Passenger Traffic Forecasts for Bristol Airport to Inform the Proposed Development to 12 mppa

Bristol Airport Limited

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York Aviation

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1. Introduction

Background

1.1. York Aviation (YAL) has been commissioned by Bristol Airport Limited (BAL) to produce updated long term planning forecasts to inform the planning appeal against North Somerset Council's (NSC) decision in March 2020 to refuse planning permission for the expansion of Bristol Airport to accommodate 12 million passengers per annum (mppa) (the Proposed Development).

1.2. The original application was submitted to NSC in December 2018 and the forecasts, which were prepared in advance of the submission date, anticipated Bristol Airport reaching a throughput of 12 mppa by 2026. At around the time of the refusal of the application by NSC in mid-March 2020, the impact of the COVID-19 pandemic in Europe was starting to become clear. Early on during the pandemic, it was recognised that the virus would suppress demand for air travel in the short term, both due to Government restrictions on travel and also as a result of a likely economic downturn, that could delay the point at which 12 mppa would be reached. However, at that time, it was unclear how long the pandemic would last and what its severity would be; certainly, the scale of the second wave in Europe and further national restrictions could not have been anticipated. It is in this context that YAL was commissioned to provide updated forecasts to ensure that the appeal is on a sound basis in terms of the nature of future demand growth.

1.3. It is anticipated that the forecasts will provide the basis for the supplementary environmental assessments for the Proposed Development to be presented in an Addendum to the 2018 Environmental Statement (ES).

Scope of Work

1.4. The scope of work has included the following:

- **Production of detailed passenger forecasts**: Combining 'bottom up' short term forecasts and longer term econometrically driven forecasts over the period to which Bristol Airport reaches 12 mppa. These forecasts include consideration of different potential paths for growth taking into account different projections of economic growth as well as factors related to capacity at competing airports, such as the proposed third runway at London Heathrow. Furthermore, consideration is given to risks and uncertainties at the present time, particularly associated with the COVID-19 pandemic and its impact on the economy, the aviation sector generally and Bristol Airport specifically. The forecasts are cognisant of airline behaviours and views, as well as passenger behaviour and airport choice decisions.
- **Production of air transport movement (ATM) forecasts and environmental outputs**: These are required in order to inform capacity planning and supplementary environmental assessments.
- **Assessment of potential displacement**: The forecasts take into account how passengers would switch between airports as the air service provision at Bristol Airport grows over time and, in particular, identify the extent to which these passengers will choose Bristol Airport over other airports.

Impact of COVID-19 on the Forecasts

1.5. The forecasts have been developed in the context of the COVID-19 pandemic. In summer 2020, when the forecasts were being prepared, a limited number of flights had restarted operations across the UK airports and it is still a time of considerable uncertainty in terms of the progress of the pandemic in the short term, with rapid changes in UK and international approaches to handling the crisis, including travel corridors and quarantine restrictions.

1.6. Two key aspects arising from the COVID-19 pandemic are of particular influence on the forecasts:

- **In the short term**: Travel restrictions and other Government imposed measures associated with the pandemic impact air travel, as well as any public concerns about travel and flying. As has been seen, particularly with the development of the Government's quarantine list, the impact can be significant on the overall levels of air travel demand; and

- **In the short and medium term**: The underlying economic ramifications of the pandemic will impact on the underlying air travel market, with Gross Domestic Product (GDP) continuing to be a key parameter in determining the rate of growth (or shrinkage in times of economic downturns) of air travel in the UK and Europe.

1.7. Whilst there have been regional pandemics of a similar nature over recent years, often in China and the Far East, the rapid global spread of COVID-19 means that the specific impact on air travel in the UK and Europe is unprecedented, including the depth and length of any impact on demand as well as the likely recovery trajectory.

1.8. However, evidence from pandemics such as SARS (2003), Avian Flu (2005 and 2013) and MERS (2015), clearly shows an initial decline in demand, followed by a recovery back to pre-pandemic levels of demand and then a normal level of growth from the 'bounce back' point. As with the wider sector, we believe this is a pattern of recovery which is likely in Europe and the UK although, within this (as with any recovery), there will be some airports which will grow faster and slower than the overall market rate. Faster than average growth might be likely at airports that have strong airlines that are capable of using pricing as a mechanism to attract back passengers and growth.

1.9. Our forecasts, therefore, assume that the impact of COVID-19 is ultimately a short term issue covering the next 2-4 years and that, over the period of the planning forecasts, more normal market conditions and drivers for growth will return. Whilst the forecasts have been developed using the latest available information, including consultations with airlines, it must be recognised that uncertainty remains and to address this, we have produced Faster Growth and Slower Growth forecasts alongside our Core Case, with the Slower Growth Case in particular reflecting a slower economic recovery.

1.10. However, in all scenarios, there remains particular uncertainty for 2021 in relation to ongoing Government restrictions to control the spread of COVID-19 that could continue to prevent or deter passengers from travelling, meaning that the overall passenger throughput could, in the short term, be lower than underlying levels of demand due to ongoing passenger restrictions imposed by Government.

Structure of the Report

1.11. The report is structured as follows:

- in **Section 2**, we set out the approach taken to producing the forecasts and the main assumptions that have informed the analysis;
- in **Section 3**, we present the results of the forecasting process, including the range of growth rates identified, a potential range of forecast outcomes and the 'with' and 'without' development forecasts to inform the supplementary environmental assessments;
- in **Section 4**, we identify the outputs produced to inform the supplementary environmental assessments for the ES Addendum and the core assumptions used in producing these outputs.

2. Our Approach to Demand Forecasting

Introduction

2.1. In this section, we outline the overall approach adopted by YAL to develop the passenger forecasts and, from these, the outputs such as aircraft movements, fleet mixes and busy day scheduled aircraft timetables that are required to inform the supplementary environmental assessments in the ES Addendum. The approach taken for these updated forecasts has been designed, in particular, to help better understand and address uncertainty given the current market conditions around COVID-19.

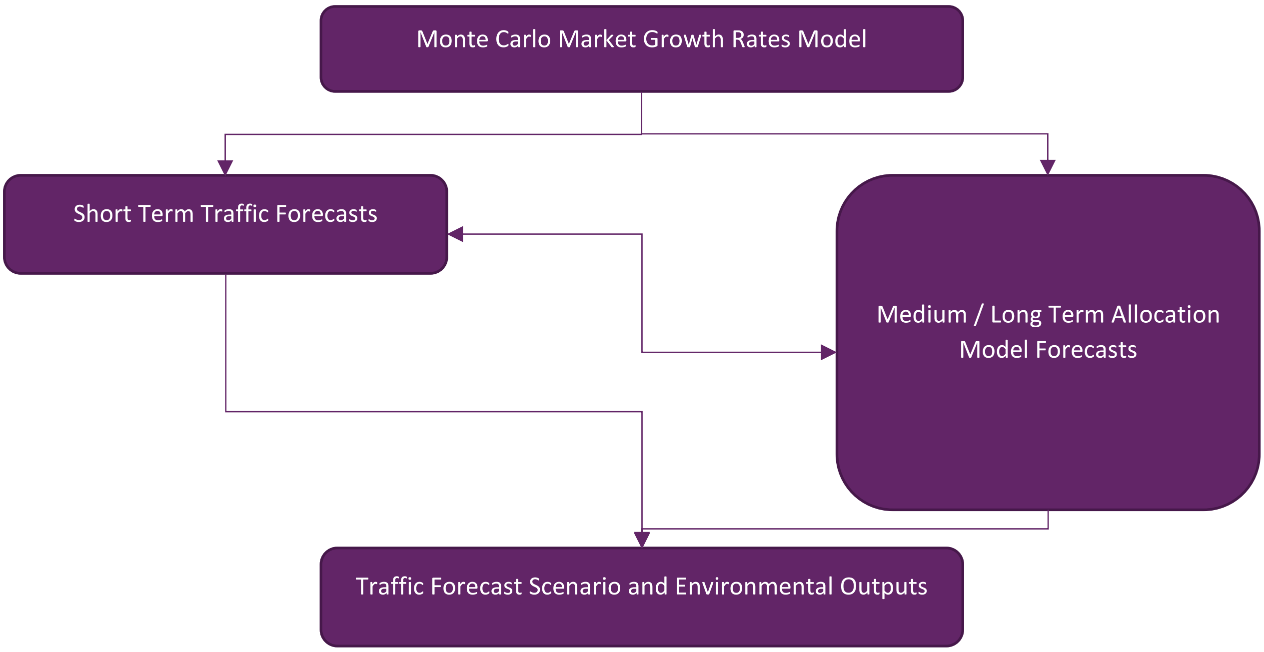
Overview of Our Approach

2.2. In producing passenger forecasts for Bristol Airport, we have adopted a hybrid approach combining 'top down' econometric forecasts with 'bottom up' route and airline specific forecasts for the short term. The 'top down' econometric approach enables robust consideration of macroeconomic effects, passenger choice and displacement, and long term trends. A 'bottom up', market intelligence led, process allows individual airline decisions and particular circumstances to be factored in over the period where the assumption of market equilibrium[1], upon which econometric models rely, is not being fulfilled.

