Environmental Research and Consultancy Department

Civil Aviation Authority

Aircraft movements, fleet mix and noise quota usage at Gatwick, Heathrow and Stansted

CAP 2128

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The first edition of CAP 2128 included information on aircraft movements between 1 January 2019 and 31 October 2020.

Summary

This report describes a review that was undertaken by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) on changes in the numbers of aircraft movements, aircraft fleet mix and noise quota usage at Gatwick, Heathrow and Stansted airports between 1 January 2019 and 31 December 2022.

The study was initially commissioned by the Department for Transport (DfT) to understand the impact of the Covid-19 pandemic on aircraft operations and the possible knock-on effect on noise around the airports. Changes in the average age of aircraft and the average distance flown were also studied. The study has been a useful reference for understanding and monitoring trends in the aviation sector. New editions of the report have been published to include more up to date information as the aviation sector recovered.

The results of the study showed a significant reduction in the numbers of movements and associated noise quota usage at all three airports in the months following the introduction of lockdown restrictions in March 2020.

Despite the opening of travel corridors during July 2020, aircraft movements during August and September 2020 (normally two of the busiest months of the year at all three airports) were significantly lower compared to the same months in 2019 and remained at these exceptionally low levels through the first half of 2021. Aircraft movements at all three airports then increased from July 2021 as a result of further easing of travel restrictions and the resumption of international travel (resulting in greater consumer confidence and thus bookings) but remained well below pre-pandemic levels for the remainder of 2021, particularly at Gatwick.

Following the removal in March 2022 of all remaining Covid-19 travel restrictions for international arrivals in the UK, overall movement numbers at Gatwick and Heathrow reached approximately 85 to 90 percent of pre-pandemic levels during the remaining months of 2022. At Stansted, overall movement numbers reached approximately 95 percent of pre-pandemic levels. In addition, during the peak summer months of 2022 (June – September) night-time movement numbers at Stansted exceeded those for summer 2019, whereas night-time movements at Gatwick and Heathrow over the same months in summer 2022 remained below 2019 levels.

Chapter 1

Introduction

1.1 Gatwick, Heathrow and Stansted airports are designated by the Secretary of State for the purpose of noise regulation and the government has, for many years, set noise controls at these airports. These controls include restrictions on aircraft movements at night which are based on the Quota Count (QC) system. Under the QC system, movements at each airport count against the airport's noise quota according to their QC classifications (see Appendix A).

1.2 Although originally designed to regulate aircraft noise at night, the noise quota scheme is considered a useful proxy for the amount of noise made around an airport over any period of time since it takes account of both the numbers of movements and the noise levels of the operations[1].

1.3 This report describes a review that was undertaken by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) on changes in the numbers of aircraft movements, aircraft fleet mix and noise quota usage at Gatwick, Heathrow and Stansted airports between 1 January 2019 and 31 December 2022.

1.4 The study was initially commissioned by the Department for Transport (DfT) to understand the impact of the Covid-19 pandemic on aircraft operations and the possible knock-on effect on noise around the airports and has been a useful reference for understanding and monitoring trends in the aviation sector. New editions of the report have been published to include more up to date information as the aviation sector recovered.

1.5 The following high-level tasks were identified:

- Review overall numbers of aircraft movements and noise quota usage[2]
- Review average QC per movement
- Review average aircraft age[3]
- Review average distance flown[4]

[1] See Chapter 3 of CAP 1129, *Noise Envelopes*, Civil Aviation Authority, 2013.

[2] Defined as the sum of the QC classifications of all aircraft movements over a specified period at an airport.

[3] Newer aircraft are more likely to incorporate the latest engine and airframe technologies designed to make them quieter and/or more fuel efficient.

[4] Aircraft that are flying further will generally be heavier because they are carrying more fuel and will therefore be lower, on average, over the ground after take-off (all other things being equal). For a long-range aircraft in particular, a substantial proportion of the mass is fuel, not passengers or cargo.

1.6 Chapter 2 of this report describes the methodology used to determine and classify aircraft movements for this study. Chapters 3, 4 and 5 provide a summary of the results for Gatwick, Heathrow and Stansted respectively. The main conclusions are provided in Chapter 6.

Chapter 2

Methodology

2.1 Aircraft movement information for this study was extracted from the Gatwick, Heathrow and Stansted Noise and Track-Keeping (NTK) systems. The airport NTK systems provide aircraft registration (tail number) and airport of origin or destination for each movement. Detailed information on aircraft type and aircraft age[5] was determined using an airline fleet database search based on aircraft registration.

2.2 QC classifications for aircraft operating during the night quota period (23:30-06:00) are routinely determined by each airport and recorded in their respective NTK systems. At Heathrow, QC classifications for the overwhelming majority of aircraft operating outside of the night quota period are also recorded. However, QC classifications for a significant proportion of daytime operations at Gatwick and Stansted are not routinely determined.

2.3 For some of these missing cases it was possible to estimate the QC classifications with a high degree of certainty using best judgement, based on knowledge of the specific aircraft type.

2.4 For example, variants of the Boeing 777-300ER are classified QC/1 on arrival, irrespective of their maximum certificated landing weight. On departure the Boeing 777-300ER is classified QC/2 at all but the very lowest maximum certificated take-off weights possible for this type. Since the certificated take-off weights applicable to a QC/1 Boeing 777-300ER departure are unrealistically low for normal airline operations, a QC/2 departure rating can be assigned with a high level of confidence to all Boeing 777-300ERs in an airport's fleet.

2.5 The QC classifications for any remaining missing cases at each airport were estimated based on average QC values for similar aircraft types in the known fleet. Taking for example the Airbus A320, the average arrival and departure QC classifications would first be calculated for all A320s in the fleet that had a QC value assigned. The calculated average values would then be assigned to all remaining A320s in the fleet that were not already assigned a QC value. This process would be repeated for each aircraft type in the fleet. After assigning a QC value to each individual aircraft movement in this way, it was then possible to calculate the total noise quota usage for that airport.

[5] The average aircraft ages calculated for this study are based on total movements (e.g. individual aircraft that fly several times a day from an airport count more towards the average than aircraft that visit less frequently).

2.6 Airline fleet data sources used for this study included Cirium[6], the UK Register of Civil Aircraft (G-INFO[7]) and other publicly available aviation fleet databases[8]. The distance flown for each movement was estimated from the great-circle distance[9] to the relevant origin or destination airport.

