Ogwr - Bridgend	30037.68	15236.50	1305.99	4382.85	0.00	0.00
Powys - Powys	21087.09	10543.55	1622.08	6758.91	0.00	0.00
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	61952.82	25131.81	4675.68	9925.66	0.00	0.00
Sir Benfro - Pembrokeshire	30723.12	5266.82	1316.70	1712.32	0.00	0.00
Sir Ceredigion - Ceredigion	6646.90	2099.02	0.00	409.43	0.00	0.00
Sir Ddinbych - Denbighshire	0.00	0.00	0.00	0.00	0.00	0.00
Sir Fynwy - Monmouthshire	58869.96	29154.65	7849.33	9527.85	0.00	0.00
Sir Gaerfyrddin - Carmarthenshire	52791.70	17415.82	2176.98	7155.70	0.00	0.00
Sir y Fflint - Flintshire	12.10	5.41	1.34	0.39	2.49	0.00
Sir Ynys Mon - Isle of Anglesey	37.59	0.00	0.00	0.00	0.00	0.00
	-					



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Tor-faen - Torfaen	27801.83	25330.56	4942.55	5732.86	0.00	0.00
Wrecsam - Wrexham	51.19	22.90	5.66	1.65	10.53	0.00
Birmingham Airport	72.12	32.26	7.97	2.33	14.83	0.00
Birmingham District	4923.05	2202.42	544.13	158.83	1012.56	0.00
Bromsgrove District	2776.37	1242.06	306.86	89.57	571.03	0.00
Cannock Chase District	352.76	157.81	38.99	11.38	72.55	0.00
City of Stoke-on-Trent	1491.34	667.18	164.83	48.12	306.73	0.00
City of Wolverhampton District	2024.38	905.65	223.75	65.31	416.37	0.00
County of Herefordshire	43109.54	19285.85	4764.74	1390.85	8866.65	0.00
Coventry District	1567.21	701.12	173.22	50.56	322.34	0.00
Dudley District	4557.91	2039.07	503.77	147.05	937.46	0.00
East Staffordshire District	384.40	171.97	42.49	12.40	79.06	0.00
Lichfield District	445.72	199.40	49.26	14.38	91.67	0.00
Malvern Hills District	4951.72	2215.24	547.29	159.76	1018.45	0.00
Newcastle-under-Lyme District	265.47	118.76	29.34	8.56	54.60	0.00
North Warwickshire District	196.18	87.76	21.68	6.33	40.35	0.00
Nuneaton and Bedworth District	369.13	165.14	40.80	11.91	75.92	0.00
Redditch District	1767.51	790.73	195.36	57.03	363.54	0.00
Rugby District	319.82	143.08	35.35	10.32	65.78	0.00
Sandwell District	3667.42	1640.69	405.35	118.32	754.30	0.00
Shropshire	3945.23	1764.97	436.05	127.29	811.44	0.00
Shropshire County Unspecified	77.92	34.86	8.61	2.51	16.03	0.00
Solihull District	2262.17	1012.02	250.03	72.98	465.28	0.00
South Staffordshire District	1039.89	465.21	114.94	33.55	213.88	0.00
Stafford District	987.28	441.68	109.12	31.85	203.06	0.00
Staffordshire Moorlands District	686.68	307.20	75.90	22.15	141.24	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Stratford-on-Avon District	2179.14	974.88	240.85	70.31	448.20	0.00
Tamworth District	261.20	116.85	28.87	8.43	53.72	0.00
Telford and Wrekin	1182.43	528.98	130.69	38.15	243.20	0.00
Walsall District	1062.84	475.48	117.47	34.29	218.60	0.00
Warwick District	1659.84	742.56	183.46	53.55	341.39	0.00
West Midlands Unspecified	2.68	1.20	0.30	0.09	0.55	0.00
Worcester District	8734.77	3907.66	965.42	281.81	1796.54	0.00
Wychavon District	9520.54	4259.19	1052.27	307.16	1958.16	0.00
Wyre Forest District	1471.69	658.39	162.66	47.48	302.69	0.00

The number of car, car drop off, taxi and motorcycle vehicle movements are shown. Variable numbers of passengers are assumed to travel in each vehicle based on assumptions in **Chapter 6** of the ES Addendum.

Passengers who travel by active transport means (cycling or walking) are assumed to contribute zero emissions.

Table 10A.19 Passenger modal splits under the 'Without Development' case in 2030

District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Basingstoke and Deane District	2082.20	1222.16	181.06	101.30	810.42	45.27
Bracknell Forest	435.46	255.59	37.87	21.19	169.49	9.47
Cherwell District	803.12	471.40	69.84	39.07	312.59	17.46
City of Portsmouth	1107.99	650.34	96.35	53.91	431.25	24.09
City of Southampton	1389.17	815.38	120.80	67.59	540.68	30.20
East Hampshire District	336.78	197.67	29.28	16.38	131.08	7.32
Eastleigh District	436.29	256.08	37.94	21.23	169.81	9.48
Fareham District	673.80	395.49	58.59	32.78	262.25	14.65
Gosport District	752.67	441.78	65.45	36.62	292.95	16.36
Hampshire County Unspecified	4.32	2.53	0.38	0.21	1.68	0.09
Hart District	413.88	242.93	35.99	20.14	161.09	9.00
Havant District	588.06	345.16	51.14	28.61	228.88	12.78
New Forest District	1860.56	1092.07	161.79	90.52	724.16	40.45