2.3. The 'top down' model also uses a Monte Carlo simulation approach to assist in considering different potential paths for key forecast drivers moving forward, such as economic growth, fuel prices or carbon costs. Monte Carlo simulation is a mathematical technique that uses the probabilities of occurrence of different forecast drivers to analyse the potential range of outcomes that might occur in the future.

2.4. Figure 2.1 illustrates the interactions between these approaches, each element of which is described in more detail in this section.

Figure 2.1: Overview of Modelling Approach



2.5. By adopting a two stage approach, this allows us to take into account current uncertainties arising from COVID-19 and the airline reactions to the pandemic, albeit there remains risk as to the rate at which air travel can return to pre-COVID levels as Government controls and travel restrictions are lifted going into 2021. It should be noted that

[1] i.e. a balance between demand and supply.

the risks around the forecast range are believed to diminish in the medium and long term when more normal market conditions are expected to return and outcomes become more predictable. Nevertheless, the forecasts for Bristol Airport presented here include a range to reflect these uncertainties.

2.6. We consider the two key approaches in more detail below, but both are dependent on the same macroeconomic assumptions and underlying market growth rates. In summary, we use the approaches as follows:

- The **'Bottom up'** approach is primarily focussed on the short term but continues to influence the structure of demand over the longer term and provides the basis for many environmental assessment outputs;
- The **'Top Down'** element is the primary driver of passenger volumes over the medium to longer term and is central to understanding competition and market displacement issues.

Establishing Future Market Growth Rates

2.7. The first stage in the forecasting process was to develop an understanding of how underlying passenger demand in Bristol Airport's catchment area is expected to grow over time. The future growth rates model is based around the underlying analysis that underpins the Department for Transport's UK wide passenger demand forecasting model[2,3]. In our view, this represents the most robust assessment of overall passenger demand drivers in the UK market. At the outset, it is important to note that the initial stage is to forecast growth in the underlying market in which Bristol Airport operates and, as such, this does not directly represent how passenger volumes at Bristol Airport will grow in serving that market. A later stage of the modelling process then determines how much of the underlying market would be expected to use Bristol Airport in the context of market growth overall.

2.8. As with the Department for Transport model, the Bristol Airport model determines future growth rates in the market based on a forward view of two main drivers, economic growth, usually UK or overseas GDP (or a combination of the two), and modelled air fares, which are dependent on a number of core building blocks, notably:

- Fuel price and fuel consumption;
- Air Passenger Duty;
- Cost of carbon;
- Average sector length in different market segments; and
- Average aircraft size and load factor in different market segments.

2.9. How changes in economic growth and air fares translate through to growth in air transport markets is based on the elasticities identified within the Department for Transport's forecasting model. These were set out in detail in the Department's 2013 UK Aviation Forecasts Report and summarised in the 2017 UK Aviation Forecasts as reproduced in Table 2.1 below.

Table 2.1: Income and Air Fare Elasticities

Sector	Income Elasticity	Price Elasticity
UK Business	1.2	-0.2
UK Leisure	1.4	-0.7
Foreign Business	1.0	-0.2
Foreign Leisure	1.0	-0.7
International to International Transfers	0.5	-0.5
Domestic	1.1	-0.5
Total	1.2	-0.6

Source: Department for Transport.

[2] Department for Transport (2017), UK Aviation Forecasts.

[3] It should be noted that this does not imply that that the outputs will be the same as those from the Department for Transport model as set out in the 2017 UK Aviation Forecasts. The input assumptions are updated and, crucially, the passenger allocation model, described below, which identifies the traffic at individual airports has been developed specifically for the appeal. It should also be noted that the 2017 Department for Transport forecasts limited growth at Bristol Airport to its existing 10 mppa planning constraint.

2.10. Income elasticities are subject to the market maturity assumptions set out within the UK Aviation Forecasts 2017. Price elasticities remain constant throughout the forecast period in the model used here, as they do in the Department for Transport's model.

2.11. To enable the future growth rates model to consider uncertainty, risk and different potential scenarios for economic growth and drivers of air fares effectively in current circumstances, the model includes a Monte Carlo analysis. This is a mathematical simulation technique that, in essence, combines different random paths for core assumptions, such as GDP growth, air fare paths or market restrictions, but weights them within the analysis based on an assessment of their probability of occurrence. The simulation runs the potential different combinations of inputs, weighted by their probabilities, many times (the model identifies 1,000 iterations of what can be considered individual underlying growth rate scenarios) to determine a broad range of growth rates for each year for the forecast. This is helpful in defining a 'most likely' path but also in understanding the potential breadth of forecast outcomes. It is also helpful in, as far as possible, removing optimism bias from the forecasts. It is also important to understand that the growth rates that come forward from this analysis represent a rounded view of risk. Highs and lows are reflections of a wide range of factors rather than any specific potential driver. For instance, BREXIT is a factor in all the forecasts identified but lower range forecasts are a reflection of a BREXIT that has a greater adverse effect on international trade and travel. In the forecasts developed here, a range of scenarios have been presented that use the growth rates associated with different percentiles within the overall growth rate range.

2.12. This modelling approach uses future forecasts of key air transport demand drivers from a number of key sources:

- **Economic Growth** – a range of economic growth scenarios for the UK and other world regions has been developed based on economic forecasts from the Office Budgetary Responsibility[4], HM Treasury's review of independent forecasts[5], Bank of England[6], the International Monetary Fund[7] and the Organisation for Economic Co-operation and Development (OECD)[8]. In each case, the most recent short and long term forecasts available at the time of analysis were used. In each case, 'central' scenarios from each organisation are assumed to have a higher probability of occurrence. High and low forecasts are assumed to have less likelihood of occurrence, with the weighting of probabilities towards the downside given the current circumstances around the COVID-19 pandemic. In other words, low economic growth scenarios are assumed to be more likely to occur than high economic growth scenarios. This means that there is a degree of conservativeness inherent across all forecast scenarios;

- **Carbon Pricing** – the latest available guidance on carbon pricing from the Department for Business, Energy and Industrial Strategy (BEIS)[9] has been used to identify a range of scenarios for future carbon prices. It should be noted that the forecasts assume that passengers will, via some mechanism, have to pay for the carbon emissions associated with their travel. In other words, the cost of carbon is internalised within the forecasts;

- **Air Passenger Duty (APD)** – a series of potential paths for APD are set out, including both increasing APD and the possibility of an APD waiver;

- **Fuel Prices** – fuel prices have a significant influence on air fares. The potential future price of oil has been taken from the latest guidance from BEIS[10]. An additional scenario has also been added based on the BEIS' projections reflecting the current low oil prices.

2.13. The full range of assumption scenarios are set out in Appendix A, along with the probabilities assigned to each scenario within the Monte Carlo analysis.

[4] Office for Budgetary Responsibility (2020). July 2020 Fiscal sustainability report: Supplementary Tables and Office for Budgetary Responsibility (2018). Fiscal Sustainability Report.
[5] HM Treasury (2020). Forecasts for the UK economy: a comparison of independent forecasts May 2020.
[6] Bank of England (2020). Monetary Policy Report May 2020.
[7] International Monetary Fund (2020). World Economic Outlook Update June 2020.
[8] OECD (2020). Economic Outlook June 2020.
[9] HM Treasury (2018). Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal.
[10] Department for Business, Energy and Industrial Strategy (2020). BEIS 2019 Fossil Fuel Price Assumptions.

2.14. It should be noted that this analysis only provides guidance as to the expected underlying growth rates in air passenger demand in relation to changes due to the rate of economic growth or the cost of travel. In the current circumstances, there are clearly additional factors that are affecting the demand for air travel, such as, for instance, consumer confidence in travel, quarantine and other travel restrictions. The impact of these on the demand forecasts are dealt with via the 'bottom up' forecasting approach described below, but still taking account of the estimated overall potential market size identified in each year.

2.15. The growth rates by market segment, identified through this process, are applied to an underlying demand base defined at district level using Civil Aviation Authority (CAA) Passenger Survey data. The primary source is the 2019 survey data which provides information on demand using Bristol, Birmingham, Cardiff, Gatwick, Heathrow, Stansted and Luton airports and its surface origin or destination. Data for other relevant airports, notably Bournemouth, Exeter and Newquay, has been derived from the latest available CAA Passenger Survey data. Where earlier data has been used, demand levels have been updated to 2019 using CAA Statistics.

'Bottom Up' Forecasting

2.16. In any passenger forecast, over time, there will be years in which an airport performs above and below the long-term average passenger growth projection that is derived from an econometrically driven forecast. This is because airline supply-side decisions can lead to blocks of new capacity being added to an airport which allow step changes in growth in some years, even if the underlying demand overall grows in line with the wider market. Over a long-term forecast period, these intermittent step changes average out and a high level of confidence can be attributed to the overall shape and rate of growth expected over time.

2.17. However, such supply-side changes have a more pronounced impact on the forecasts in the early years and, therefore, we have developed 'bottom up' projections to cover the short term planning forecasts for Bristol Airport. This is particularly relevant to assessing the rate of early year growth that affects the year in which the airport is expected to reach its current 10 mppa cap. These forecasts converge to the 'top down' econometric forecast in the medium term and the latter becomes the primary forecast from the point that the two converge.