2.7 The term ‘New Generation’ has been used throughout this report to identify particular types of aircraft within an individual manufacturer's product range that incorporate the latest engine and/or airframe technologies designed to make aircraft quieter and typically more fuel efficient. For example, the Airbus A340, Airbus A380, Boeing 747-400 and Boeing 747-8 are all wide-body aircraft designs with four-engines. However the A380 and 747-8 are categorised as New Generation aircraft in this report since they incorporate newer engine and airframe technology than the older A340 and 747-400 models (see Appendix B for aircraft groupings).

2.8 Whilst every effort was made to ensure the accuracy of the fleet information and the estimated QC values used for this study, it is possible that some small errors may still exist in the data. It should also be noted that it was beyond the scope of this study to investigate in detail how factors such as airline fleet planning or passenger air travel demand may have affected aircraft movement numbers or airline fleets.

[6] https://www.cirium.com/ (accessed 03/10/2023)

[7] https://www.caa.co.uk/aircraft-register/g-info/ (accessed 03/10/2023)

[8] e.g. https://www.airfleets.net/ and https://www.iaa.ie/commercial-aviation/aircraft-registration-2 (accessed 03/10/2023)

[9] The great-circle distance (or direct route length) will be slightly shorter than the actual distance flown.

Chapter 3

Gatwick Airport

Daily aircraft movements and noise quota

3.1 Figure 1 presents the daily numbers of aircraft movements at Gatwick since 1 January 2019. Figure 2 presents the corresponding daily quota usage over the same period. In each figure, aircraft movements have been grouped into the following broad categories of aircraft based on size and where applicable the level of aircraft noise reduction technology:

- Wide-body
- 'New Generation' Wide-body
- Narrow-body
- 'New Generation' Narrow-body
- Other

3.2 A summary of aircraft types included in each category is provided in Appendix B. It is evident from Figure 1 that narrow-body aircraft dominate the fleet at Gatwick, accounting for approximately 90 percent or more of all aircraft movements[10].

3.3 The results in Figures 1 and 2 show a significant reduction in the numbers of movements and associated quota usage at Gatwick, particularly for the wide-body fleet[11], in the months following the introduction of lockdown restrictions in March 2020. On several days during April, May and June 2020 there were fewer than 10 movements per day. The results for 2019 and 2022 also illustrate the significant increase in movements that normally occurs during the summer months at Gatwick.

3.4 The results show a marked increase in Gatwick movements and daily noise quota from July 2020 onwards. On 3 July 2020 the government announced that from 10 July 2020, passengers returning or visiting from certain destinations which posed a reduced risk to the public health of UK citizens would no longer need to self-isolate when arriving in England[12]. The 'travel corridor' list included a number of popular holiday destinations in Europe and in other regions.

[10] easyJet operates a fleet of Airbus A320 family (narrow-body) aircraft and typically accounts for nearly half of all operations at Gatwick.

[11] The reductions for the wide-body fleet were driven largely by the cancellation of long-haul services to North America, the Caribbean and the Middle East.

[12] https://www.gov.uk/government/speeches/travel-corridors (accessed 03/10/2023)

3.5 Despite the opening of travel corridors, aircraft movements during August and September 2020 were approximately 70 percent lower compared to the same months in 2019. The average daily noise quota was approximately 80 percent lower over the same periods. The larger reduction in noise quota compared with movements is due to the lower proportion of (generally noisier) wide-body aircraft operating during August and September 2020. All other things being equal, an 80 percent reduction in noise quota is equivalent to a 7 dB reduction in average noise exposure.

3.6 There was also a further decrease in movements and noise quota at Gatwick from the end of September 2020, which then remained at low levels over the Christmas 2020 period and through the first half of 2021. Aircraft movements then increased again from July 2021[13] but still remained significantly below pre-pandemic levels for the rest of 2021. Figure 1 also shows that since the start of the pandemic, New Generation narrow-body aircraft (which includes the A320neo) have accounted for a greater proportion of the overall narrow-body fleet.

3.7 On 18 March 2022, the government removed all remaining Covid-19 travel restrictions for international arrivals in the UK[14]. During the remaining months of 2022, movement numbers at Gatwick reached approximately 85 to 90 percent of pre-pandemic levels.

[13] International travel restrictions were eased on 17 May 2021, allowing people in England to go on foreign holidays to 'green' list countries, see https://www.gov.uk/government/news/further-easing-of-covid-restrictions-confirmed-for-17-may (accessed 03/10/2023)

[14] https://www.gov.uk/government/news/all-covid-19-travel-restrictions-removed-in-the-uk (accessed 03/10/2023)

Figure 1 Daily Gatwick movements, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average