	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						
Oxford District	4459.27	2617.40	387.76	216.95	1735.61	96.94
Oxfordshire County Unspecified	57.39	33.69	4.99	2.79	22.34	1.25
Reading	2146.25	1259.76	186.63	104.42	835.35	46.66
Rushmoor District	123.55	72.52	10.74	6.01	48.09	2.69
Slough	180.96	106.22	15.74	8.80	70.43	3.93
South Oxfordshire District	419.34	246.13	36.46	20.40	163.21	9.12
Test Valley District	1449.75	850.94	126.07	70.53	564.26	31.52
Vale of White Horse District	4074.63	2391.63	354.32	198.24	1585.90	88.58
West Berkshire	2753.65	1616.27	239.45	133.97	1071.76	59.86
West Oxfordshire District	1901.38	1116.03	165.34	92.51	740.04	41.33
Winchester District	1204.31	706.88	104.72	58.59	468.73	26.18
Windsor and Maidenhead	416.72	244.60	36.24	20.27	162.19	9.06
Wokingham	1191.41	699.30	103.60	57.96	463.71	25.90
Bath and North East Somerset	65784.81	89529.62	39704.44	107459.85	20249.97	0.00
Bournemouth	2092.82	935.34	210.45	44.95	359.57	0.00
Bournemouth Airport	9.05	4.05	0.91	0.19	1.56	0.00
Bristol Airport	9030.58	2257.64	5644.11	878.61	0.00	0.00
Cheltenham District	19315.94	15775.34	6687.80	2900.43	5083.22	78.68
Christchurch District	232.13	103.75	23.34	4.99	39.88	0.00
City of Bristol	201515.93	376448.91	347722.17	434908.46	14659.84	857.51
City of Plymouth	96250.40	42386.42	5839.46	25259.29	19712.74	0.00
Cornwall	197553.68	51718.06	4659.28	9651.06	26093.61	0.00
Cotswold District	11600.51	9474.14	4016.47	1741.90	3052.81	47.25
Devon County Unspecified	2319.25	1021.34	140.71	608.65	475.00	0.00
Dorset County Unspecified	590.02	263.70	59.33	12.67	101.37	0.00
East Devon District	84497.31	37210.63	5126.41	22174.89	17305.63	0.00
East Dorset District	2328.26	1040.56	234.13	50.00	400.02	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Exeter Airport	179.23	78.93	10.87	47.03	36.71	0.00
Exeter District	91879.10	40461.40	5574.25	24112.12	18817.47	0.00
Forest of Dean District	13640.35	11140.08	4722.73	2048.20	3589.62	55.56
Gloucester District	23092.81	18859.92	7995.48	3467.55	6077.15	94.06
Gloucestershire County Unspecified	121.29	99.06	42.00	18.21	31.92	0.49
Mendip District	46954.49	61336.95	15651.50	9796.33	1632.72	423.01
Mid Devon District	34991.15	15409.28	2122.89	9182.84	7166.43	0.00
North Devon District	46468.58	20463.67	2819.22	12194.89	9517.08	0.00
North Dorset District	2687.15	1200.96	270.22	57.71	461.68	0.00
North Somerset	98866.48	199509.00	110114.76	69763.47	2250.43	0.00
Poole	2256.69	1008.58	226.93	48.47	387.72	0.00
Purbeck District	1313.37	586.98	132.07	28.21	225.65	0.00
Sedgemoor District	75960.26	89667.37	13707.11	5336.45	3557.64	571.13
Somerset County Unspecified	1221.73	1832.60	0.00	0.00	0.00	0.00
South Gloucestershire	131577.73	107459.61	45556.44	19757.35	34626.28	535.96
South Hams District	43284.35	19061.42	2626.04	11359.25	8864.93	0.00
South Somerset District	116783.77	79709.56	8032.75	7671.10	7191.66	617.90
Stroud District	34949.06	28542.92	12100.49	5247.85	9197.27	142.36
Swindon	43788.43	36924.29	6272.40	1878.37	17173.63	0.00
Taunton Deane District	69912.31	50249.48	8192.85	15685.85	11558.00	0.00
Teignbridge District	52218.68	22995.88	3168.08	13703.91	10694.74	0.00
Tewkesbury District	8683.01	7091.42	3006.34	1303.82	2285.04	35.37
Torbay	52613.23	23169.64	3192.02	13807.45	10775.55	0.00
Torridge District	17295.18	7616.39	1049.29	4538.83	3542.17	0.00
West Devon District	15024.09	6616.26	911.50	3942.82	3077.04	0.00
West Dorset District	46154.33	20627.64	4641.22	991.23	7929.81	0.00
West Somerset District	14479.17	9391.89	1173.99	2951.63	2951.63	0.00
Weymouth and Portland District	10297.24	4602.12	1035.48	221.15	1769.18	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Wiltshire	123944.95	104515.74	17754.28	5316.79	48610.67	0.00
Abertawe - Swansea	50388.55	20274.68	2981.57	17018.27	9282.69	0.00
Blaenau Gwent - Blaenau Gwent	17906.18	8953.09	1342.96	1049.10	0.00	0.00
Bro Morgannwg - the Vale of Glamorgan	25497.01	12748.50	1158.95	11740.17	0.00	0.00
Caerdydd - Cardiff	134927.93	73643.87	20084.69	129300.20	0.00	0.00
Caerffili - Caerphilly	45511.29	29651.29	3447.82	23192.60	0.00	0.00
Cardiff Airport	425.14	232.04	63.28	407.40	0.00	0.00
Casnewydd - Newport	67792.56	43973.55	11604.13	28141.93	0.00	0.00
Castell-nedd Port Talbot - Neath Port Talbot	27259.37	6468.33	3234.16	8096.06	0.00	0.00
Conwy - Conwy	0.00	31.77	0.00	0.00	0.00	0.00
Gwynedd - Gwynedd	109.29	0.00	0.00	0.00	0.00	0.00
Merthyr Tudful - Merthyr Tydfil	9642.12	5582.28	4567.32	0.00	0.00	0.00
Pen-y-bont ar Ogwr - Bridgend	27203.27	13798.76	1182.75	3969.28	0.00	0.00
Powys - Powys	19912.13	9956.06	1531.70	6382.30	0.00	0.00
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	57490.97	23321.81	4338.94	9210.81	0.00	0.00
Sir Benfro - Pembrokeshire	28078.47	4813.45	1203.36	1564.93	0.00	0.00
Sir Ceredigion - Ceredigion	5625.96	1776.62	0.00	346.54	0.00	0.00
Sir Ddinbych - Denbighshire	0.00	0.00	0.00	0.00	0.00	0.00
Sir Fynwy - Monmouthshire	58485.64	28964.32	7798.09	9465.64	0.00	0.00
Sir Gaerfyrddin - Carmarthenshire	49004.02	16166.28	2020.78	6642.30	0.00	0.00
Sir y Fflint - Flintshire	9.82	4.40	1.09	0.32	2.02	0.00
Sir Ynys Mon - Isle of Anglesey	29.89	0.00	0.00	0.00	0.00	0.00
Tor-faen - Torfaen	27013.98	24612.73	4802.48	5570.40	0.00	0.00



	Number of car	Number of car drop off	Number of taxi	Number of bus passengers	Number of rail passengers	Number of motorcycle
District	Journeys	Journeys	Journeys			journeys
Wrecsam - Wrexham	46.57	20.83	5.15	1.50	9.58	0.00
Birmingham Airport	65.31	29.22	7.22	2.11	13.43	0.00
Birmingham District	4251.48	1901.98	469.90	137.17	874.43	0.00
Bromsgrove District	2427.37	1085.93	268.29	78.31	499.25	0.00
Cannock Chase District	298.77	133.66	33.02	9.64	61.45	0.00
City of Stoke-on-Trent	1314.53	588.08	145.29	42.41	270.37	0.00
City of Wolverhampton District	1723.51	771.05	190.49	55.61	354.49	0.00
County of Herefordshire	40685.71	18201.50	4496.84	1312.65	8368.12	0.00
Coventry District	1357.01	607.08	149.99	43.78	279.11	0.00
Dudley District	3930.33	1758.31	434.40	126.80	808.38	0.00
East Staffordshire District	345.54	154.58	38.19	11.15	71.07	0.00
Lichfield District	385.59	172.50	42.62	12.44	79.31	0.00
Malvern Hills District	4527.91	2025.64	500.45	146.08	931.29	0.00
Newcastle-under-Lyme District	226.57	101.36	25.04	7.31	46.60	0.00
North Warwickshire District	166.02	74.27	18.35	5.36	34.15	0.00
Nuneaton and Bedworth District	315.37	141.09	34.86	10.17	64.86	0.00
Redditch District	1529.94	684.45	169.10	49.36	314.67	0.00
Rugby District	282.69	126.47	31.24	9.12	58.14	0.00
Sandwell District	3158.49	1413.01	349.10	101.90	649.63	0.00
Shropshire	3404.74	1523.18	376.31	109.85	700.28	0.00
Shropshire County Unspecified	65.05	29.10	7.19	2.10	13.38	0.00
Solihull District	1953.77	874.06	215.94	63.03	401.85	0.00
South Staffordshire District	896.51	401.07	99.09	28.92	184.39	0.00
Stafford District	876.48	392.11	96.87	28.28	180.27	0.00
Staffordshire Moorlands District	590.02	263.96	65.21	19.04	121.35	0.00
Stratford-on-Avon District	1926.24	861.74	212.90	62.15	396.18	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Tamworth District	219.63	98.26	24.27	7.09	45.17	0.00
Telford and Wrekin	1013.16	453.26	111.98	32.69	208.38	0.00
Walsall District	897.18	401.37	99.16	28.95	184.53	0.00
Warwick District	1525.75	682.57	168.64	49.23	313.81	0.00
West Midlands Unspecified	2.19	0.98	0.24	0.07	0.45	0.00
Worcester District	7613.06	3405.84	841.44	245.62	1565.83	0.00
Wychavon District	8368.90	3743.98	924.98	270.01	1721.29	0.00
Wyre Forest District	1245.11	557.02	137.62	40.17	256.09	0.00

Table 10A.20Passenger modal splits under the 'With Development' case in 2024

District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Basingstoke and Deane District	2052.55	1204.76	178.48	99.86	798.88	44.62
Bracknell Forest	437.03	256.52	38.00	21.26	170.10	9.50
Cherwell District	887.67	521.02	77.19	43.19	345.49	19.30
City of Portsmouth	1104.90	648.53	96.08	53.76	430.04	24.02
City of Southampton	1428.72	838.59	124.24	69.51	556.08	31.06
East Hampshire District	325.75	191.20	28.33	15.85	126.79	7.08
Eastleigh District	433.58	254.49	37.70	21.09	168.76	9.43
Fareham District	677.29	397.54	58.89	32.95	263.61	14.72
Gosport District	829.74	487.02	72.15	40.37	322.95	18.04
Hampshire County Unspecified	4.42	2.59	0.38	0.21	1.72	0.10
Hart District	436.11	255.98	37.92	21.22	169.74	9.48
Havant District	591.15	346.98	51.40	28.76	230.08	12.85
New Forest District	2048.26	1202.24	178.11	99.65	797.21	44.53
Oxford District	4814.25	2825.76	418.63	234.22	1873.77	104.66
Oxfordshire County Unspecified	64.45	37.83	5.60	3.14	25.09	1.40