2.18. A core element of this work on the short term forecast has been to engage with the key airlines at BAL, namely easyJet, Ryanair and Tui[11]. In order to provide the greatest value to the forecasting process, these meetings remain commercially confidential, but the intelligence gathered on airline intentions influenced the short-term forecasts and also provided validation on the long-term forecasts based on how the airlines view the market within the region. Furthermore, engagement with the airlines has allowed us to consider other relevant matters including expected changes in the fleet mix over time (which are dealt with later in this section).

2.19. Whilst many 'bottom up' forecasts are derived solely from assumptions about aircraft capacity, frequency and load factors, YAL has expanded on this approach to develop a hybrid model to reflect not only airline behaviour, but also the underlying market demand at a route level to determine real world opportunities available to airlines to support the growth.

2.20. The model and forecasts have been developed through the following steps:

- The existing underlying demand for each CAA defined district in Bristol Airport's catchment area is determined from CAA survey data, split by route (existing and a long list of potential new routes);
- This underlying demand is then projected forward using the growth rates determined in the econometric modelling described above, broken down by passenger characteristics (i.e. business/leisure, UK/foreign) over the period for the short term forecasts;
- For existing routes, a market capture rate is determined for each district, i.e. how much of the market air services from Bristol Airport capture currently (2019). For existing routes, this remains static throughout the forecast period. For potential new routes, the average market capture for a basket of similar existing routes

[11] Jet2.com was not consulted as part of this analysis as, at the time of analysis, it was not an airline operating at the airport.

is determined and it is assumed that this market capture rate would apply to similar new routes (the baskets are assumed to be Domestic, Hub services, Leisure – Low Frequency, Leisure – High Frequency, City – Business/Leisure mix and City – Visiting Friends & Relatives (VFR), Leisure);

- For potential new routes, market stimulation is applied based on evidence of historic rates of stimulation seen at Bristol Airport as new services have been launched; and
- As the forecasts are based on point to point passengers, then for services to hub airports (when operated by a hub carrier or its partner) an 'onward connecting factor' is applied which bolsters the passengers to reflect that there will also be passengers using the hub. This is based on evidence seen at Bristol Airport as well as other UK regional airports with similar services.

2.21. This stepped approach determines the likely number of potential passengers which a route would be expected to attract at Bristol Airport, either existing routes with changes in underlying demand, or new routes if services were provided. At this point, we have undertaken three further steps:

- For existing routes that are expected to see a reduction in demand as a result of COVID-19, we have adjusted down frequency (and aircraft capacity where appropriate) until routes reach sensible load factors which would be commercially acceptable to the airlines operating them;
- Going forward, we increase frequency and aircraft capacity (determined by aircraft type assumptions) to meet the demand on existing routes based on appropriate target load factors; and
- We include new routes based on expected airline by airline increases in capacity at Bristol Airport. This assumes capacity and frequency, as well as commercial load factors, and then checks these against the previously calculated passenger potential on routes. If the potential demand is not enough to sustain a sensible schedule, then a route is not included in the forecast.

2.22. In some cases, there are routes which may generate a viable number of passengers, but which are not included in the forecast in a given year as this would require more airline capacity than we believe will be delivered based on feedback from the airlines and feedback from BAL itself on which carriers may be willing to launch new services at the airport.

2.23. The result is a route by route forecast, with an assumed split by airline and aircraft type. At the point when the total passenger forecast converges with the 'top-down' econometric forecast (in 2023), the econometric forecast is used thereafter as the more appropriate overall basis for the total passenger forecast, albeit the bottom up approach continues to inform the detail within the forecasts, such as route structure and aircraft mix.

2.24. The short-term forecasts have been developed assuming some return to normal flying conditions during 2021, i.e. passengers have greater freedom to travel, but demand is suppressed overall by the economic downturn arising from the COVID-19 pandemic. This also reflects the expected capacity and reaction to the market as discussed with the airlines. Given the strength of the low fares carriers, by comparison to many of the legacy full service carriers that are seeking significant government support across Europe and drastically cutting their fleet sizes, it is expected that these airlines will be best placed to dynamically react to the market and grow more quickly, which, without continued travel restrictions, would likely see more rapid growth at Bristol Airport than some comparator airports that have a lower presence of low fares airlines. The dynamic response of these carriers, along with other leisure airlines, has been seen at Bristol Airport recently as airlines have responded quickly by adding capacity as countries and regions were placed on the Government's Quarantine Exemption list.

2.25. However, in practice, the 'bottom-up' forecasts for the short term, particularly 2021, are likely to represent an upper bound which reflect the economic conditions, but which cannot factor in any as yet unknown COVID-19 restrictions which may carry over into the new year. As highlighted in Section 1 of this report, as restrictions lift it is expected that the market will return to normal conditions based on expected economic drivers. With a significant resurgence in COVID-19 cases and extreme measures by Government, passenger throughout at Bristol Airport could be around 3 to 6 mppa in 2021, which is less than that suggested by the 'bottom-up' methodology. Nonetheless, ultimately, we expect that more adverse conditions in the short term will result in a faster subsequent 'bounce back' as the air transport market catches up with economic recovery. This means that the medium to long term forecasts are not expected to be significantly affected by ongoing restrictions into 2021.

'Top Down' Allocation Model Forecasting

2.26. In the longer term, the traffic forecasts use an econometric passenger allocation model to determine how the underlying passenger demand base in the broad catchment area around Bristol Airport will split between it and a number of competing airports. The airports within the model are Bristol, Birmingham, Bournemouth, Cardiff, Exeter, Gatwick, Heathrow, Luton, Newquay and Stansted.

2.27. The allocation model is similar in concept to that used by the Department for Transport within its aviation forecasting suite. The approach uses a multinomial logit form, a type of discrete choice regression analysis. This essentially examines how passengers make choices between the different airports available based on factors including surface access time, flight time, the availability of the relevant destination, the 'quality' of service as represented by the level of service frequency offered, the availability of indirect options, airline type and fares on offer.

2.28. In this case, the model has been calibrated using data from CAA Passenger Survey, schedules data from the Official Airline Guide (OAG) and travel times data from Google Maps. For the majority of the airports in the model, the core passenger choice data has been drawn from the CAA Passenger Survey 2019[12]. Where airports were not surveyed in 2019, the last available CAA Passenger Survey data for that airport has been used as a basis with route networks and passenger volumes updated to 2019 levels using data from CAA Statistics.

2.29. Different models of passenger behaviour have been estimated to reflect different segments of the air transport market, notably different behaviours in relation to domestic, short haul and long haul travel.

2.30. The model operates at a CAA district level[13]. It derives market shares for each airport in the model within each district based on the passenger choice parameters described above. As markets grow, it examines how the market share balance will change based on how frequencies are expected to grow at each airport and based on any capacity constraints that are relevant at each airport. The way that frequency at each airport is expected to grow is based on airports' previous frequency growth in response to underlying demand growth in the UK market.

2.31. In relation to airport capacity constraints, only Heathrow and Gatwick are assumed to be currently constrained. Their growth within the model is limited to incremental growth up to assumed capacities of 90 million passengers per annum and 50 million passengers per annum respectively, consistent with Department for Transport assumed capacities. Capacity expansion plans at both airports are currently uncertain and are certainly highly unlikely to be delivered within the timescales originally envisaged within the plans of both airports. In the majority of scenarios tested, the model assumes that a third runway is delivered at Heathrow in 2033 and no additional capacity is added at Gatwick. A sensitivity test has, however, been undertaken, with Gatwick adding a second runway in 2028. In order to produce a 'Without Development' scenario to inform the supplementary environmental assessments in the ES Addendum, Bristol Airport is artificially constrained at 10 mppa, reflecting the extant planning permission.

2.32. The mechanism for applying this constraint within the model is by adding a time penalty for passengers using constrained airports. This makes the airports in question less attractive within the model and makes the initial choice to fly less attractive. This results in two effects: passengers choosing to use an alternative airport for their travel needs based on the relative attractiveness of the options available; or some passengers choosing not to travel. In the latter case, this effect uses elasticities once again taken from the Department for Transport's UK Aviation Forecasts to assess the number of passengers lost due to the increase in the effective 'cost' of flying.

[12] The CAA surveys a number of airports each year, the main London airports, Manchester, Birmingham and East Midlands. Others are surveyed on a rotational basis approximately every four years. Bristol and Cardiff were surveyed in 2019.
[13] In the main these reflect local authority districts but there are some minor differences.

Conclusions

2.33. The forecasts use a mixture of ‘bottom up’, market intelligence driven approaches and ‘top down’ econometric techniques to provide a rounded and comprehensive view of the market moving forward. This hybrid approach to demand forecasting represents a best practice methodology. It recognises the inherent uncertainty in the market currently due to the COVID-19 pandemic and uses a structured approach to assessing risk and uncertainty to ensure that different potential paths for future growth are reflected, considered and dealt with effectively.