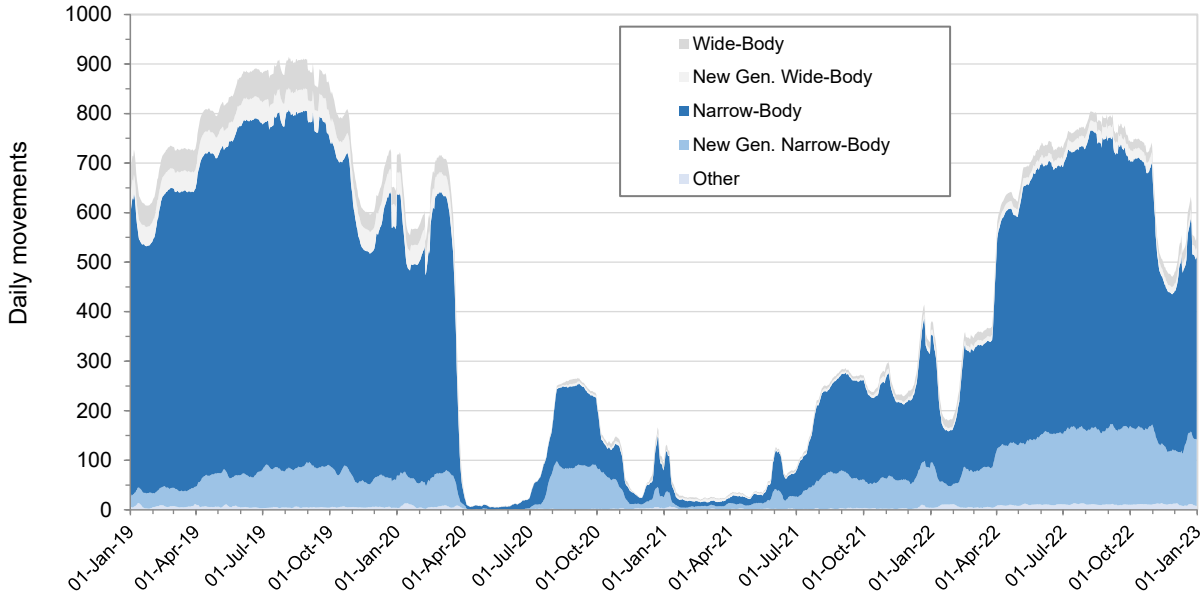
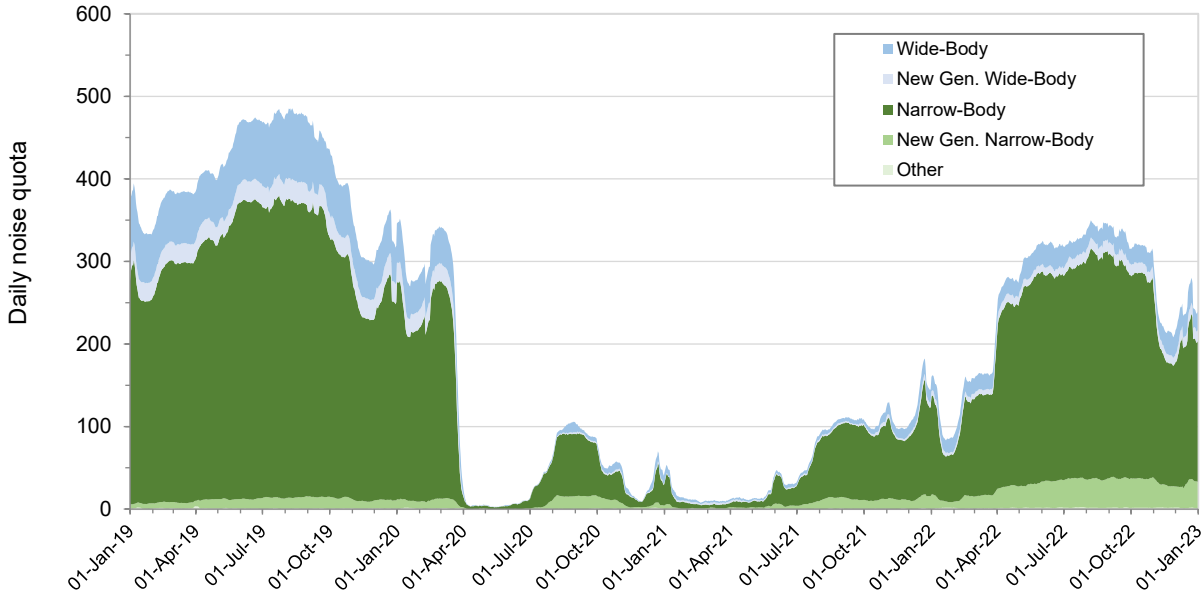


Figure 2 Daily quota usage at Gatwick, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



3.8 Figures 3, 4 and 5 show the numbers of Gatwick movements for the 16 hour day (07:00-23:00), 8 hour night (23:00-07:00) and 6.5 hour night (23:30-06:00), with results shown separately for arrivals and departures. Again, the results for 2019 and 2022 illustrate the significant increase in movements that normally occurs during the summer months. The results also show that night movements at Gatwick are historically dominated by arrivals.

Figure 3 Daily Gatwick movements, 16 hr day
(1 January 2019 - 31 December 2022, 7 day rolling average)

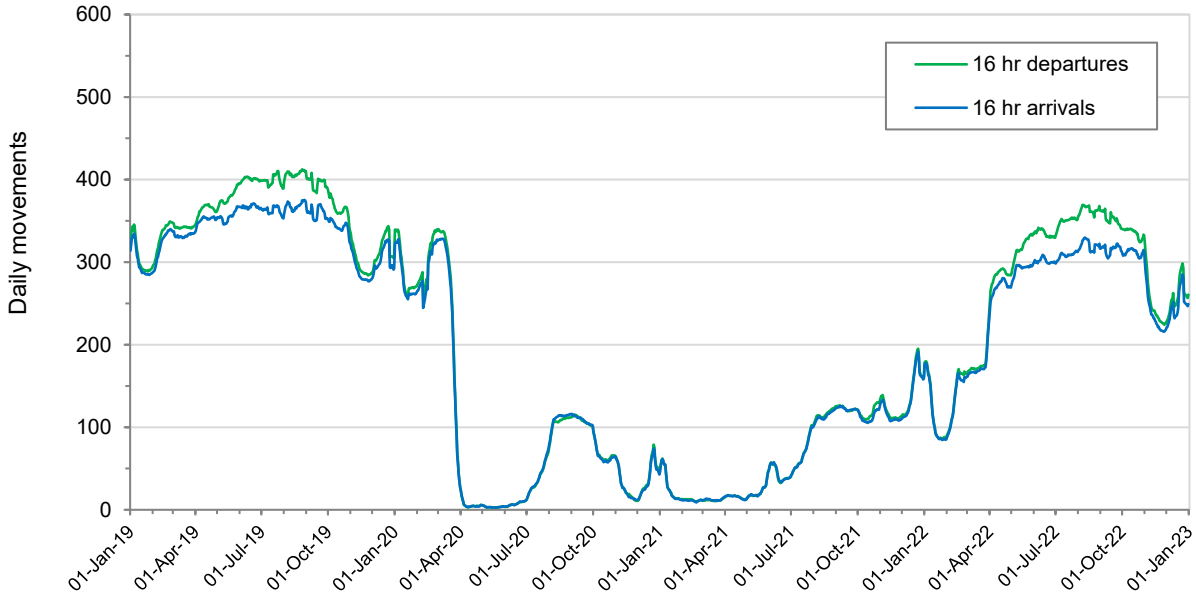


Figure 4 Daily Gatwick movements, 8 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