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Reading	2178.95	1278.95	189.47	106.01	848.08	47.37
Rushmoor District	123.63	72.56	10.75	6.01	48.12	2.69
Slough	187.16	109.86	16.28	9.11	72.85	4.07
South Oxfordshire District	430.46	252.66	37.43	20.94	167.54	9.36
Test Valley District	1472.79	864.46	128.07	71.65	573.23	32.02
Vale of White Horse District	4066.92	2387.11	353.65	197.86	1582.90	88.41
West Berkshire	2849.07	1672.28	247.75	138.61	1108.90	61.94
West Oxfordshire District	2100.88	1233.12	182.69	102.21	817.69	45.67
Winchester District	1233.94	724.27	107.30	60.03	480.27	26.82
Windsor and Maidenhead	430.88	252.91	37.47	20.96	167.70	9.37
Wokingham	1178.06	691.47	102.44	57.31	458.52	25.61
Bath and North East Somerset	66631.85	90682.40	40215.67	108843.50	20510.71	0.00
Bournemouth	2403.68	1074.27	241.71	51.62	412.98	0.00
Bournemouth Airport	10.63	4.75	1.07	0.23	1.83	0.00
Bristol Airport	8596.30	2149.07	5372.69	836.36	0.00	0.00
Cheltenham District	21735.26	17751.20	7525.45	3263.71	5719.90	88.53
Christchurch District	271.86	121.50	27.34	5.84	46.71	0.00
City of Bristol	197037.54	368082.88	339994.56	425243.25	14334.04	838.46
City of Plymouth	104931.74	46209.48	6366.15	27537.56	21490.74	0.00
Cornwall	218400.72	57175.66	5150.96	10669.50	28847.17	0.00
Cotswold District	12230.71	9988.83	4234.67	1836.53	3218.66	49.82
Devon County Unspecified	2601.87	1145.80	157.85	682.82	532.88	0.00
Dorset County Unspecified	641.55	286.72	64.51	13.78	110.22	0.00
East Devon District	90324.89	39776.96	5479.96	23704.24	18499.15	0.00
East Dorset District	2692.13	1203.19	270.72	57.82	462.54	0.00
Exeter Airport	207.62	91.43	12.60	54.49	42.52	0.00
Exeter District	96796.65	42626.98	5872.60	25402.64	19824.62	0.00
Forest of Dean District	15612.37	12750.63	5405.50	2344.31	4108.58	63.59



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Gloucester District	24413.29	19938.35	8452.67	3665.83	6424.65	99.44
Gloucestershire County						
Unspecified	137.26	112.10	47.52	20.61	36.12	0.56
Mendip District	45760.61	59777.37	15253.54	9547.25	1591.21	412.26
Mid Devon District	34770.90	15312.29	2109.53	9125.04	7121.32	0.00
North Devon District	47513.13	20923.67	2882.60	12469.02	9731.01	0.00
North Dorset District	2927.78	1308.51	294.41	62.88	503.02	0.00
North Somerset	93398.45	188474.72	104024.62	65905.05	2125.97	0.00
Poole	2610.29	1166.61	262.49	56.06	448.48	0.00
Purbeck District	1535.53	686.27	154.41	32.98	263.82	0.00
Sedgemoor District	73860.21	87188.37	13328.16	5188.92	3459.28	555.34
Somerset County Unspecified	1255.39	1883.08	0.00	0.00	0.00	0.00
South Gloucestershire	128107.16	104625.20	44354.82	19236.22	33712.96	521.82
South Hams District	45868.00	20199.19	2782.79	12037.28	9394.08	0.00
South Somerset District	113035.14	77150.97	7774.90	7424.87	6960.82	598.07
Stroud District	36378.69	29710.50	12595.47	5462.52	9573.49	148.18
Swindon	43062.14	36311.86	6168.36	1847.21	16888.79	0.00
Taunton Deane District	68020.06	48889.41	7971.10	15261.29	11245.16	0.00
Teignbridge District	55789.10	24568.21	3384.69	14640.91	11425.99	0.00
Tewkesbury District	9527.73	7781.31	3298.81	1430.66	2507.34	38.81
Torbay	55973.44	24649.39	3395.88	14689.28	11463.74	0.00
Torridge District	17406.70	7665.50	1056.06	4568.10	3565.01	0.00
West Devon District	16041.31	7064.22	973.22	4209.77	3285.37	0.00
West Dorset District	47403.91	21186.10	4766.87	1018.06	8144.50	0.00
West Somerset District	14844.06	9628.58	1203.57	3026.01	3026.01	0.00
Weymouth and Portland District	11785.04	5267.06	1185.09	253.10	2024.80	0.00
Wiltshire	124233.43	104759.00	17795.60	5329.17	48723.81	0.00
Abertawe - Swansea	58049.07	23357.02	3434.86	19605.54	10693.93	0.00



	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						
Blaenau Gwent - Blaenau Gwent	19858.77	9929.38	1489.41	1163.50	0.00	0.00
Bro Morgannwg - the Vale of Glamorgan	29588.44	14794.22	1344.93	13624.09	0.00	0.00
Caerdydd - Cardiff	143032.55	78067.39	21291.11	137066.78	0.00	0.00
Caerffili - Caerphilly	50471.05	32882.66	3823.56	25720.10	0.00	0.00
Cardiff Airport	518.02	282.73	77.11	496.41	0.00	0.00
Casnewydd - Newport	70171.35	45516.55	12011.31	29129.41	0.00	0.00
Castell-nedd Port Talbot - Neath Port Talbot	31047.37	7367.17	3683.59	9221.10	0.00	0.00
Conwy - Conwy	0.00	42.39	0.00	0.00	0.00	0.00
Gwynedd - Gwynedd	129.47	0.00	0.00	0.00	0.00	0.00
Merthyr Tudful - Merthyr Tydfil	10863.02	6289.12	5145.64	0.00	0.00	0.00
Pen-y-bont ar Ogwr - Bridgend	31425.01	15940.22	1366.30	4585.28	0.00	0.00
Powys - Powys	21797.75	10898.88	1676.75	6986.69	0.00	0.00
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	64308.53	26087.42	4853.47	10303.07	0.00	0.00
Sir Benfro - Pembrokeshire	32028.20	5490.55	1372.64	1785.06	0.00	0.00
Sir Ceredigion - Ceredigion	7049.27	2226.09	0.00	434.21	0.00	0.00
Sir Ddinbych - Denbighshire	0.00	0.00	0.00	0.00	0.00	0.00
Sir Fynwy - Monmouthshire	60308.99	29867.31	8041.20	9760.75	0.00	0.00
Sir Gaerfyrddin - Carmarthenshire	54956.22	18129.89	2266.24	7449.09	0.00	0.00
Sir y Fflint - Flintshire	12.94	5.79	1.43	0.42	2.66	0.00
Sir Ynys Mon - Isle of Anglesey	40.26	0.00	0.00	0.00	0.00	0.00
Tor-faen - Torfaen	28583.58	26042.82	5081.53	5894.06	0.00	0.00
Wrecsam - Wrexham	53.73	24.04	5.94	1.73	11.05	0.00
Birmingham Airport	75.09	33.59	8.30	2.42	15.44	0.00



	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						
Birmingham District	5225.14	2337.56	577.52	168.58	1074.69	0.00
Bromsgrove District	2932.80	1312.04	324.15	94.62	603.21	0.00
Cannock Chase District	374.95	167.74	41.44	12.10	77.12	0.00
City of Stoke-on-Trent	1572.18	703.34	173.77	50.72	323.36	0.00
City of Wolverhampton District	2151.60	962.56	237.81	69.42	442.53	0.00
County of Herefordshire	44906.52	20089.76	4963.35	1448.82	9236.24	0.00
Coventry District	1664.91	744.83	184.02	53.72	342.43	0.00
Dudley District	4840.45	2165.46	535.00	156.17	995.57	0.00
East Staffordshire District	405.38	181.36	44.81	13.08	83.38	0.00
Lichfield District	473.26	211.72	52.31	15.27	97.34	0.00
Malvern Hills District	5203.75	2327.99	575.15	167.89	1070.29	0.00
Newcastle-under-Lyme District	281.62	125.99	31.13	9.09	57.92	0.00
North Warwickshire District	208.58	93.31	23.05	6.73	42.90	0.00
Nuneaton and Bedworth District	392.68	175.67	43.40	12.67	80.77	0.00
Redditch District	1876.57	839.52	207.41	60.54	385.97	0.00
Rugby District	338.85	151.59	37.45	10.93	69.69	0.00
Sandwell District	3907.28	1747.99	431.86	126.06	803.64	0.00
Shropshire	4189.11	1874.07	463.01	135.15	861.60	0.00
Shropshire County Unspecified	82.98	37.12	9.17	2.68	17.07	0.00
Solihull District	2399.37	1073.40	265.19	77.41	493.49	0.00
South Staffordshire District	1101.53	492.79	121.75	35.54	226.56	0.00
Stafford District	1039.35	464.97	114.88	33.53	213.77	0.00
Staffordshire Moorlands District	727.73	325.56	80.43	23.48	149.68	0.00
Stratford-on-Avon District	2311.12	1033.92	255.44	74.56	475.34	0.00
Tamworth District	278.40	124.55	30.77	8.98	57.26	0.00
Telford and Wrekin	1256.18	561.98	138.84	40.53	258.37	0.00