3. Passenger Demand Forecasts

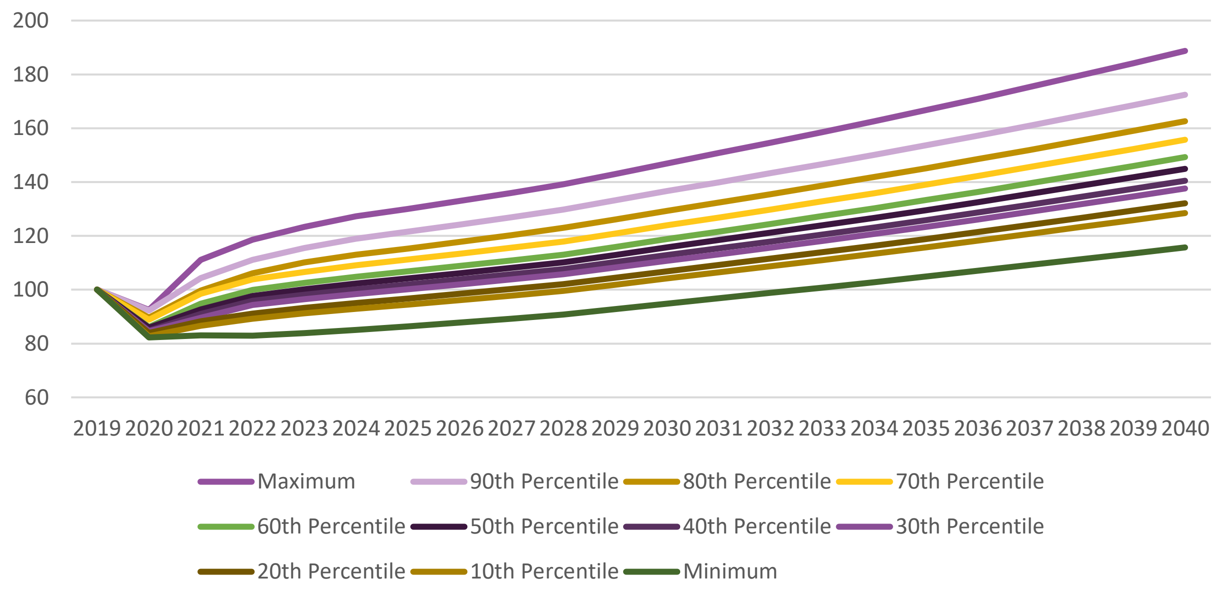
Introduction

3.1. In this section, we set out the passenger forecasts developed to inform the planning appeal for the Proposed Development. This includes establishing the range of underlying air passenger growth rates developed through the Monte Carlo growth rates model described in Section 2 and a number of scenarios for future growth at Bristol Airport based on the national level growth rates identified, including the Core Case, Slower Growth Case and Faster Growth Case for the Proposed Development.

Underlying Passenger Demand Growth Rates

3.2. Figure 3.1 shows the range of potential underlying demand growth rates for Bristol Airport's catchment area derived from the Monte Carlo growth rates model[14]. Growth is indexed to 100 for 2019. It should again be noted that this shows the expected growth in passenger demand based on changes in income (GDP) and air fares. The rates do not reflect the broader effects associated with the COVID-19 pandemic coming from quarantine and travel restrictions and consumer confidence. These effects have been dealt with via the 'bottom up' forecasts through analysis of restrictions and discussions with the airline community. These underlying growth forecasts are presented as percentiles through the range. The closer the range is to the 50% percentile the higher the probability of occurrence.

Figure 3.1: Index of Underlying Passenger Demand Growth Rates by Percentiles (2019 = 100)



Source: York Aviation.

3.3. The forecast growth rates represent a substantial range in potential outcomes and the influence of the economic effects of the COVID-19 pandemic are obvious. The mid-range scenarios see passenger demand in Bristol Airport's catchment area recover to 2019 levels by around 2023 and total traffic growth of around 40% by 2040. More optimistic scenarios see recovery in underlying demand by 2021 or 2022 and total traffic growth of between 55% and 89% by 2040. Again, we would emphasise that this analysis does not reflect the influence of travel restrictions or issues such as consumer confidence in flying. Consequently, the short term forecasts may be optimistic in general

[14] The input assumptions for the Monte Carlo analysis are set out in Appendix A.

as they do not sufficiently reflect the 'shock' associated with COVID-19. However, in the medium to long term, when normal market conditions will return, we believe these forecasts represent a reasonable range.

3.4. These growth rates form the basis for the scenarios modelled for Bristol Airport in considering potential future growth in the context of the proposed expansion to 12 mppa.

Updated Traffic Forecasts for the Planning Appeal

3.5. Based on our analysis, we have identified a range of different scenarios for future growth at Bristol Airport and present these as Core, Slower Growth and Faster Growth Cases, with each reaching 10 mppa and growing to 12 mppa over different timescales. In summary, these scenarios are:

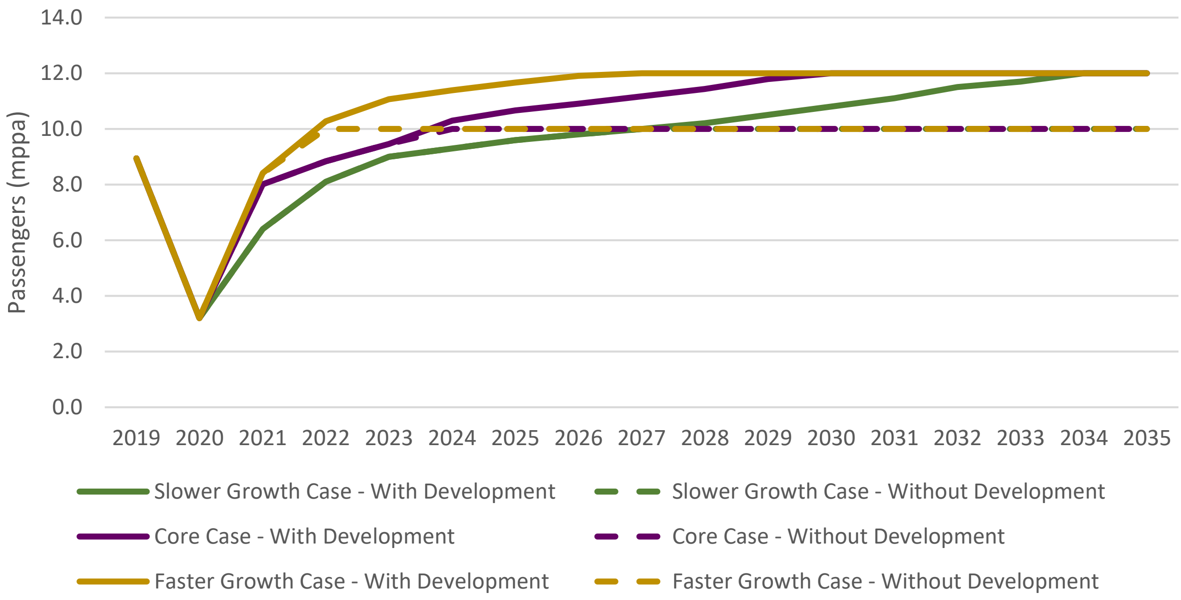
- **Core Case**: this represents a balanced view of the future market and current risks that is felt to be a reasonable best estimate of when Bristol Airport will reach 10 mppa and 12 mppa;
- **Slower Growth Case**: this represents a reasonable worse case in terms of the future growth of the airport, reflecting potentially slower than expected recovery from COVID-19, lower economic growth in the future/or other adverse market conditions; and
- **Faster Growth Case**: this represents a reasonable faster growth scenario for the airport, reflecting a more rapid bounce back from COVID-19 and / or faster economic growth in the future. Hence, this case shows an accelerated point at which both 10 mppa and 12 mppa are reached.

3.6. The corresponding passenger forecasts for 12 mppa (With Development) and 10 mppa (Without Development) are shown in Figure 3.1 below. These forecasts show:

- in the Core Case, passenger demand reaches 10 mppa in around 2024 and grows to 12 mppa by 2030;
- in the Slower Growth Case, the growth rate slows and 10 mppa is reached in 2028, whilst 12 mppa is reached in 2034;
- in the Faster Growth Case, growth is faster than the Core Case and 10 mppa is reached around 2022 and 12 mppa is reached in 2027.

3.7. The passenger forecast scenarios are also set out in Table 3.2. The ATMs associated with the Core Case are set out in Appendix B.

Figure 3.1: With Development and Without Development Forecast Scenarios for Bristol Airport



Source: York Aviation.