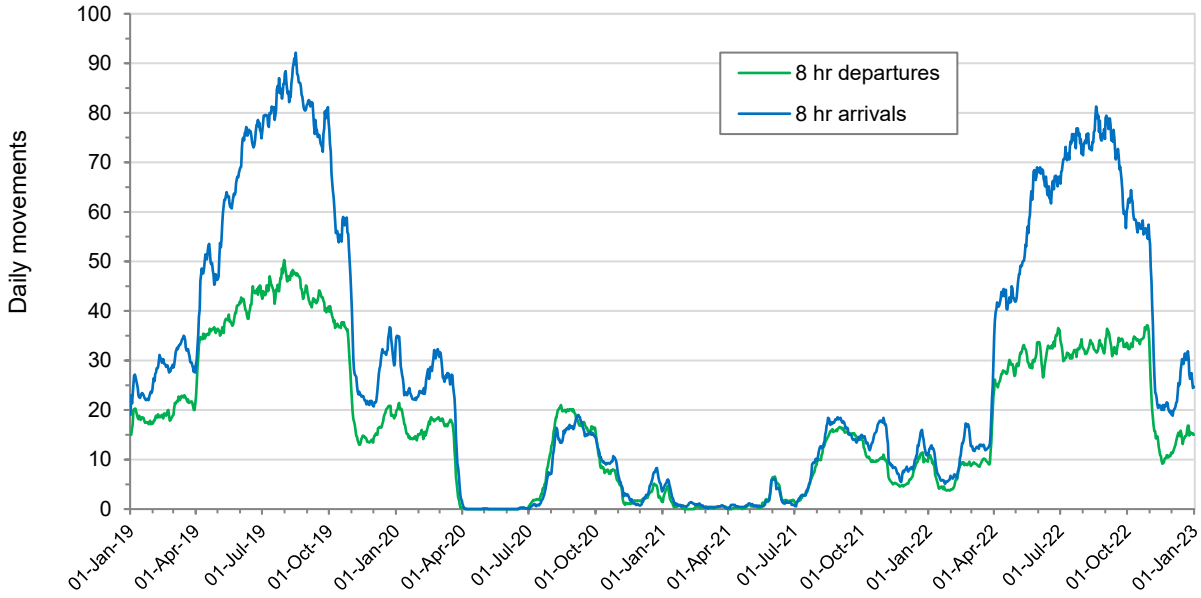
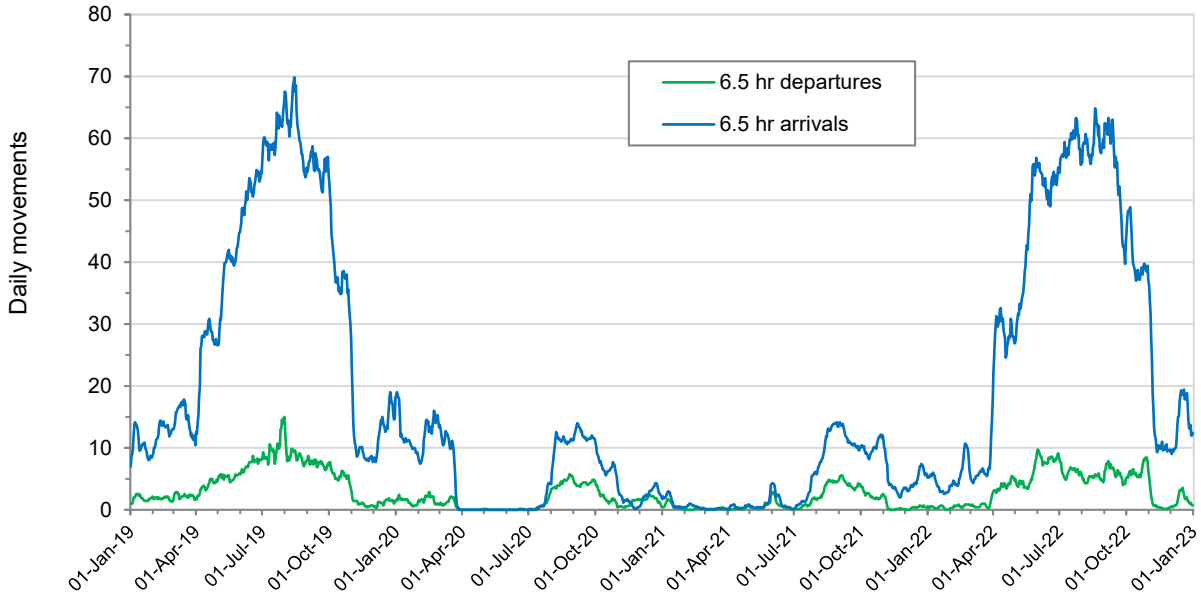


Figure 5 Daily Gatwick movements, 6.5 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)



Average QC per movement

3.9 Figure 6 shows the average daily QC value per movement at Gatwick (24 hour), with results shown separately for wide-body and narrow-body aircraft. Separate results are not shown for the 'Other' category due to the significantly smaller sample sizes but are included in the results for 'All aircraft'. The results show that wide-body aircraft are generally noisier than smaller narrow-body aircraft, as reflected in the higher average QC values for the wide-body types.

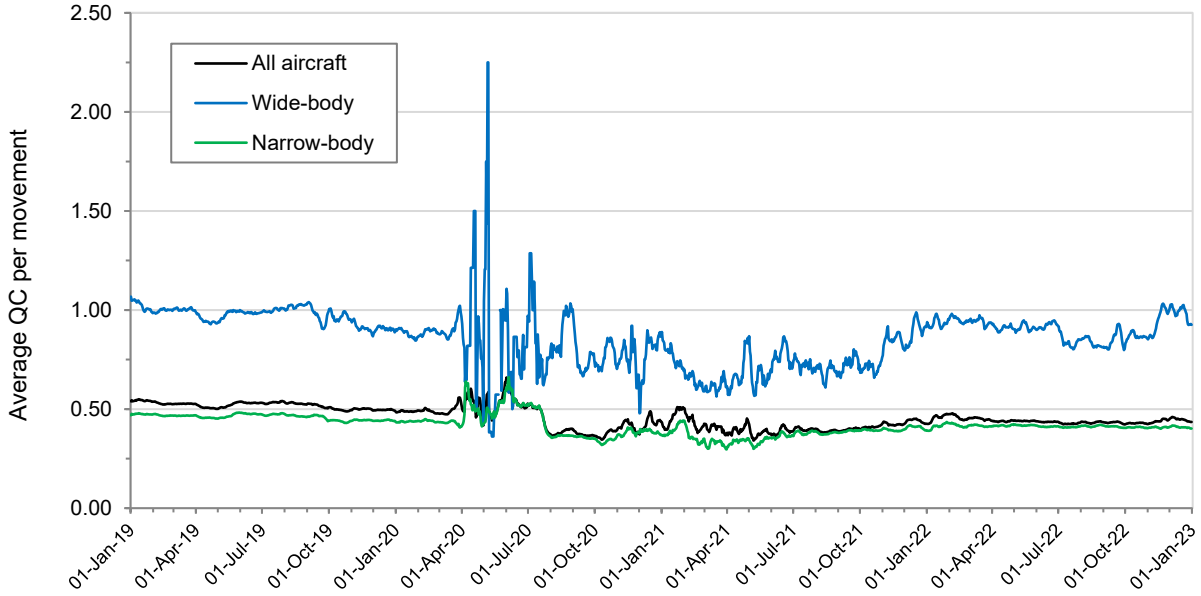
3.10 The results in Figure 6 also show a slight reduction in the average QC per movement of narrow-body aircraft from mid-July 2020. This was due to a greater proportion of more modern and quieter New Generation aircraft (such as the Airbus A320neo and A321neo) being re-introduced back into the Gatwick fleet over summer 2020[15].