District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Walsall District	1131.69	506.28	125.08	36.51	232.76	0.00
Warwick District	1755.06	785.16	193.98	56.62	360.98	0.00
West Midlands Unspecified	2.87	1.28	0.32	0.09	0.59	0.00
Worcester District	9220.21	4124.83	1019.08	297.47	1896.39	0.00
Wychavon District	10057.64	4499.47	1111.63	324.49	2068.63	0.00
Wyre Forest District	1565.64	700.42	173.04	50.51	322.02	0.00

Table 10A.21Passenger modal splits under the 'With Development' case in 2030

District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						
Basingstoke and Deane District	2937.35	1724.10	255.42	173.68	1389.41	63.86
Bracknell Forest	632.05	370.99	54.96	37.37	298.97	13.74
Cherwell District	1138.50	668.25	99.00	67.32	538.53	24.75
City of Portsmouth	1598.86	938.46	139.03	94.54	756.28	34.76
City of Southampton	2021.92	1186.78	175.82	119.55	956.40	43.95
East Hampshire District	492.76	289.23	42.85	29.14	233.08	10.71
Eastleigh District	601.37	352.98	52.29	35.56	284.46	13.07
Fareham District	969.97	569.33	84.35	57.35	458.81	21.09
Gosport District	1141.81	670.19	99.29	67.51	540.09	24.82
Hampshire County Unspecified	5.93	3.48	0.52	0.35	2.81	0.13
Hart District	609.74	357.89	53.02	36.05	288.42	13.26
Havant District	852.69	500.49	74.15	50.42	403.33	18.54
New Forest District	2570.78	1508.94	223.55	152.00	1216.02	55.89
Oxford District	6233.77	3658.95	542.07	368.58	2948.66	135.52
Oxfordshire County Unspecified	75.96	44.58	6.60	4.49	35.93	1.65
Reading	3023.82	1774.85	262.94	178.79	1430.31	65.74
Rushmoor District	176.87	103.82	15.38	10.46	83.66	3.85



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Slough	251 74	147 76	21.89	14.88	119.08	5.47
South Oxfordshire District	604.91	255.05	52.60	25 77	286.12	12 15
Tort Valley District	2059 10	1208 60	170.05	121 75	072.00	13.15
	2039.10	1208.00	179.05	121.75	515.55	44.70
Vale of White Horse District	5513.74	3236.32	479.46	326.01	2608.08	119.86
West Berkshire	3881.39	2278.21	337.51	229.49	1835.96	84.38
West Oxfordshire District	2747.24	1612.51	238.89	162.44	1299.49	59.72
Winchester District	1733.99	1017.78	150.78	102.53	820.20	37.70
Windsor and Maidenhead	591.86	347.40	51.47	35.00	279.96	12.87
Wokingham	1705.20	1000.88	148.28	100.82	806.58	37.07
Bath and North East Somerset	71659.19	97524.34	43249.93	148866.94	28052.82	0.00
Bournemouth	3109.49	1389.72	312.69	79.62	636.93	0.00
Bournemouth Airport	12.62	5.64	1.27	0.32	2.59	0.00
Bristol Airport	9160.51	2290.13	5725.32	1054.24	0.00	0.00
Cheltenham District	25295.06	20658.49	8757.96	4561.58	7994.52	103.03
Christchurch District	347.82	155.45	34.98	8.91	71.25	0.00
City of Bristol	212387.56	396758.04	366481.51	573428.75	19329.06	903.78
City of Plymouth	115138.54	50704.32	6985.39	36769.45	28695.44	0.00
Cornwall	250724.68	65637.83	5913.32	14623.33	39537.16	0.00
Cotswold District	14854.75	12131.89	5143.19	2678.83	4694.86	60.51
Devon County Unspecified	2884.73	1270.37	175.02	921.24	718.95	0.00
Dorset County Unspecified	821.75	367.26	82.63	21.04	168.32	0.00
East Devon District	100322.22	44179.56	6086.49	32037.86	25002.84	0.00
East Dorset District	3401.66	1520.30	342.07	87.10	696.78	0.00
Exeter Airport	231.18	101.81	14.03	73.83	57.62	0.00
Exeter District	108850.03	47935.00	6603.87	34761.21	27128.19	0.00
Forest of Dean District	18047.06	14739.04	6248.47	3254.51	5703.78	73.51
Gloucester District	28514.56	23287.86	9872.66	5142.17	9012.05	116.15



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
Gloucestershire County						
Unspecified	159.13	129.96	55.10	28.70	50.29	0.65
Mendip District	51424.47	67176.11	17141.49	12758.26	2126.38	463.28
Mid Devon District	38584.12	16991.54	2340.88	12321.82	9616.14	0.00
North Devon District	52600.64	23164.09	3191.25	16797.99	13109.41	0.00
North Dorset District	3793.47	1695.41	381.47	97.13	777.03	0.00
North Somerset	105566.75	213029.92	117577.34	89448.06	2885.42	0.00
Poole	3283.45	1467.46	330.18	84.07	672.56	0.00
Purbeck District	1890.92	845.11	190.15	48.42	387.33	0.00
Sedgemoor District	82566.47	97465.69	14899.21	6859.64	4573.09	620.80
Somerset County Unspecified	1406.40	2109.60	0.00	0.00	0.00	0.00
South Gloucestershire	145678.57	118975.77	50438.61	26270.92	46041.82	593.40
South Hams District	52141.74	22962.00	3163.41	16651.44	12995.04	0.00
South Somerset District	134253.67	91633.46	9234.38	10452.21	9798.95	710.34
Stroud District	42002.50	34303.46	14542.62	7574.51	13274.92	171.09
Swindon	52976.09	44671.73	7588.47	2739.01	25042.40	0.00
Taunton Deane District	76662.48	55101.16	8983.88	20732.18	15276.34	0.00
Teignbridge District	62231.67	27405.37	3775.56	19873.66	15509.71	0.00
Tewkesbury District	11202.14	9148.80	3878.54	2020.14	3540.45	45.63
Torbay	62339.74	27452.96	3782.12	19908.17	15536.64	0.00
Torridge District	20409.98	8988.08	1238.26	6517.92	5086.68	0.00
West Devon District	18106.30	7973.59	1098.50	5782.24	4512.55	0.00
West Dorset District	56157.36	25098.26	5647.11	1437.87	11502.93	0.00
West Somerset District	16388.47	10630.36	1328.79	4031.91	4031.91	0.00
Weymouth and Portland District	14124.17	6312.48	1420.31	361.64	2893.11	0.00
Wiltshire	147880.07	124698.87	21182.82	7645.82	69904.60	0.00
Abertawe - Swansea	65621.34	26403.85	3882.92	27043.02	14750.74	0.00
Blaenau Gwent - Blaenau Gwent	22094.88	11047.44	1657.12	1527.66	0.00	0.00