Table 3.2: Passenger Forecasts by Scenario (mppa)

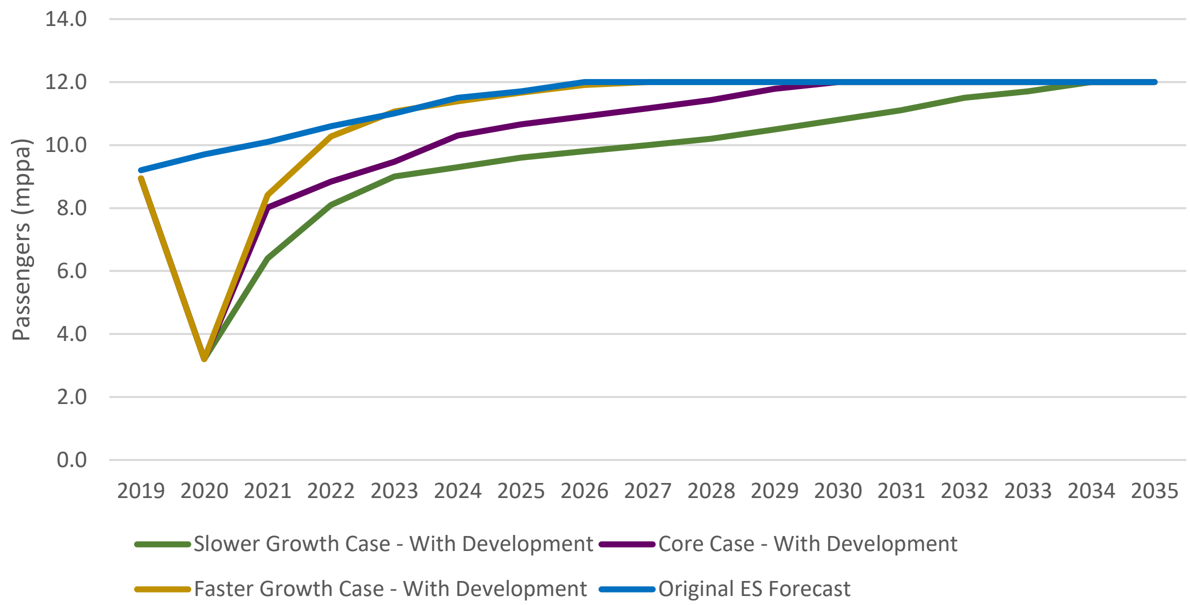
	Core Case		Slower Growth Case		Faster Growth Case	
	With Development	Without Development	With Development	Without Development	With Development	Without Development
2019	8.9	8.9	8.9	8.9	8.9	8.9
2020	3.2	3.2	3.2	3.2	3.2	3.2
2021	8.0	8.0	6.4	6.4	8.4	8.4
2022	8.8	8.8	8.1	8.1	10.3	10.0
2023	9.5	9.5	9.0	9.0	11.1	10.0
2024	10.3	10.0	9.3	9.3	11.4	10.0
2025	10.7	10.0	9.6	9.6	11.7	10.0
2026	10.9	10.0	9.8	9.8	11.9	10.0
2027	11.2	10.0	10.0	10.0	12.0	10.0
2028	11.4	10.0	10.2	10.0	12.0	10.0
2029	11.8	10.0	10.5	10.0	12.0	10.0
2030	12.0	10.0	10.8	10.0	12.0	10.0
2031	12.0	10.0	11.1	10.0	12.0	10.0
2032	12.0	10.0	11.5	10.0	12.0	10.0
2033	12.0	10.0	11.7	10.0	12.0	10.0
2034	12.0	10.0	12.0	10.0	12.0	10.0
2035	12.0	10.0	12.0	10.0	12.0	10.0

Source: York Aviation.

3.8. As previously highlighted, if COVID-19 sees a resurgence or Government restrictions remain significant into 2021, passenger projections in this one year could be as lower, although Bristol Airport would be expected to bounce back to the long term econometrically driven trend line thereafter.

3.9. Figure 3.2 provides a comparison of our own forecast with development compared to those presented in the 2018 ES, when 12 mppa was forecast to be reached in 2026 before the advent of COVID-19 and its effects.

Figure 3.2: Comparison of With Development Forecasts for Bristol Airport



Source: York Aviation.

Conclusions

3.10. This section sets out a range of forecasts for Bristol Airport based on an analysis of potential underlying demand growth rates. The Core Case forecast sees the airport reach 10 mppa in 2024 and 12 mppa in 2030, while under the Slower Growth Case, throughput reaches 10 mppa in 2028 and 12 mppa in 2034. In the Faster Growth Case, growth is faster than the Core Case and 10 mppa is reached in 2022 and 12 mppa in 2027. The Core Case growth is in line with the forecasts produced by a range of commentators:

- ACI EUROPE, the industry trade body for European airports, has forecast recovery to 2019 traffic levels in around 2024 and its most recent review of traffic forecasts from around Europe continues to suggest recovery in around 2024 or 2025[15];
- IATA has forecast a return to 2019 traffic levels by around 2024[16];
- EUROCONTROL has forecast that, with a vaccine widely available in 2021, traffic will recover by around 2024 or, if a vaccine is not available until 2022, then recovery would be delayed until around 2026[17].

[15] ACI EUROPE (2020). COVID-19 & AIRPORTS Traffic Forecast & Financial Impact 3rd Updated Forecast (October).
[16] IATA (2020). IATA Economics' Chart of the Week Five years to return to the pre-pandemic level of passenger demand July 2020.
[17] EUROCONTROL (2020). Five-Year Forecast 2020-2024 European Flight Movements and Service Units: Three Scenarios for Recovery from COVID-19.

4. Environmental Outputs

Introduction

4.1. A key requirement of the forecasting work has been to produce outputs to inform the supplementary environmental assessments presented in the ES Addendum and, in-turn, to ensure that the conclusions on likely significant effects in the ES for the Proposed Development are robust. These outputs are based on the Core Case forecast and provide our most likely view of how the forecast passenger numbers will be delivered, although we also provide some commentary on how the outputs may vary in the Slower Growth and Faster Growth Cases. Nonetheless, there remains some degree of conservatism within these outputs to ensure the environmental impacts of the Proposed Development are not understated. Environmental upsides may be gained through factors such as a faster switchover to newer generation aircraft, but the most likely case reflects that the airport may not be able to control the rate of introduction sufficiently to assume this as a reasonable basis for assessment as the Core Case.

4.2. In addition to providing the outputs related to the 'With Development' forecast, we have also developed corresponding outputs for a 'Without Development' scenario in which permission for the Proposed Development, including lifting of the passenger cap, is refused, and this allows the true impact of the Proposed Development to be assessed. This is covered in more detail in the ES Addendum. The assumptions that underpin both these scenarios are broadly consistent, with any variation highlighted below.

Aircraft Movements

4.3. Commercial passenger aircraft movements, or Air Transport Movements (ATMs), have been calculated for future years based on a projected average number of passengers per movement, with the overall forecast then divided by this figure to provide an annual number of movements.

4.4. The average number of passengers per movement has been derived by looking at historic trends, as well as confirming likely fleet plans for Bristol Airport with the key airlines. Over the last four years, the average number of passengers per commercial movement has been growing at a relatively rapid rate of 4.4% per annum, from 126 passengers per movement in 2016 to 146 by 2019. This is the result of three key factors:

- some airlines have been increasing the average size of their aircraft based at Bristol Airport, or at least increasing the number of seats on some of their aircraft through reconfiguration;
- the loss of bmi Regional has removed many of the smaller aircraft which were carrying significantly fewer passengers per movement and therefore reducing the average; and
- key airlines such as easyJet and Ryanair have been actively increasing their load factors in recent years (the percentage of seats filled on every flight).

4.5. Whilst we do expect some increases in activity by airlines with smaller aircraft within our forecasts (for example, to serve European hubs), the majority of growth at Bristol Airport is assumed to come from the low fares and charter airlines in both the 'With' and 'Without' development scenarios, hence we would not expect any significant dilution of the average number of passengers per movement through rapid growth in regional aircraft types in future.

4.6. Based on publicly known airline re-fleeting strategies, alongside conversations with the carriers specific to Bristol Airport, we believe there will continue to be an upward trend in the average number of passengers per aircraft, not least because easyJet will need to retire their Airbus A319 aircraft (across their whole fleet - this is not unique to Bristol Airport), and are replacing this type with larger aircraft. We do not believe that the rate of change in average aircraft size will be as quick as seen recently, however, because of the three factors noted above meaning that there is little scope for a further increase in average load factors and the loss of bmi Regional's small aircraft is now complete.

4.7. Many of the factors that will lead to future changes to the average aircraft size will be common in both the 'With' and 'Without' development scenarios in the Core Case (we consider the Slower Growth and Faster Growth Cases in further detail below) until 10 mppa capacity is reached in the 'Without Development' scenario. We have, thus, assumed a common rate of change in passengers per ATM, at 1% increase per annum, across both scenarios. However, on reaching 10 mppa, the airlines are likely to react differently if they are capped at 10 mppa. For the period from 2024, we have assumed:

- if permission is granted for the Proposed Development, there will be a slowing of the rate of change (because the A319 fleets are assumed to be fully retired by this point). However, there will still be scope for airlines to increase capacity as demand grows without undermining frequencies and their flight schedules. We have assumed from 2025 onwards that the average increase in passengers per movement will be 0.75% per annum;
- if permission for the Proposed Development is not granted and the airport is capped at 10 mppa, then the initial changes will be consistent with the 'With Development' scenario, but the following rate of change, from 2025 onwards, will likely be slower. Any rapid increase in average passengers per movement would mean the carriers would have to drop overall frequencies, and whilst we believe there may be some degree of this (which will see a small reduction in overall movements over time), we do not believe it will be widespread as the airlines will not want to undermine their overall schedules, frequencies and load factors by increasing capacity. As a result, the average passengers per movement growth will be slower in this scenario, at 0.5% per annum from 2025.