3.11 The large and volatile variation in daily average QC for the wide-body fleet (which includes New Generation wide-body types) in the months immediately following the initial lockdown in March 2020 is due to the significant reduction in the numbers of movements, which highlights the wide variation of QC values that existed across the small daily numbers of wide-body types that were still in operation. As expected, this volatility is smoothed in the 'All aircraft' results, where the wide-body results are averaged with the relatively large number of

[15] Over the same period, the proportions of movements of older and noisier narrow-body types such as the Airbus A319, A320 and Boeing 737-800 decreased slightly. The A320 for example is typically QC/0.25 on arrival and QC/0.5 on departure. By comparison the newer and quieter A320neo is typically QC/0.125 on both arrival and departure.

narrow-body results. The annual average QC per movement at Gatwick in 2019 was 0.52, compared with an average of 0.44 in 2022.

Figure 6 Average daily QC per movement at Gatwick, 24 hr (1 January 2019 - 31 December 2022, 7 day rolling average)



3.12 Figures 7, 8 and 9 show the average QC value per movement at Gatwick for the 16 hour day (07:00-23:00), 8 hour night (23:00-07:00) and 6.5 hour night (23:30-06:00), with results shown separately for arrivals and departures. The results illustrate that, on average, arrivals have a lower QC value compared to departures. Again, the results also show a slight reduction in the average QC per movement from mid-July 2020 due to a greater proportion of more modern and quieter New Generation aircraft being re-introduced back into the Gatwick fleet over summer 2020. Note also that there were almost no night movements at Gatwick during April, May and June 2020 (Figures 8 and 9), and that volatility in average QC value per movement is high where movement numbers are low either side of this period (particularly for departures during the 6.5 hour night).

Figure 7 Average QC per movement at Gatwick, 16 hr day
(1 January 2019 - 31 December 2022, 7 day rolling average)

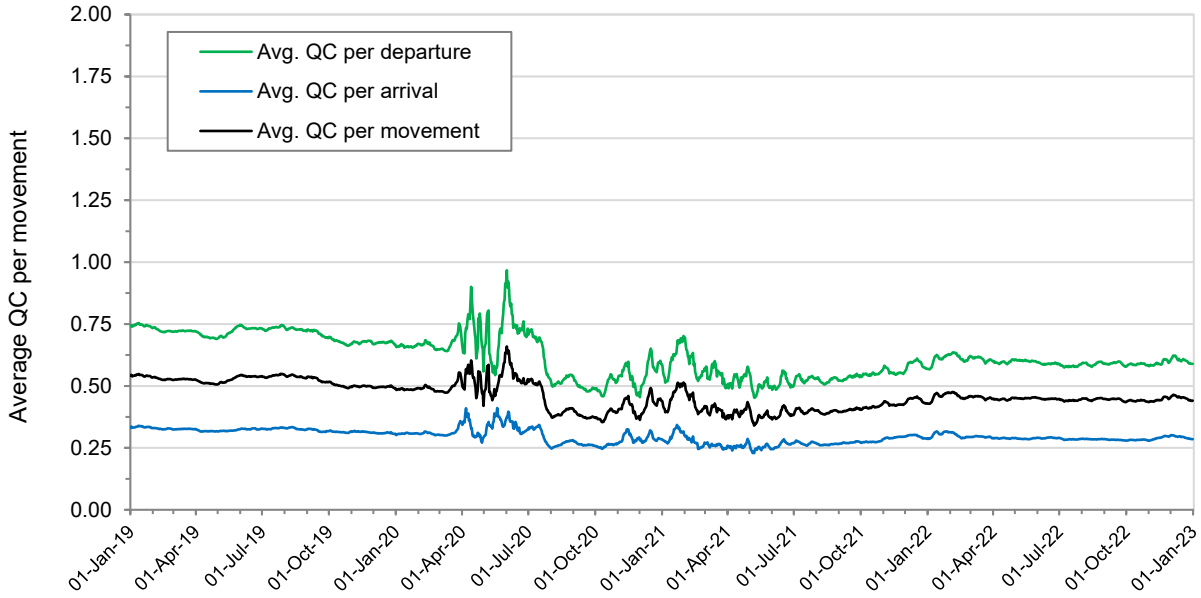


Figure 8 Average QC per movement at Gatwick, 8 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