Dictrict	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
District						
Bro Morgannwg - the Vale of Glamorgan	33409.96	16704.98	1518.63	18626.88	0.00	0.00
Caerdydd - Cardiff	159343.46	86969.90	23719.06	191540.94	0.00	0.00
Caerffili - Caerphilly	55588.95	36217.05	4211.28	34386.03	0.00	0.00
Cardiff Airport	576.04	314.40	85.75	692.44	0.00	0.00
Casnewydd - Newport	78640.70	51010.18	13461.02	39360.80	0.00	0.00
Castell-nedd Port Talbot - Neath Port Talbot	34770.38	8250.60	4125.30	12383.61	0.00	0.00
Conwy - Conwy	0.00	49.15	0.00	0.00	0.00	0.00
Gwynedd - Gwynedd	149.69	0.00	0.00	0.00	0.00	0.00
Merthyr Tudful - Merthyr Tydfil	12442.70	7203.67	5893.91	0.00	0.00	0.00
Pen-y-bont ar Ogwr - Bridgend	36076.74	18299.79	1568.55	6246.70	0.00	0.00
Powys - Powys	24016.79	12008.39	1847.45	9264.22	0.00	0.00
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	72212.37	29293.70	5449.99	13757.81	0.00	0.00
Sir Benfro - Pembrokeshire	36506.54	6258.26	1564.57	2402.91	0.00	0.00
Sir Ceredigion - Ceredigion	8168.97	2579.67	0.00	594.28	0.00	0.00
Sir Ddinbych - Denbighshire	0.00	0.00	0.00	0.00	0.00	0.00
Sir Fynwy - Monmouthshire	66910.46	33136.61	8921.39	12872.15	0.00	0.00
Sir Gaerfyrddin - Carmarthenshire	62826.05	20726.12	2590.76	10114.29	0.00	0.00
Sir y Fflint - Flintshire	14.84	6.64	1.64	0.57	3.65	0.00
Sir Ynys Mon - Isle of Anglesey	46.41	0.00	0.00	0.00	0.00	0.00
Tor-faen - Torfaen	31755.46	28932.75	5645.41	7778.16	0.00	0.00
Wrecsam - Wrexham	62.00	27.74	6.85	2.39	15.24	0.00
Birmingham Airport	82.57	36.94	9.13	3.18	20.29	0.00
Birmingham District	6105.82	2731.55	674.85	235.37	1500.46	0.00
Bromsgrove District	3381.16	1512.63	373.71	130.34	830.89	0.00



District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
	422.50	102.07	47.00	10 71	100 55	0.00
Cannock Chase District	433.58	193.97	47.92	16.71	106.55	0.00
City of Stoke-on-Trent	1804.82	807.42	199.48	69.57	443.52	0.00
City of Wolverhampton District	2500.78	1118.77	276.40	96.40	614.55	0.00
County of Herefordshire	51997.43	23262.01	5747.08	2004.38	12777.94	0.00
Coventry District	1962.31	877.88	216.89	75.64	482.22	0.00
Dudley District	5673.37	2538.09	627.06	218.70	1394.18	0.00
East Staffordshire District	475.51	212.73	52.56	18.33	116.85	0.00
Lichfield District	555.52	248.52	61.40	21.41	136.52	0.00
Malvern Hills District	6107.00	2732.08	674.98	235.41	1500.75	0.00
Newcastle-under-Lyme District	324.71	145.26	35.89	12.52	79.79	0.00
North Warwickshire District	241.28	107.94	26.67	9.30	59.29	0.00
Nuneaton and Bedworth District	460.41	205.97	50.89	17.75	113.14	0.00
Redditch District	2202.52	985.34	243.44	84.90	541.25	0.00
Rugby District	401.76	179.74	44.41	15.49	98.73	0.00
Sandwell District	4662.95	2086.06	515.38	179.75	1145.88	0.00
Shropshire	4915.21	2198.91	543.26	189.47	1207.87	0.00
Shropshire County Unspecified	95.92	42.91	10.60	3.70	23.57	0.00
Solihull District	2792.58	1249.31	308.65	107.65	686.25	0.00
South Staffordshire District	1270.96	568.59	140.47	48.99	312.33	0.00
Stafford District	1192.56	533.51	131.81	45.97	293.06	0.00
Staffordshire Moorlands District	841.79	376.59	93.04	32.45	206.86	0.00
Stratford-on-Avon District	2755.35	1232.66	304.54	106.21	677.11	0.00
Tamworth District	324.79	145.30	35.90	12.52	79.81	0.00
Telford and Wrekin	1465.08	655.43	161.93	56.48	360.03	0.00
Walsall District	1317.99	589.63	145.67	50.81	323.88	0.00
Warwick District	2139.41	957.11	236.46	82.47	525.74	0.00





District	Number of car journeys	Number of car drop off journeys	Number of taxi journeys	Number of bus passengers	Number of rail passengers	Number of motorcycle journeys
West Midlands Unspecified	3.31	1.48	0.37	0.13	0.81	0.00
Worcester District	10578.02	4732.27	1169.15	407.76	2599.46	0.00
Wychavon District	11682.22	5226.26	1291.19	450.32	2870.81	0.00
Wyre Forest District	1818.38	813.48	200.98	70.09	446.85	0.00

Table 10A.22Employee modal splits under for 2024 'With Development' and 'Without Development' case.These values are also assumed to represent employee modal splits in 2030 'Without Development' case.

District	Number of car journeys	Number of bus passengers	Number of motorcycle journeys
New Forest District	1735.46	0.00	0.00
Vale of White Horse District	867.73	0.00	0.00
Bath and North East Somerset	39047.89	9444.36	0.00
Cheltenham District	1735.46	1349.19	0.00
City of Bristol	137252.29	33729.85	2361.27
City of Plymouth	0.00	1349.19	0.00
Cornwall	3470.92	0.00	0.00
Cotswold District	867.73	0.00	0.00
East Devon District	3470.92	0.00	0.00
Exeter District	867.73	0.00	0.00
Gloucester District	867.73	2698.39	1180.63
Mendip District	27528.42	1349.19	1180.63
North Devon District	867.73	0.00	0.00
North Somerset	200898.28	32369.60	4722.54
Sedgemoor District	46379.52	1349.19	2361.27
South Gloucestershire	62237.65	12120.63	1180.63
South Somerset District	9545.04	0.00	0.00
Stroud District	6941.85	1349.19	0.00
Swindon	4338.65	0.00	0.00
Taunton Deane District	7809.58	0.00	0.00







District	Number of car journeys	Number of bus passengers	Number of motorcycle journeys
Teignbridge District	1735.46	0.00	0.00
Tewkesbury District	867.73	0.00	0.00
Torbay	867.73	0.00	0.00
West Dorset District	2603.19	0.00	0.00
West Somerset District	867.73	0.00	0.00
Wiltshire	13644.72	2698.39	1180.63
Abertawe - Swansea	1735.46	0.00	0.00
Blaenau Gwent - Blaenau Gwent	867.73	0.00	0.00
Bro Morgannwg - the Vale of Glamorgan	5206.39	1338.14	0.00
Caerdydd - Cardiff	6941.85	1338.14	1180.63
Caerffili - Caerphilly	5835.14	0.00	0.00
Casnewydd - Newport	6074.12	2698.39	0.00
Castell-nedd Port Talbot - Neath Port Talbot	867.73	0.00	0.00
Merthyr Tudful - Merthyr Tydfil	867.73	0.00	0.00
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	1735.46	1349.19	0.00
Sir Fynwy - Monmouthshire	6941.85	0.00	0.00
Tor-faen - Torfaen	2603.19	0.00	0.00
County of Herefordshire	1735.46	0.00	0.00

No employees are assumed to travel by car drop off, taxi or rail journeys.

The number of car and motorcycle vehicle movements are shown. Variable numbers of employees are assumed to travel in each vehicle based on assumptions in **Chapter 6** of the ES Addendum.

Employees who travel by active transport means (cycling or walking) are assumed to contribute zero emissions.

Employees who work from home are assumed to contribute zero emissions.

Table 10A.23 Employee modal splits under for 2030 'With Development' case.