4.8. In the Core Case, the result is that by 2030, it is assumed that there will be an average of 159 passengers per movement if permission is granted, generating around 75,500 annual commercial ATMs. If the cap remains in place, we project that the average number of passengers per movement will be around 157, generating a total of around 63,700 annual commercial ATMs. In comparison to the forecasts presented in the 2018 ES, this represents around 8,300 fewer annual movements by commercial aircraft if the 10 mppa cap is lifted. This is largely the result of the demise of bmi Regional which was assumed to continue to operate a significant number of movements by smaller aircraft within the original projections. The updated forecasts are based on growth being driven primarily by the low fares carriers with their larger aircraft, resulting in the subsequent reduction in movements over the original ES.

4.9. In the Slower Growth Case, we believe that movements at 12 mppa will be similar to those seen in the Core Case because airlines operating at Bristol Airport will need to maintain some balance of their larger and smaller aircraft as not all routes will be able to sustain larger aircraft. However, it is likely that by 2034, slightly more operations could be by newer generation aircraft, such as the Airbus 'Neo' and Boeing 'Max' families, than projected in 2030 in the Core Case.

4.10. In the Faster Growth Case, we project that movements will be slightly higher when the airport initially reaches 12 mppa in 2027 because the airlines are unlikely to be able to allocate their larger aircraft to Bristol Airport by this time due to the delivery timescales of their newer fleets. However, under these circumstances we believe from our consultations with the airlines that there would still be some accelerated growth in aircraft size ahead of the Core Case as airlines would seek to maximise efficiency on core routes by using larger aircraft where possible. Hence in this case we have increased the passengers per ATM rate of growth to 1% per annum until 2027. This leads to an average of 157 passengers per movement in this case when the airport reaches 12 mppa, compared to 159 in the Core Case. The result is around 1,150 additional annual commercial movements at the point that 12 mppa is reached. Furthermore, a greater proportion of this fleet is likely to be the current generation of aircraft than would be expected at the point that the airport reaches 12 mppa in the Core Case. However, as in the 'Without' development scenario, we would expect some slight reduction in movements over time by airlines once the 12 mppa cap is reached as newer, larger aircraft are delivered to the airlines and can be allocated to Bristol Airport. We believe this will bring the movements back in line with the Core Case by 2030 and beyond.

4.11. All other movements, such as general and business aviation, are assumed to remain broadly similar to recent years, and these movements are consistent across both scenarios. These are set out in Appendix B.

Busy Day Timetables

4.12. Busy Day Timetables (BDTTs) have been developed as these provide outputs for surface access assessments, capacity planning, and also because they form the basis of annual fleet mixes as well as informing calculations related to the numbers of flights by each time of day.

4.13. The first step in developing the BDTTs has been to determine how many movements will take place on a busy day, and this is done applying a ratio to the annual movements. We have analysed recent data for Bristol Airport to determine this ratio, looking for evidence of flattening in seasonality as it has grown, which would reduce the number of movements on a typical busy day. However, there is no clear evidence of changes to seasonality or indeed the individual busy day to annual ratios at Bristol Airport, and indeed there remains volatility from one year to the next over recent years. Therefore, we have used an average ratio over the last 5 years[18] for both the 'With' and 'Without' development scenarios.

4.14. Once the number of movements required in each BDTT has been calculated, then we take the 2019 typical busy day timetable as our starting point and then build the future timetables through the following stages:

- remove services known to no longer be operating (due to airline failures or service withdrawals);
- adjust aircraft types based on airline feedback and aircraft size parameters;
- add new flights to the schedule up to the projected number of movements for a busy day. Additional flights are based on real operating patterns for airlines, whether with based or inbound aircraft. Mini schedules have been created for new based aircraft which will reflect likely and forecast destinations, sector lengths and turnaround times, building up a day's operation for such an aircraft to add into the Bristol Airport busy day timetable. For potential inbound aircraft, these are be based on likely arrival times at Bristol Airport from the origin as well as realistic turnaround times before departure.

4.15. For the early years, the build-up of these BDTTs is consistent up to 10 mppa. In the 'Without Development' scenario, the number of movements on a typical busy day falls slightly over the period to 2030 as a limited number of larger aircraft are included. However, in the 'With Development' scenario, the number of movements continues to grow slightly, even with increases in aircraft size.

Fleet Mix and 92-Day Fleet Mix

4.16. The fleet mix for the year is required for air quality, carbon assessments and some elements of the noise assessment. It is derived by allocating each airline in the BDTTs into a category (such as Low Fares, Charter, Full Service etc.) and determining the individual busy day to annual ratio for each of these airline types. Once these were determined, again based on an average of recent years as per the overall busy day to annual ratio, we then applied these ratios to the airlines and their corresponding aircraft types contained within the BDTT to multiply the day back up to annual. Where this more detailed approach led to some variance at an annual level from the previous projections, any difference was allocated pro-rata back across the low fares carriers and their fleets. The projected fleet mix for the Core Case at 12 mppa in 2030 is shown in Table 4.1 overleaf.

4.17. By comparison to this Core Case fleet mix, we would expect a lower proportion of newer generation aircraft in the Faster Growth Case at the point that 12 mppa is reached. These aircraft are likely to have a greater environmental footprint and, therefore, could increase the impacts of development slightly, though over time would converge back in line with the Core Case as new aircraft are delivered to the airlines.

4.18. In the Slower Growth Case, we would expect a greater proportion of newer generation aircraft, which will have lower environmental footprints compared to the current generation of aircraft.

[18] 2019's ratio has been adjusted to reflect the collapse of Thomas Cook and bmi Regional due to their failures part way through the year.

Table 4.1: Forecast Core Case Fleet Mix With Development at 2030 (12 mppa)

Commercial Aircraft	*Aircraft*	*Annual Movements*
	Airbus A320	6,540
	Airbus A320Neo	20,200
	Airbus A321Neo	15,600
	Airbus A321Neo XLR	120
	ATR 72-500	3,850
	ATR 72-600	4,510
	Boeing 737 MAX 10	2,050
	Boeing 737 MAX 8	14,360
	Boeing 737-700W	750
	Boeing 737-800W	2,380
	Boeing 787-8	510
	Embraer 190	2,240
	Embraer 195-E2	2,240
	Total Commercial	*75,350*
Positioning Aircraft	*Aircraft*	*Annual Movements*
	Airbus A320	20
	Airbus A320Neo	280
	Boeing 737-800W	20
	Boeing 737 MAX 8	280
	Total Positioning	*600*
Other Aircraft	*Aircraft*	*Annual Movements*
	Airbus A400M	10
	AS365 Dauphin 2	100
	Augusta AW139	150
	Beech King Air 200	1,180
	Cessna 172	1,470
	Cessna Citation 525	680
	Cessna Mustang 510	160
	Cirrus SR22	490
	Citation Excel 560XL	270
	Embraer E145	140
	Embraer Legacy 500	410
	Eurocopter EC135	1,320
	Falcon 2000	210
	Gulfstream 550	210
	Learjet 45	160
	Piper PA28	2,950
	Socata Tobago 10	130
	Total Other	*10,040*

4.19. The 92-Day movements, which cover the period from 16th June to 15th September each year and are used for the noise contour modelling, are then derived using a ratio, again by airline type, that converts the annual fleet back to the seasonal one. As we have assumed no shift in the seasonality of the airport then once again, recent averages are used for these ratios. Crucially, however, these also take into account the time of day in which movements occur, by:

- Daytime – covering 0700 – 1900 hours local time;
- Evening – covering 1900 – 2300 hours local time; and
- Night periods – covering 2300 – 0700 hours local time (this is the 8-hour period used in noise assessment, but differs from night control periods which are covered below).

4.20. The time of day for each flight is derived from the BDTT and pro-rata applied to the overall 92-day fleet mix by type. As the BDTTs represent a planned schedule, allowance has been made for some delayed flights arriving in the night period, and this is set at 6% based on recent data analysed for BAL.

4.21. For the Slower Growth Case, we would expect the pattern of movements in the 92-day period to match that in the Core Case. However, on reaching 12 mppa in the Faster Growth Case, we would expect around 350 additional commercial movements in the 92-day period, which would decrease again over time to match the Core Case as average aircraft sizes increase further.

Night Movements and Quota Count

4.22. Using the BDTT and annual fleet data, we have projected the following:

- the anticipated number of movements taking place in the summer period and over the year in the 2330-0559 period of the night;
- the Quota Count (QC) total for all aircraft expected to operate in the QC period of the night for the summer.

4.23. The period 2330-0559 is the night control period for which there are current controls at the airport permitting 4,000 annual movements, of which 3,000 are permitted in the summer period currently and 1,000 in the winter period. This differs from the 2300-0700 night period calculated for the 92-day summer period because the latter timing is a standard 8-hour window used for noise assessment.