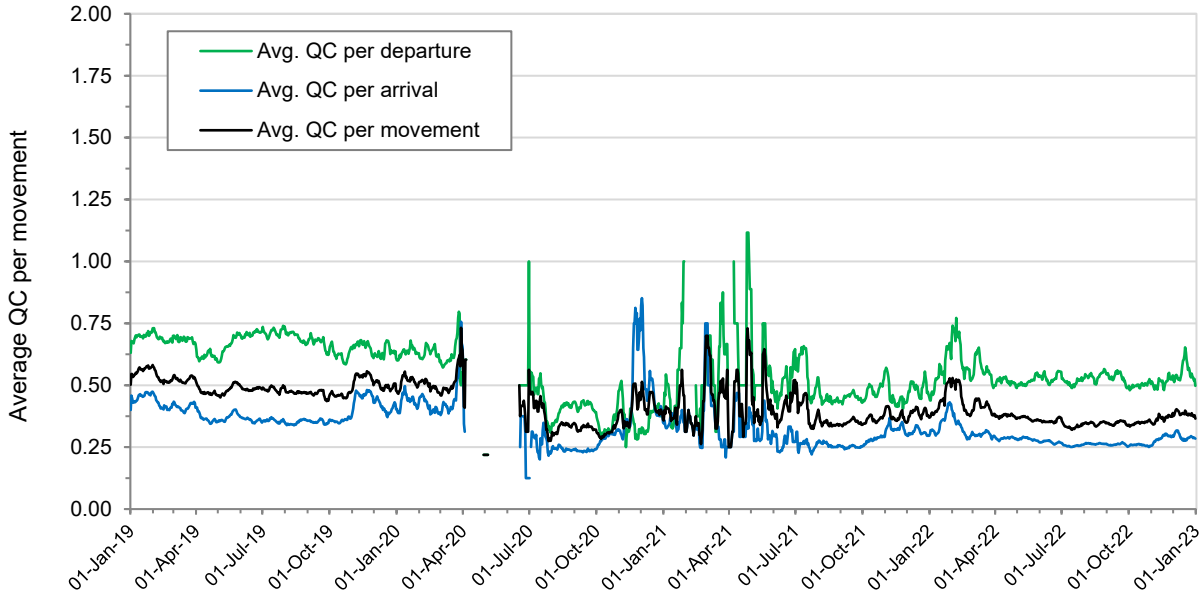
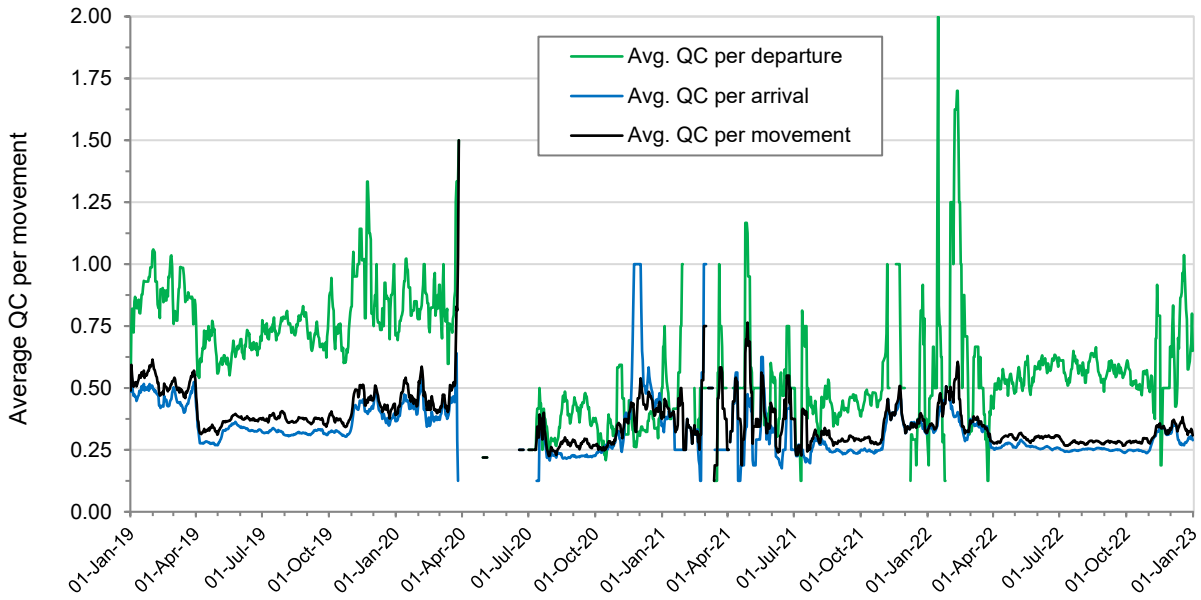


Figure 9 Average QC per movement at Gatwick, 6.5 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)



Average aircraft age

3.13 Figure 10 shows the average age of aircraft at Gatwick. The results show a marked reduction in the average age of the wide-body fleet from the end of October 2019. This was due to airlines replacing some older wide-body types with newer (and quieter) aircraft types at the start of the Winter 2019/20 scheduling season (e.g. newer Boeing 787s replacing older 767s[16]).

3.14 The results show a marked reduction in the average age of narrow-body aircraft from July 2020, following the introduction of travel corridors. This was due to newer aircraft types such as the Airbus A320neo comprising a higher proportion of the in-service fleet once airlines began to resume operations at Gatwick. A subsequent increase in the average age of narrow-body aircraft is then apparent from November 2020 onwards, due to a greater proportion of newer types being removed from service following the second national lockdown which commenced on 5 November 2020[17].

3.15 The large variation in the average age of aircraft at Gatwick in the months immediately following lockdown in March 2020 was due to the significant reduction in the numbers of movements (particularly for the wide-body fleet), which highlights the wide variation in aircraft age of the remaining fleet. The

[16] The Boeing 767-300 for example is typically classified QC/0.5 on arrival and QC/2 on departure. By comparison the Boeing 787-9 is typically classified QC/0.25 on arrival and QC/0.5 or QC/1 on departure.

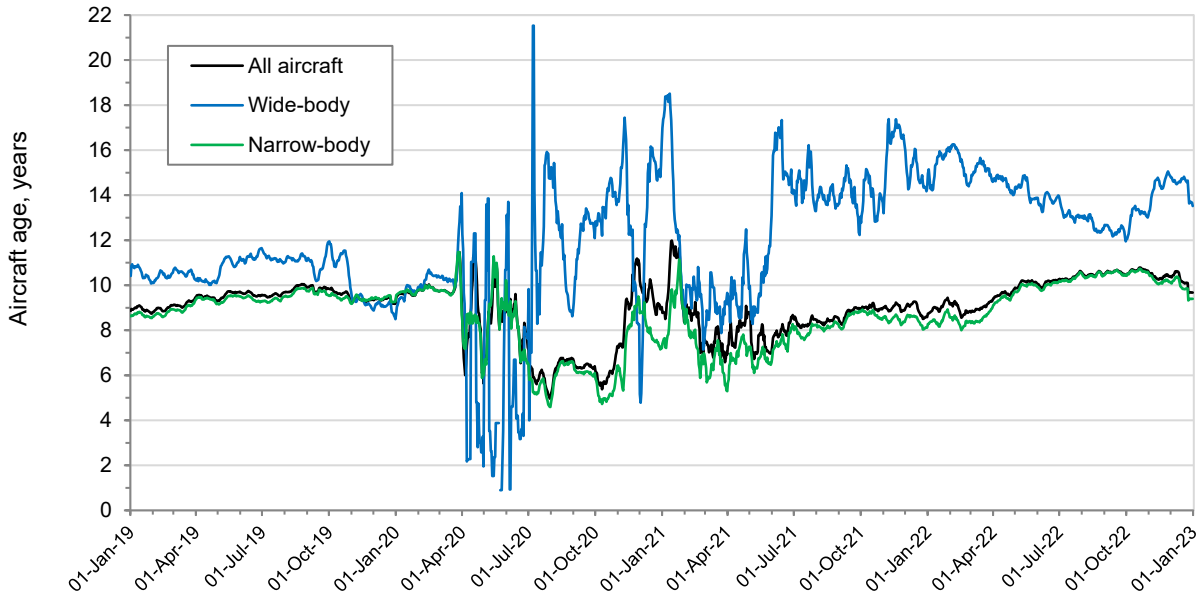
[17] https://www.gov.uk/government/news/prime-minister-announces-new-national-restrictions (accessed 03/10/2023). A third national lockdown was subsequently announced on 4 January 2021 (commencing on 5 January 2021), see https://www.gov.uk/government/news/prime-minister-announces-national-lockdown (accessed 03/10/2023).