District	Number of car journeys	Number of bus passengers	Number of motorcycle journeys
New Forest District	2082.55	0.00	0.00
Vale of White Horse District	1041.28	0.00	0.00
Bath and North East Somerset	46857.47	11333.23	0.00
Cheltenham District	2082.55	1619.03	0.00
City of Bristol	164702.75	40475.82	2833.52
City of Plymouth	0.00	1619.03	0.00
Cornwall	4165.11	0.00	0.00





District	Number of car journeys	Number of bus passengers	Number of motorcycle journeys
Cotswold District	1041.28	0.00	0.00
East Devon District	4165.11	0.00	0.00
Exeter District	1041.28	0.00	0.00
Gloucester District	1041.28	3238.07	1416.76
Mendip District	33034.10	1619.03	1416.76
North Devon District	1041.28	0.00	0.00
North Somerset	241077.94	38843.52	5667.05
Sedgemoor District	55655.43	1619.03	2833.52
South Gloucestershire	74685.18	14544.76	1416.76
South Somerset District	11454.05	0.00	0.00
Stroud District	8330.22	1619.03	0.00
Swindon	5206.39	0.00	0.00
Taunton Deane District	9371.49	0.00	0.00
Teignbridge District	2082.55	0.00	0.00
Tewkesbury District	1041.28	0.00	0.00
Torbay	1041.28	0.00	0.00
West Dorset District	3123.83	0.00	0.00
West Somerset District	1041.28	0.00	0.00
Wiltshire	16373.67	3238.07	1416.76
Abertawe - Swansea	2082.55	0.00	0.00
Blaenau Gwent - Blaenau Gwent	1041.28	0.00	0.00
Bro Morgannwg - the Vale of Glamorgan	6247.66	1605.76	0.00
Caerdydd - Cardiff	8330.22	1605.76	1416.76
Caerffili - Caerphilly	7002.17	0.00	0.00
Casnewydd - Newport	7288.94	3238.07	0.00
Castell-nedd Port Talbot - Neath Port Talbot	1041.28	0.00	0.00
Merthyr Tudful - Merthyr Tydfil	1041.28	0.00	0.00
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	2082.55	1619.03	0.00
Sir Fynwy - Monmouthshire	8330.22	0.00	0.00
Tor-faen - Torfaen	3123.83	0.00	0.00
County of Herefordshire	2082.55	0.00	0.00

Appendix 10B Greenhouse Gas emissions associated with surface access to airports outside the South West

Introduction

This Appendix sets out the assessment of Greenhouse Gas (GHG) emissions associated with surface access to Bristol Airport in the 'With Development' case compared to other airports in the 'Without Development' case.

Additional capacity at Bristol Airport has the potential to clawback local demand from passengers from the South West region that currently travel to London's airports. Meeting regional passenger demand will help to reduce the need for passengers to travel long distances to fly, minimising associated emissions.

Increased demand for Bristol Airport leading to reduced travel to airports outside of the South West region (referred to as leakage) was not considered as part of the original Environmental Statement (ES) but has been quantified in the ES Addendum (see **Chapter 7: Socio-economics** of the ES Addendum).

The assessment provides evidence against the Government's general support for regional airports to minimise surface journeys, as well as leakage to other airports from the South West region as set out in North Somerset Council's Core Strategy Policy CS23: Bristol Airport³⁴.

The assessment should be read in conjunction with **Chapter 10: Carbon and Other Greenhouse Gases** of the ES Addendum. Emissions associated with leakage from the South West to other UK airports are not considered within the assessment of effects of the Proposed Development on the global climate. This is because the assessment does not relate to the journeys that would not exist in the 'Without Development' case, only the difference between the emissions from those customers that would chose to fly from Bristol Airport compared to another airport when the capacity of Bristol Airport is increased. Therefore, this assessment is provided as additional evidence only and does not affect the conclusions of the ES Addendum.

Methodology for quantifying GHG emissions associated with reducing leakage of passengers from the South West region to other airports

The extent of GHG emissions associated with the change in demand profiles at Bristol Airport and other UK airports in the 'With Development' and 'Without Development' cases has been quantified in this Appendix.

Providing greater availability and travel options at regional airports can influence the amount of GHG emissions associated with passengers travelling to and from airports outside their region, including the London airports. This leakage can result in additional GHG emissions associated with passengers travelling greater distance to airports further from a passenger's normal place of work or residence. This is referred to in the North Somerset Core Strategy Policy CS23: Bristol Airport³⁴.

Surface access emissions have been calculated based on passenger numbers provided in the BAL demand data produced for the Socio-economic assessment (**Chapter 7** of the ES Addendum), see **Section 0** of this Appendix. Calculations have been made for journeys to other airports under the 'Without Development' case and to Bristol Airport under the 'With Development' case. All journeys associated with more than 1,000 passenger trips per year have been considered in the assessment, representing 89% of the total journeys



³⁴ North Somerset Council (2017). Core Strategy, [online]. Available at: <u>https://www.n-somerset.gov.uk/sites/default/files/2020-07/core%20strategy.pdf</u> [Accessed 21 October 2020].



made at peak leakage once the 12 million passengers per annum (mppa) Proposed Development capacity is reached.

Existing journeys that are not related to the expansion of Bristol Airport from 10 mppa to 12 mppa are not included. New aviation demand from passengers choosing to travel only in a scenario where Bristol Airport is expanded are not considered since this assessment only considers journeys that would take place anyway. Full demand from the 12 mppa Proposed Development case are presented in **Chapter 10** of the ES Addendum.

Bristol Airport is currently the only UK airport with a commitment to offset passenger journeys by road to and from the airport³⁵. This offsetting commitment is therefore only included in the assessment in the 'With Development' case where there are journeys to Bristol Airport.

The modal splits for other airports have been derived from the latest available Civil Aviation Authority (CAA) passenger survey and updated for regional variations in preferred transport mode for common journeys (for those origin-airport pairs associated with more than 10,000 passengers in the 2030 time period). For those journeys with less than 10,000 passengers per year, the overall modal split for the relevant airport has been used. The number of total kilometres travelled for each mode of transport has been estimated based on publicly available information.

Passenger origin and modal splits have been forecast by Bristol Airport for 2024 and 2030, the later represents peak leakage once the 12 mppa Proposed Development capacity is reached. The assessment has been conducted for the time periods 2024, 2030, 2040 and 2050 using the emissions improvement factors described in **Section 10.6** of **Chapter 10** of the ES Addendum and **Section 10.2** of **Appendix 10A** of the ES Addendum. The passenger origin and modal splits are assumed constant beyond 2030.

Assessment of GHG emissions associated with reducing leakage of passengers from the South West region to other airports

The assessment indicates that compared to the 'Without Development' case, the 'With Development' case would result in a 29% reduction in total GHG emissions under the central emission scenario by 2050, related to passenger journeys which would take place anyway. This is equivalent to 2.1 ktCO_{2e}/yr avoided by passengers using the expanded Bristol Airport rather than travelling to other national airports in 2050 (**Figure 10B.8** Total surface access GHG emissions associated with displaced journeys in 'With Development' case and 'Without Development' cases, for the upper, central and lower emission scenario).

The upper and lower emission scenarios also show reductions in total GHG emissions in the 'With Development' case related to passenger journeys which would take place anyway. Under the upper emission scenario, the Proposed Development would result in a 26% reduction in GHG emissions compared to the 'Without Development' case by 2050. In the lower emission scenario, the Proposed Development would result in a 52% reduction in GHG emissions compared to the 'without development' case by 2050 (**Figure 10B.8**).

In all cases, the difference between the 'With Development' and 'Without Development' case is highest in 2030 due to the higher proportion of petrol and diesel engine vehicles used to access the airports, which accentuates the difference in kilometres travelled.



³⁵ Bristol Airport Limited (2019). Carbon Roadmap. [online]. Available at: <u>https://www.bristolairport.co.uk/about-us/environment/carbon-roadmap</u> [Accessed 21 October 2020].



Figure 10B.8 Total surface access GHG emissions associated with displaced journeys in 'With Development' case and 'Without Development' cases, for the upper, central and lower emission scenarios. Offsetting of surface access by road to Bristol Airport not considered.











Offsetting all passenger journeys to and from Bristol Airport by road is included in the core assessment of the ES Addendum as an embedded mitigation, see **Chapter 10** of the ES Addendum. **Figure 10B.9** shows the beneficial impact of this for the upper, central and lower emission scenarios.

Residual emissions associated with passenger journeys are reduced to $0.1 - 0.4 \text{ ktCO}_{2e}/\text{yr}$ in 2050 across the three scenarios (the vast majority of which is related to train travel to Bristol Temple Meads for onward travel) in the 'With Development' case. There are no published commitments from other airports to offset passenger journeys, therefore the residual emissions from the 'Without Development' case do not reduce.

Combined, the impact of reduced leakage from the South West region and the offsetting commitment represents an overall reduction of 84 - 97% in emissions by 2050 across the scenarios compared to the 'Without Development' case.

Figure 10B.9 Total surface access GHG emissions associated with displaced journeys in 'With Development' case and 'Without Development' cases, for the upper, central and lower emission scenarios. Offsetting of surface access by road to Bristol Airport considered.