4.24. The first of these, the movements in the 2330-0559 period, have been calculated by reviewing the ratio of busy day scheduled flights with actual movements in these periods. This factors in aircraft which are delayed into this night period. These ratios have been applied to the future busy day timetables on the basis that patterns of operation are expected to remain broadly similar. Using this approach, we estimate that around 3,600 movements would be needed in the summer season at 12 mppa, whilst over the course of the year the total movements would remain within the current 4,000 limit which applies at Bristol Airport. By comparison, in the 'Without Development' scenario, we believe that airlines would be restricted to the current limit of 3,000 annual movements in the summer period, although in reality this will need to be enforced through the scheduling process.

4.25. Finally, the 3,600 movements projected in the summer 2330-0559 period (which matches the QC period) have been allocated by aircraft type based on the busy day timetable, which also indicates arrivals and departures in this period as each aircraft has a separate allocation of QC points for arriving and departing. We have then multiplied the forecast number of movements by each aircraft type by its ascribed QC points, taken from the latest CAA guidance[19].

4.26. In total, the Core Case would generate a total QC count of 948 in the summer night time period. Without development, this figure would be 1,180 because it is based on historic CAA QC points scoring which would still be relevant if the Proposed Development is not permitted as the airport continues to be bound by planning conditions associated with the 10 mppa cap which cite this specifically. The projections can be seen in Table 4.2 below for the Core Case.

[19] AIP SUP 012/2019, CAA, Effective 31st March 2019

4.27. In the Faster Growth Case, at the point that 12 mppa is reached, we would expect a slightly higher total QC count because of the lower number of new generation (quieter) aircraft, but over time this would converge with the 948 figure above.

Table 4.2: Projection of QC Count for Summer Period With and Without Development

With Development - 12 mppa						
	Movements		QC Points Per Movement		Total QC Points	
	Arr	Dep	Arr	Dep	Arr	Dep
Airbus A320	424	0	0.5		212	0
Airbus A320neo	678	0	0.125		85	0
Airbus A321neo	1,101	0	0.25		275	0
Boeing 737 MAX 10	212	0	0.25		53	0
Boeing 737 MAX 8	868	212	0.25	0.25	217	53
Boeing 787-8	106	0	0.5		53	0
Total Movements		**3,600**			**Total QC Count**	**948**
Without Development - 10 mppa						
	Movements		QC Points Per Movement		Total QC Points	
	Arr	Dep	Arr	Dep	Arr	Dep
Airbus A320	400	0	0.5		200	0
Airbus A320neo	640	0	0		0	0
Airbus A321neo	640	0	0.5		320	0
Boeing 737 MAX 10	200	0	0.5		100	0
Boeing 737 MAX 8	820	200	0.5	0.5	410	100
Boeing 787-8	100	0	0.5		50	0
Total Movements		**3,000**			**Total QC Count**	**1,180**

Average Range Forecasts

4.28. We have calculated the average range for each aircraft type based on the BDTTs, taking the networks on these days as a proxy for the whole year. These are weighted averages which multiply the number of flights to each destination by the range to those respective destinations for the day, and then divides the combined range by the number of flights to get a weight average per flight. These calculations are undertaken for each aircraft type in the fleet mix individually and the results can be found in Appendix C.

Surface Origins and Destinations

4.29. The surface origins of passengers using Bristol Airport in the With Development and Without Development scenarios have been determined based on the outputs from the passenger allocation model described above. This uses an econometric analysis to consider how passengers will choose between different airport options based on key choice variables including surface access time, the number of frequencies offered, the airline type offering the service and the air fare. The model allocates passengers to Bristol Airport and its competitors based on these factors at a district level.

Airport Displacement

4.30. The alternate airports used by Bristol Airport passengers displaced if it is constrained to 10 mppa has again been determined based on the outputs from the passenger allocation model. This models passenger choices between airports at a district level based on key choice variables including surface access time, the number of frequencies offered, the airline type offering the service and the air fare. It also considers the number of passengers that would no longer travel in the event of constraint at Bristol Airport based on the loss of utility to passengers, as represented by the change in the choice factors described in the event of constraint at Bristol Airport. This enables the number of passengers using each other airport in the model, if they cannot use Bristol Airport, to be identified. This data from the forecasts provides an additional level of granularity to support the supplementary environmental assessments where appropriate.

Appendix A: Monte Carlo Growth Rates Assumptions and Probabilities

UK GDP Growth

Scenario Name	OBR Central	OBR Upside	OBR Downside	IMF Central	HM Treasury Review of Independent Average	HM Treasury Review of Independent High	HM Treasury Review of Independent Low	OECD Single Hit, then OECD Central Post COVID	OECD Double Hit then central post COVID
Source	OBR June 2020	OBR June 2020	OBR June 2020	IMF WEO June 2020	HM Treasury June 2020	HM Treasury June 2020	HM Treasury June 2020	OECD June 2020	OECD June 2020
Assumed Probability	15%	5%	10%	15%	15%	5%	10%	15%	10%
2020	-12.4%	-10.6%	-14.3%	-6.5%	-9.1%	-6.5%	-12.9%	-11.5%	-14.0%
2021	8.7%	14.5%	4.6%	4.0%	6.2%	10.0%	1.0%	9.0%	5.0%
2022	4.5%	1.9%	5.4%	4.5%	4.5%	1.9%	5.4%	4.5%	5.4%
2023	2.1%	1.3%	3.3%	2.1%	2.1%	1.3%	3.3%	2.1%	3.3%
2024	1.9%	1.4%	2.5%	1.9%	1.9%	1.4%	2.5%	1.7%	1.7%
2025	1.6%	1.7%	1.5%	1.6%	1.6%	1.7%	1.5%	1.8%	1.8%
2026	1.6%	1.7%	1.5%	1.6%	1.6%	1.7%	1.5%	1.8%	1.8%
2027	1.6%	1.7%	1.5%	1.6%	1.6%	1.7%	1.5%	1.9%	1.9%
2028	1.6%	1.7%	1.5%	1.6%	1.6%	1.7%	1.5%	2.0%	2.0%
2029	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.0%	2.0%
2030	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.0%	2.0%
2031	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.1%	2.1%
2032	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.1%	2.1%
2033	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.1%	2.1%
2034	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.1%	2.1%
2035	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.1%	2.1%
2036	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.2%	2.2%
2037	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.2%	2.2%
2038	2.2%	2.4%	2.1%	2.2%	2.2%	2.4%	2.1%	2.2%	2.2%
2039	2.2%	2.4%	2.0%	2.2%	2.2%	2.4%	2.0%	2.2%	2.2%
2040	2.2%	2.4%	2.0%	2.2%	2.2%	2.4%	2.0%	2.2%	2.2%

Overseas GDP Growth

World Area	Europe			OECD			Newly Industrialised Countries			Less Developed Countries		
Scenario Name	Central	High	Low	Central	High	Low	Central	High	Low	Central	High	Low
Source	YAL analysis of OECD and IMF											
Probability	60%	10%	30%	60%	10%	30%	60%	10%	30%	60%	10%	30%
2020	-8.4%	-6.8%	-10.1%	-7.5%	-6.0%	-9.0%	-2.3%	-1.8%	-2.7%	-5.5%	-4.4%	-6.6%
2021	5.2%	6.3%	4.2%	4.4%	5.3%	3.5%	6.0%	7.2%	4.8%	4.2%	5.1%	3.4%
2022	3.5%	4.2%	2.8%	3.2%	3.9%	2.6%	5.2%	6.2%	4.2%	4.0%	4.8%	3.2%
2023	2.4%	2.8%	1.9%	2.4%	2.8%	1.9%	4.5%	5.5%	3.6%	3.9%	4.6%	3.1%
2024	1.7%	2.0%	1.3%	1.7%	2.1%	1.4%	4.0%	4.8%	3.2%	3.7%	4.5%	3.0%
2025	1.7%	1.8%	1.5%	1.8%	2.0%	1.6%	3.4%	3.7%	3.0%	3.4%	3.8%	3.1%
2026	1.7%	1.8%	1.5%	1.9%	2.0%	1.7%	3.3%	3.6%	3.0%	3.3%	3.7%	3.0%
2027	1.7%	1.8%	1.5%	1.9%	2.1%	1.7%	3.2%	3.5%	2.9%	3.2%	3.5%	2.9%
2028	1.7%	1.8%	1.5%	1.9%	2.1%	1.7%	3.1%	3.4%	2.8%	3.1%	3.4%	2.8%
2029	1.7%	1.8%	1.5%	1.9%	2.1%	1.7%	3.0%	3.3%	2.7%	3.0%	3.4%	2.7%
2030	1.7%	1.8%	1.5%	1.9%	2.1%	1.7%	2.9%	3.2%	2.6%	3.0%	3.3%	2.7%
2031	1.6%	1.8%	1.5%	1.9%	2.1%	1.7%	2.9%	3.1%	2.6%	2.9%	3.2%	2.6%
2032	1.6%	1.8%	1.5%	1.9%	2.1%	1.7%	2.8%	3.1%	2.5%	2.8%	3.1%	2.5%
2033	1.6%	1.8%	1.5%	1.9%	2.1%	1.7%	2.7%	3.0%	2.4%	2.7%	3.0%	2.5%
2034	1.6%	1.8%	1.4%	1.9%	2.1%	1.7%	2.6%	2.9%	2.4%	2.7%	2.9%	2.4%
2035	1.6%	1.8%	1.4%	1.9%	2.1%	1.8%	2.5%	2.8%	2.3%	2.6%	2.8%	2.3%
2036	1.6%	1.7%	1.4%	2.0%	2.2%	1.8%	2.5%	2.7%	2.2%	2.5%	2.8%	2.3%
2037	1.6%	1.7%	1.4%	2.0%	2.2%	1.8%	2.4%	2.6%	2.2%	2.4%	2.7%	2.2%
2038	1.6%	1.7%	1.4%	2.0%	2.2%	1.8%	2.3%	2.6%	2.1%	2.4%	2.6%	2.1%
2039	1.6%	1.7%	1.4%	2.0%	2.2%	1.8%	2.3%	2.5%	2.1%	2.3%	2.6%	2.1%
2040	1.6%	1.7%	1.4%	2.0%	2.2%	1.8%	2.2%	2.4%	2.0%	2.3%	2.5%	2.0%