initial increase in the average age of wide-body aircraft from July 2020 onwards was due largely to older Boeing 777 aircraft (operated by British Airways, with an average age of approximately 20 years) that had previously been removed from airline service being brought back into operation following the easing of lockdown restrictions.

3.16 The temporary reduction in the average age of the wide-body fleet over the first few months of 2021 was due mainly to a reduction in the numbers of older Boeing 777 aircraft and an increase in the numbers of newer Boeing 787-9 aircraft (operated by TUI Airways[18], with an average age of approximately four years).

3.17 From June 2021, Boeing 777 movements then gradually increased over the remainder of the year, causing an increase in the average age of the wide-body fleet. By 2022, the average age of the Gatwick fleet as a whole broadly returned to the average age immediately prior to the pandemic.

Figure 10 Average aircraft age at Gatwick, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



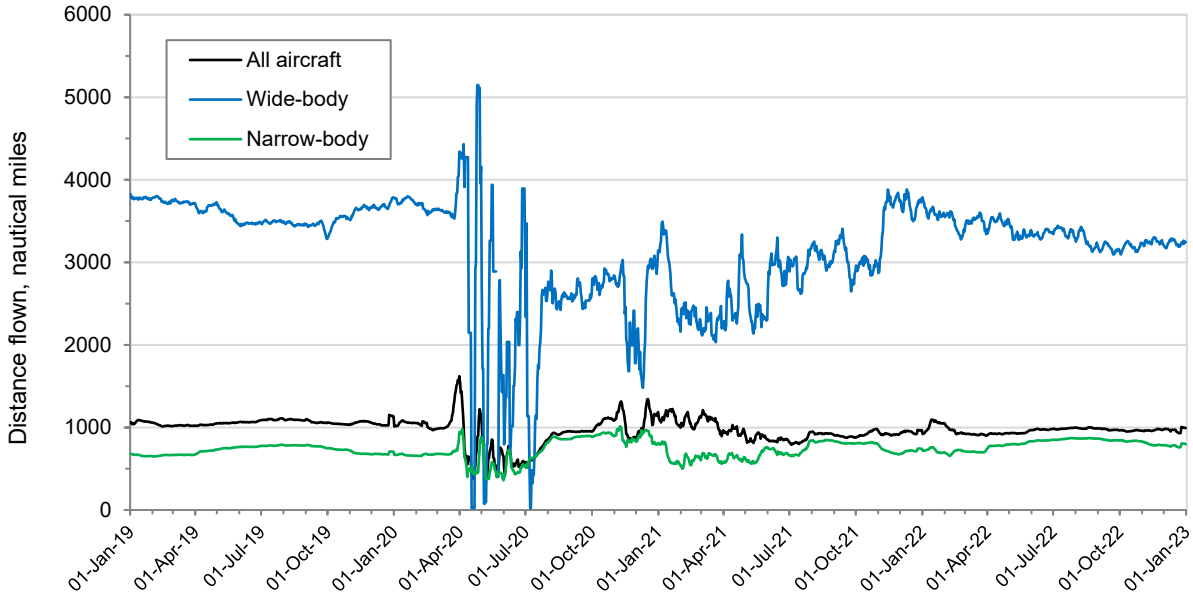
Average distance flown

3.18 Figure 11 shows the average distance flown from Gatwick, with results shown separately for wide-body and narrow-body aircraft. Results for the 'Other' category are not shown separately but are included in the results for 'All aircraft'. The results show that, as expected, wide-body aircraft typically fly much longer routes compared to smaller narrow-body aircraft.

[18] Operating cargo-only services.

3.19 The volatility in the average distance flown for wide-body aircraft was driven by fewer aircraft flying very different distances each day in the months following the initial lockdown in March 2020. In addition, the very short average distances (<100 nautical miles) shown on occasion between April and July 2020 were due to a small number of positioning flights that operated between Gatwick and other airports in the South of England. The results also show that through most of 2021, the remaining wide-body aircraft at Gatwick were typically flying shorter average distances compared to before the pandemic. Towards the end of 2021 however, the average distance flown for wide-body aircraft broadly returned to pre-pandemic levels but declined again slightly during 2022. This was caused by a smaller proportion of wide-body flights to some of the furthest destinations, including the Caribbean and Far East.

Figure 11 Average distance flown to/from Gatwick, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



3.20 To provide further insight on the distances flown by aircraft operating from Gatwick, Figures 12 and 13 show the different route categories flown by narrow-body and wide-body aircraft respectively. In each figure, aircraft movements have been grouped as follows:

- Short-haul flights under 1,500 km (<810 NM)
- Medium-haul flights between 1,500 and 3,500 km (810-1,890 NM)
- Long-haul flights over 3,500 km (>1,890 NM)

3.21 The results show, unsurprisingly, that narrow-body aircraft at Gatwick typically fly short-haul routes (and to a lesser extent medium-haul) whereas larger wide-body aircraft typically fly long-haul routes. Note again that the large and volatile variations in percentage of movements visible in Figure 13 between April and July 2020 are due to the significant reduction in numbers of wide-body

movements (often with no daily movements). The results also show that through most of 2021, a smaller percentage of the remaining wide-body fleet were flying long-haul routes compared to before the pandemic (which is consistent with the results shown for wide-body aircraft in Figure 11). By the end of 2021 however, the percentage of wide-body aircraft flying long-haul routes returned to pre-pandemic levels although this declined again slightly during 2022.