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Summary of assessment

In the 'With Development' scenario, when the offsetting of surface access GHG emissions by road is considered, the benefit from realising passenger demand in the South-West at Bristol Airport rather than leaking demand to other UK airports is substantial. When offsetting is not considered, there is a small benefit.

As the core assessment is considered in isolation from other airports, this assessment is not considered within the assessment of predicted effects in **Section 10.10** of the ES Addendum, and does not affect the conclusions of the ES Addendum.

Supporting data

Table 00B.1 Demand data for passenger journeys under the 'Without Development' case to alternative airports in 2024 and 2030. In the 'With Development' case, all journeys are assumed to be to Bristol Airport.

Origin	Alternative airport destination in 'Without Development' case*	Passengers in 2024	Passengers in 2030
Caerdydd - Cardiff	Cardiff Airport	9185.24	66799.67
Cornwall	Newquay Airport	5945.37	42292.48
Abertawe - Swansea	Cardiff Airport	4878.22	33535.04
Cornwall	Exeter Airport	4169.59	29821.98
City of Plymouth	Exeter Airport	4253.25	29708.43
Exeter District	Exeter Airport	3586.70	25773.63
East Devon District	Exeter Airport	3437.55	24430.64
City of Bristol	Heathrow Airport	3978.60	23847.83
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	Cardiff Airport	3007.75	21009.27
Sir Gaerfyrddin - Carmarthenshire	Cardiff Airport	2900.20	20286.85
Caerffili - Caerphilly	Cardiff Airport	2749.82	19402.39





Origin	Alternative airport destination in 'Without Development' case*	Passengers in 2024	Passengers in 2030
Wiltshire	Heathrow Airport	2964.34	18854.58
Bro Morgannwg - the Vale of Glamorgan	Cardiff Airport	2757.73	18769.31
Wiltshire	Gatwick Airport	3184.01	18749.89
County of Herefordshire	Birmingham Airport	2564.89	18399.82
City of Bristol	Birmingham Airport	2366.62	18151.03
City of Bristol	Cardiff Airport	2158.55	16374.49
Pen-y-bont ar Ogwr - Bridgend	Cardiff Airport	2324.60	16017.19
Teignbridge District	Exeter Airport	2101.50	15029.49
Torbay	Exeter Airport	2080.73	14810.76
City of Bristol	Gatwick Airport	2701.09	14330.38
Casnewydd - Newport	Cardiff Airport	1930.41	14195.18
Castell-nedd Port Talbot - Neath Port Talbot	Cardiff Airport	1974.11	13616.51
Wiltshire	Luton Airport	1381.27	13607.39
Cheltenham District	Birmingham Airport	1801.79	12916.33
City of Bristol	Luton Airport	1380.77	12248.89
Bath and North East Somerset	Heathrow Airport	2010.34	11877.29
South Hams District	Exeter Airport	1586.80	11446.18
Sir Benfro - Pembrokeshire	Cardiff Airport	1615.66	11080.71
Stroud District	Birmingham Airport	1310.98	10070.74
Forest of Dean District	Birmingham Airport	1366.83	9746.53
Bath and North East Somerset	Gatwick Airport	1690.85	9226.24
South Somerset District	Gatwick Airport	1564.86	8841.07
Wiltshire	Stansted Airport	1182.26	8462.98
Gloucester District	Birmingham Airport	1061.16	8207.55
South Gloucestershire	Heathrow Airport	1296.86	7934.46
Bath and North East Somerset	Luton Airport	841.94	7762.47
City of Bristol	Stansted Airport	1205.05	7721.71
Swindon	Heathrow Airport	1106.88	7321.99
Swindon	Gatwick Airport	1090.71	6893.25

	Alternative airport destination in 'Without		
Origin	Development' case*	Passengers in 2024	Passengers in 2030
Caerdydd - Cardiff	Heathrow Airport	1057.04	6824.30
South Gloucestershire	Birmingham Airport	869.39	6791.19
South Gloucestershire	Gatwick Airport	1250.41	6769.95
Bath and North East Somerset	Birmingham Airport	792.39	6277.96
Tewkesbury District	Birmingham Airport	843.50	6023.65
Caerdydd - Cardiff	Birmingham Airport	802.71	5994.77
West Dorset District	Bournemouth Airport	754.67	5980.80
South Somerset District	Heathrow Airport	911.62	5702.33
Worcester District	Birmingham Airport	845.75	5620.68
North Devon District	Exeter Airport	767.38	5599.12
Swindon	Luton Airport	478.74	5141.43
Bath and North East Somerset	Stansted Airport	755.72	5021.99
West Dorset District	Gatwick Airport	886.54	5000.38
Weymouth and Portland District	Bournemouth Airport	669.93	4939.17
Wychavon District	Birmingham Airport	724.37	4910.99
South Gloucestershire	Luton Airport	540.12	4816.65
Merthyr Tudful - Merthyr Tydfil	Cardiff Airport	666.79	4665.67
Tor-faen - Torfaen	Cardiff Airport	633.28	4600.85
South Somerset District	Bournemouth Airport	568.95	4564.37
Swindon	Birmingham Airport	522.05	4478.91
Wiltshire	Birmingham Airport	518.18	4391.72
Cornwall	Heathrow Airport	753.28	4348.88
Exeter District	Heathrow Airport	602.71	4237.45
City of Plymouth	Heathrow Airport	634.12	4227.28
North Somerset	Heathrow Airport	669.82	4226.13
Torridge District	Exeter Airport	557.97	4158.52
West Devon District	Exeter Airport	580.03	4119.10
Mid Devon District	Exeter Airport	561.04	4104.97
Casnewydd - Newport	Birmingham Airport	528.28	3950.12



Origin	Alternative airport destination in 'Without Development' case*	Passangers in 2024	Passangars in 2020
South Somerset District	Luton Airport	390.90	3665.89
Powys - Powys	Cardiff Airport	504.26	3573.52
Blaenau Gwent - Blaenau Gwent	Cardiff Airport	501.37	3511.23
South Gloucestershire	Cardiff Airport	434.58	3353.41
South Hams District	Heathrow Airport	470.67	3349.72
Sir Fynwy - Monmouthshire	Birmingham Airport	448.35	3333.70
Swindon	Stansted Airport	426.19	3265.45
North Somerset	Birmingham Airport	418.57	3220.42
Stroud District	Heathrow Airport	545.66	3218.95
West Dorset District	Heathrow Airport	516.33	3206.93
Caerdydd - Cardiff	Gatwick Airport	616.55	3205.50
South Somerset District	Exeter Airport	404.77	3197.73
Sir Fynwy - Monmouthshire	Cardiff Airport	423.91	3125.65
East Devon District	Heathrow Airport	441.09	2994.39
South Gloucestershire	Stansted Airport	454.92	2976.38
Taunton Deane District	Exeter Airport	391.26	2961.51
Malvern Hills District	Birmingham Airport	428.87	2960.28
Casnewydd - Newport	Heathrow Airport	472.08	2925.17
Powys - Powys	Birmingham Airport	402.13	2892.13
Sedgemoor District	Heathrow Airport	446.48	2853.36
Dudley District	Birmingham Airport	439.88	2847.18
Taunton Deane District	Heathrow Airport	421.96	2811.66
Cotswold District	Birmingham Airport	339.67	2792.66
Stroud District	Gatwick Airport	522.50	2782.85
Torbay	Heathrow Airport	401.85	2769.26
Mendip District	Heathrow Airport	405.60	2594.86
Shropshire	Birmingham Airport	406.49	2585.71
Gloucester District	Heathrow Airport	437.31	2576.90
Sir Ceredigion - Ceredigion	Cardiff Airport	392.95	2560.19