Carbon Price

Scenario Name	Low	Central	High
Source	Department for Business, Energy and Industrial Strategy		
Probability	12.5%	75%	12.5%
2020	£0	£13	£27
2021	£4	£20	£36
2022	£8	£26	£45
2023	£12	£33	£54
2024	£16	£39	£63
2025	£19	£45	£71
2026	£23	£52	£80
2027	£27	£58	£89
2028	£31	£65	£98
2029	£35	£71	£107
2030	£39	£78	£116
2031	£42	£85	£127
2032	£46	£92	£138
2033	£50	£99	£149
2034	£53	£106	£160
2035	£57	£114	£170
2036	£60	£121	£181
2037	£64	£128	£192
2038	£68	£135	£203
2039	£71	£142	£214
2040	£75	£150	£225

Air Passenger Duty

APD Band	Band A			Band B		
Scenario Name	Current Rates - No real change	Temporary Waiver	2.5% per annum real increase	Current Rates - No real change	Temporary Waiver	2.5% per annum real increase
Source	HMRC	YAL	YAL	HMRC	YAL	YAL
Probability	70%	20%	10%	70%	20%	10%
2020	£13	£13	£13	£80	£80	£80
2021	£13	£0	£13	£80	£0	£82
2022	£13	£13	£14	£80	£80	£84
2023	£13	£13	£14	£80	£80	£86
2024	£13	£13	£14	£80	£80	£88
2025	£13	£13	£15	£80	£80	£91
2026	£13	£13	£15	£80	£80	£93
2027	£13	£13	£15	£80	£80	£95
2028	£13	£13	£16	£80	£80	£97
2029	£13	£13	£16	£80	£80	£100
2030	£13	£13	£17	£80	£80	£102
2031	£13	£13	£17	£80	£80	£105
2032	£13	£13	£17	£80	£80	£108
2033	£13	£13	£18	£80	£80	£110
2034	£13	£13	£18	£80	£80	£113
2035	£13	£13	£19	£80	£80	£116
2036	£13	£13	£19	£80	£80	£119
2037	£13	£13	£20	£80	£80	£122
2038	£13	£13	£20	£80	£80	£125
2039	£13	£13	£21	£80	£80	£128
2040	£13	£13	£21	£80	£80	£131

Oil Price

Scenario Name	Low	Central	High	Low/Central
Source	BEIS Fossil Fuel Price Assumption 2019			YAL analysis of recent fuel price
Probability	10%	30%	10%	50%
2020	$35	$54	$89	$35
2021	$37	$56	$90	$37
2022	$38	$57	$93	$44
2023	$39	$60	$95	$52
2024	$40	$62	$98	$62
2025	$40	$64	$100	$64
2026	$41	$66	$102	$66
2027	$43	$68	$105	$68
2028	$44	$71	$106	$71
2029	$45	$72	$109	$72
2030	$46	$74	$111	$74
2031	$47	$76	$113	$76
2032	$48	$78	$116	$78
2033	$50	$81	$118	$81
2034	$51	$83	$121	$83
2035	$52	$85	$122	$85
2036	$52	$85	$122	$85
2037	$52	$85	$122	$85
2038	$52	$85	$122	$85
2039	$52	$85	$122	$85
2040	$52	$85	$122	$85

Appendix B: Core Case Forecast Scenarios

	With Development (12 mppa)					Without Development (10 mppa)				
	Passengers (millions)	Commercial Movements	Positioning Movements	Other Movements	Total Movements	Passengers (millions)	Commercial Movements	Positioning Movements	Other Movements	Total Movements
2019	8.9					8.9				
2020	3.2					3.2				
2021	8.0					8.0				
2022	8.8					8.8				
2023	9.5					9.5				
2024	10.3	67,630	600	10,040	78,270	10.0	65,670	600	10,040	76,310
2025	10.7	69,500	600	10,040	80,140	10.0	65,350	600	10,040	75,990
2026	10.9	70,590	600	10,040	81,230	10.0	65,030	600	10,040	75,670
2027	11.2	71,710	600	10,040	82,350	10.0	64,680	600	10,040	75,320
2028	11.4	72,870	600	10,040	83,510	10.0	64,390	600	10,040	75,030
2029	11.8	74,580	600	10,040	85,220	10.0	64,050	600	10,040	74,690
2030	12.0	75,340	600	10,040	85,980	10.0	63,730	600	10,040	74,370
2031	12.0	75,340	600	10,040	85,980	10.0	63,740	600	10,040	74,380
2032	12.0	75,340	600	10,040	85,980	10.0	63,750	600	10,040	74,390
2033	12.0	75,330	600	10,040	85,970	10.0	63,750	600	10,040	74,390
2034	12.0	75,340	600	10,040	85,980	10.0	63,730	600	10,040	74,370
2035	12.0	75,330	600	10,040	85,970	10.0	63,740	600	10,040	74,380
2036	12.0	75,340	600	10,040	85,980	10.0	63,730	600	10,040	74,370
2037	12.0	75,340	600	10,040	85,980	10.0	63,740	600	10,040	74,380
2038	12.0	75,340	600	10,040	85,980	10.0	63,740	600	10,040	74,380
2039	12.0	75,330	600	10,040	85,970	10.0	63,740	600	10,040	74,380
2040	12.0	75,340	600	10,040	85,980	10.0	63,750	600	10,040	74,390

Appendix C: Projected Average Aircraft Range

			With Development Range (km) – 12 mppa		Without Development Range (km) – 10 mppa	
Commercial Aircraft	*Aircraft*	*Aircraft Code*	*2024*	*2030*	*2024*	*2030*
	Airbus A320	32A	1,052	1,011	1,052	1,011
	Airbus A320Neo	32N	1,581	1,060	1,632	1,121
	Airbus A321Neo	32Q	1,010	1,543	1,010	1,387
	Airbus A321Neo XLR	32Q	0	5,408	0	0
	ATR 42-300	AT4	245	245	245	245
	ATR 72-500	AT75	245	487	245	447
	ATR 72-600	AT76	324	324	324	313
	Boeing 737 MAX 10	7MJ	2,295	2,092	2,295	2,092
	Boeing 737 MAX 8	7M8	1,436	1,415	1,414	1,441
	Boeing 737-700W	73W	526	526	526	526
	Boeing 737-800W	73H	1,488	1,351	1,524	1,351
	Boeing 787-8	788	2,044	2,044	2,044	2,044
	Embraer 190	E90	811	811	811	811
	Embraer 195-E2	295	526	526	526	526
	Embraer RJ145	ER4	649	649	649	649
Positioning Aircraft	*Aircraft*	*Aircraft Code*	*2024*	*2030*	*2024*	*2030*
	Airbus A320	32A	172	172	172	172
	Airbus A320Neo	32N	172	172	172	172
	Boeing 737-800W	73H	331	331	331	331
	Boeing 737 MAX 8	7MJ	331	331	331	331
Other Aircraft	*Aircraft*	*Aircraft Code*	*2024*	*2030*	*2024*	*2030*
	Airbus A400M	A400	200	200	200	200
	AS365 Dauphin 2	AS65	200	200	200	200
	Augusta AW139	AW139	100	100	100	100
	Beech King Air 200	BE20	308	308	308	308
	Cessna 172	C172	100	100	100	100
	Cessna Citation 525	C525	650	650	650	650
	Cessna Mustang 510	C510	650	650	650	650
	Cirrus SR22	SR22	100	100	100	100
	Citation Excel 560XL	56X	650	650	650	650
	Embraer E145	ER4	650	650	650	650
	Embraer Legacy 500	E550	650	650	650	650
	Eurocopter EC135	H2T	100	100	100	100
	Falcon 2000	F2TH	1,500	1,500	1,500	1,500
	Gulfstream 550	G550	1,500	1,500	1,500	1,500
	Learjet 45	LJ45	650	650	650	650
	Piper PA28	PA28	100	100	100	100
	Socata Tobago 10	TB-10	650	650	650	650

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