	Alternative airport destination in 'Without		
Origin	Development' case*	Passengers in 2024	Passengers in 2030
Caerdydd - Cardiff	Luton Airport	286.41	2495.30
Abertawe - Swansea	Heathrow Airport	378.97	2472.17
Cotswold District	Heathrow Airport	389.10	2416.71
Blaenau Gwent - Blaenau Gwent	Birmingham Airport	339.51	2411.05
Cornwall	Gatwick Airport	472.54	2394.03
Tor-faen - Torfaen	Birmingham Airport	324.20	2380.44
Gloucester District	Gatwick Airport	440.37	2376.85
Cotswold District	Gatwick Airport	403.64	2374.93
Sandwell District	Birmingham Airport	374.42	2333.52
South Somerset District	Stansted Airport	327.27	2241.78
Sir Fynwy - Monmouthshire	Heathrow Airport	384.01	2203.36
Caerffili - Caerphilly	Birmingham Airport	298.98	2143.49
Teignbridge District	Heathrow Airport	319.22	2110.19
North Devon District	Heathrow Airport	317.21	2088.08
Stroud District	Luton Airport	226.46	2006.44
West Dorset District	Luton Airport	208.83	1990.10
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	Heathrow Airport	321.77	1986.84
Mendip District	Gatwick Airport	368.82	1978.96
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	Birmingham Airport	276.20	1967.66
County of Herefordshire	Cardiff Airport	273.60	1956.09
Cornwall	Birmingham Airport	266.26	1951.86
Sir Fynwy - Monmouthshire	Gatwick Airport	376.64	1939.80
Bath and North East Somerset	Cardiff Airport	239.94	1892.79
Sir Ceredigion - Ceredigion	Birmingham Airport	293.70	1888.06
Birmingham District	Luton Airport	102.36	1855.87
Casnewydd - Newport	Gatwick Airport	356.63	1855.81
Oxford District	Luton Airport	80.82	1853.98
North Somerset	Gatwick Airport	344.55	1842.06
City of Plymouth	Gatwick Airport	340.28	1805.09



	Alternative airport destination in 'Without		
Origin	Development' case*	Passengers in 2024	Passengers in 2030
Cotswold District	Luton Airport	175.17	1783.84
Gloucester District	Luton Airport	193.89	1766.16
Caerffili - Caerphilly	Heathrow Airport	294.06	1763.79
Exeter District	Gatwick Airport	319.12	1749.44
Bromsgrove District	Birmingham Airport	264.17	1713.95
Cornwall	Bournemouth Airport	233.48	1667.86
Cheltenham District	Luton Airport	189.84	1647.50
South Hams District	Cardiff Airport	223.82	1639.50
Abertawe - Swansea	Birmingham Airport	228.87	1632.53
City of Plymouth	Bournemouth Airport	230.17	1628.00
City of Plymouth	Birmingham Airport	212.66	1600.76
East Devon District	Gatwick Airport	302.64	1594.50
Cheltenham District	Heathrow Airport	283.34	1576.07
North Somerset	Cardiff Airport	196.62	1484.60
West Somerset District	Exeter Airport	199.65	1456.60
East Devon District	Bournemouth Airport	201.22	1451.65
Caerdydd - Cardiff	Stansted Airport	228.72	1434.22
Castell-nedd Port Talbot - Neath Port Talbot	Birmingham Airport	204.13	1427.01
Sir Gaerfyrddin - Carmarthenshire	Birmingham Airport	199.27	1422.67
North Somerset	Luton Airport	161.19	1409.21
Taunton Deane District	Gatwick Airport	253.48	1405.97
Sir Fynwy - Monmouthshire	Luton Airport	164.68	1397.68
Exeter District	Birmingham Airport	179.70	1395.12
Torridge District	Heathrow Airport	192.34	1383.13
Sir Gaerfyrddin - Carmarthenshire	Heathrow Airport	222.75	1380.37
West Dorset District	Stansted Airport	200.45	1379.22
Taunton Deane District	Birmingham Airport	173.19	1369.54
East Devon District	Cardiff Airport	183.56	1329.88
Sedgemoor District	Birmingham Airport	173.85	1318.27



Origin	Alternative airport destination in 'Without Development' case*	Passengers in 2024	Passengers in 2030
City of Plymouth	Luton Airport	151.63	1310.63
Casnewydd - Newport	Luton Airport	153.02	1309.24
Exeter District	Cardiff Airport	177.49	1303.02
East Devon District	Birmingham Airport	171.89	1290.73
North Devon District	Cardiff Airport	173.05	1283.24
Merthyr Tudful - Merthyr Tydfil	Birmingham Airport	180.75	1282.04
Caerffili - Caerphilly	Gatwick Airport	257.24	1280.04
Stroud District	Stansted Airport	192.70	1246.19
Wychavon District	Luton Airport	142.83	1245.35
County of Herefordshire	Heathrow Airport	224.11	1244.84
Teignbridge District	Cardiff Airport	169.15	1225.98
Cheltenham District	Gatwick Airport	237.28	1197.78
Coventry District	Luton Airport	65.05	1195.06
Oxford District	Gatwick Airport	205.74	1178.29
East Dorset District	Bournemouth Airport	149.28	1170.10
Sedgemoor District	Exeter Airport	156.42	1147.45
Wiltshire	Cardiff Airport	136.39	1142.49
Basingstoke and Deane District	Gatwick Airport	157.47	1142.32
Rhondda, Cynon, Taf - Rhondda, Cynon, Taff	Gatwick Airport	228.87	1135.90
Weymouth and Portland District	Gatwick Airport	215.69	1134.48
City of Wolverhampton District	Birmingham Airport	194.65	1127.85
Cornwall	Luton Airport	134.51	1117.43
Cornwall	Cardiff Airport	155.83	1116.25
Bath and North East Somerset	Bournemouth Airport	142.95	1115.92
Tor-faen - Torfaen	Heathrow Airport	192.96	1112.88
Mid Devon District	Heathrow Airport	163.46	1096.38
Cotswold District	Stansted Airport	151.62	1093.13
County of Herefordshire	Gatwick Airport	219.04	1091.56
Gloucester District	Stansted Airport	164.82	1084.10



Origin	Alternative airport destination in 'Without	Descongers in 2024	Descongers in 2020
ongin	Development case	Passengers in 2024	Passengers in 2050
North Dorset District	Bournemouth Airport	129.05	1080.76
Torbay	Gatwick Airport	195.16	1071.68
Exeter District	Bournemouth Airport	145.83	1066.47
Vale of White Horse District	Luton Airport	77.67	1060.28
West Berkshire	Gatwick Airport	159.99	1059.72
Oxford District	Stansted Airport	124.15	1053.98
South Hams District	Gatwick Airport	183.60	1050.58
County of Herefordshire	Luton Airport	125.84	1048.05
Redditch District	Birmingham Airport	165.57	1047.79
Forest of Dean District	Heathrow Airport	194.58	1041.17
Bro Morgannwg - the Vale of Glamorgan	Heathrow Airport	162.64	1036.29
Poole	Bournemouth Airport	132.21	1014.29
Wiltshire	Bournemouth Airport	120.45	1004.42

* In the 'With Development' case, all journeys are assumed to be to Bristol Airport.

All journeys associated with more than >1,000 passengers in the 2030 time period which represents peak leakage are included in the assessment and shown in the table above. This represents 89% of journeys.

Passenger origins and numbers are assumed to remain constant beyond 2030.

Appendix 10C Erratum to Original Environmental Statement

Erratum

Baseline aviation GHG emissions have been updated relative to the original ES to correct an error in the calculation of the Climb-Cruise-Descent (CCD) phase related to the conversion of nautical miles to kilometres flown.

This reduces the total 2017 aviation GHG emissions from 746.77 ktCO₂/yr to 472.45 ktCO₂/yr. **Table 10C.1** updates the aviation emissions for the 2017 baseline, superseding the figures for aviation emissions in **Table 17.3** of the original ES. All other baseline values remain the same as the original ES.

Table 10C.1 Updated 2017 baseline aviation emissions

Source	Activity	Emissions (CO ₂ kt/yr) - As stated in original ES	Emissions (CO ₂ kt/yr) - corrected
Aviation	Cruise domestic	44.25	27.93
	Cruise international	586.36	328.36
	LTO cycle domestic	18.83	18.83
	LTO cycle international	97.33	97.33
Subtotal a	aviation	746.77	472.45

This error is replicated in the future projections in the original ES, including the future baseline emissions. Data, figures and conclusions relating to aviation emissions have been reassessed in Chapter 9 of the ES Addendum and can be considered superseded as per **Table 10C.2.**

Table 10C.2 Data from the original ES that has been superseded by the ES Addendum

Original ES table / figure / section reference	ES Addendum table / figure / section reference
Table 17.4 Future baseline emissions	Section 10.7 Quantification of GHG emissions
Section 17.10 Assessment of effects: the global climate	Section 10.7 Quantification of GHG emissions and Section 1.8 Overall predicted effect of GHG emissions associated with the Proposed Development
Table 10 Summary of conclusions of significance (aviation emission source only)	Section 10.8, sub-section Summary of predicted effects