Figure 12 Route categories flown by narrow-body aircraft at Gatwick, 24 hr (1 January 2019 - 31 December 2022, 7 day rolling average)

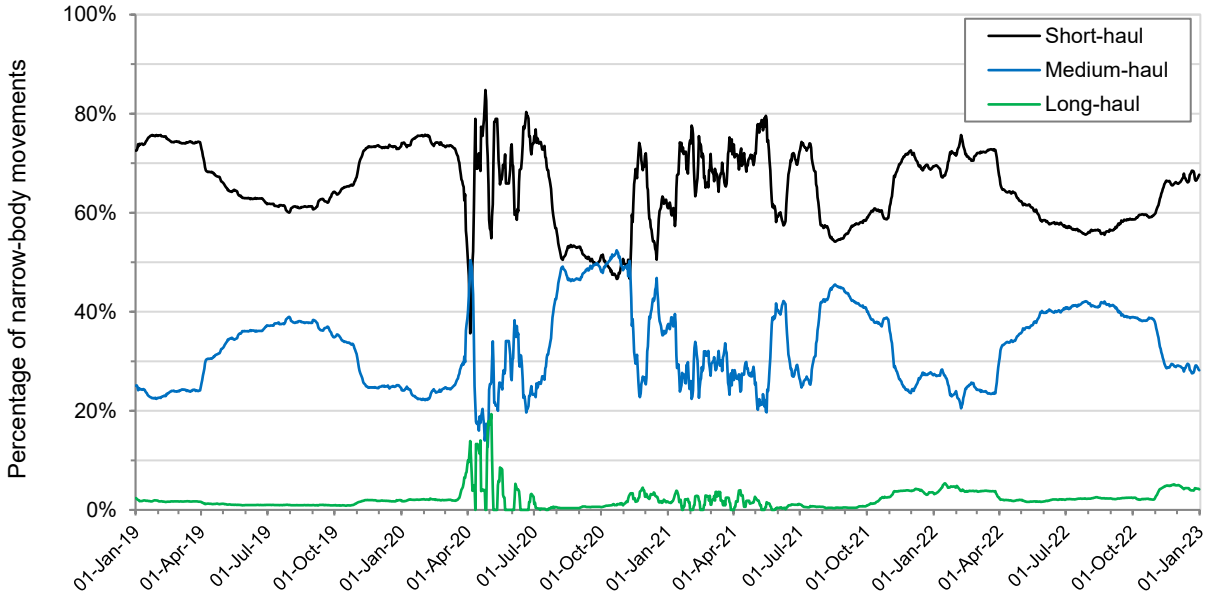
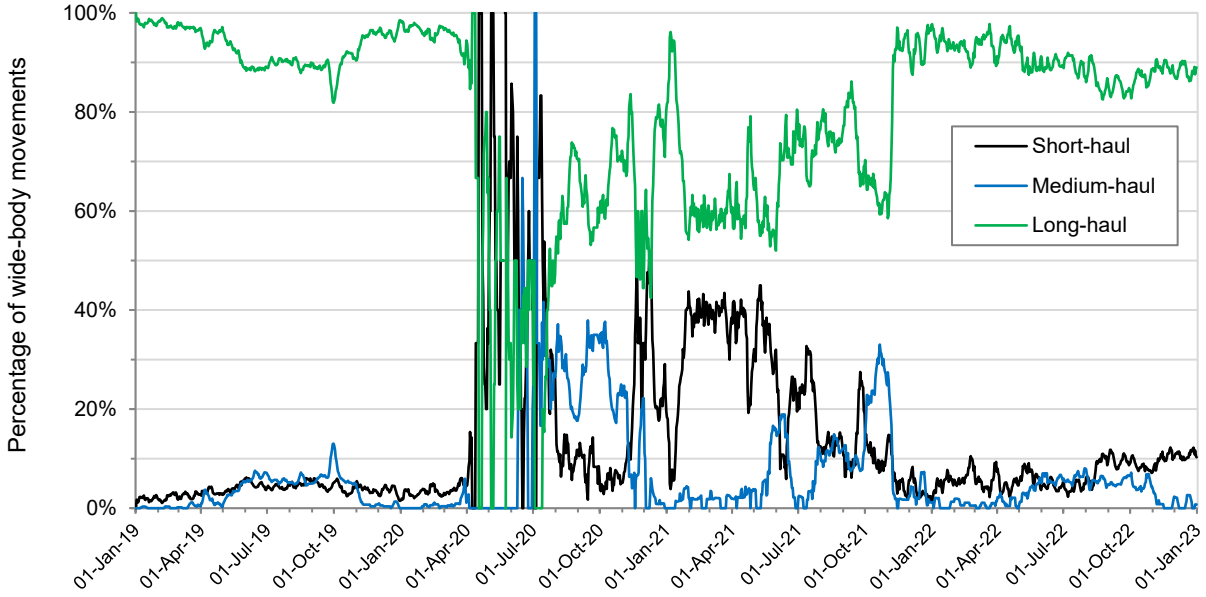


Figure 13 Route categories flown by wide-body aircraft at Gatwick, 24 hr (1 January 2019 - 31 December 2022, 7 day rolling average)



Chapter 4

Heathrow Airport

Daily aircraft movements and noise quota

4.1 Figure 14 presents the daily numbers of aircraft movements at Heathrow since 1 January 2019. Figure 15 presents the corresponding daily quota usage over the same period. In each figure, aircraft movements have been grouped into the following broad categories of aircraft based on size and where applicable the level of aircraft noise reduction technology:

- Wide-body
- 'New Generation' Wide-body
- Narrow-body
- 'New Generation' Narrow-body
- Other

4.2 A summary of aircraft types included in each category is provided in Appendix B. The results in Figure 14 indicate that narrow-body aircraft at Heathrow typically account for approximately 60 percent of all aircraft movements[19].

4.3 The results in Figures 14 and 15 show a significant reduction in the numbers of movements and associated quota usage at Heathrow in the months immediately following lockdown in March 2020. The results in Figure 14 also show a greater reduction of narrow-body aircraft than wide-body aircraft immediately following the lockdown, which can be explained by the continued use of wide-body aircraft for mainly cargo operations. Note also that the sudden and short-term reductions in the numbers of movements shown in Figure 14 prior to the pandemic were due to flight cancellations because of industrial action (9-10 September 2019) or bad weather (11 February 2020), and also due to normal seasonal lulls (25 December 2019).

4.4 The results show a temporary increase in Heathrow movements and daily noise quota from July through to October 2020, following the introduction of the UK travel corridors on 10 July 2020[12]. Despite this increase, aircraft movements during August and September 2020 were approximately 60 percent lower compared to the same months in 2019. The average daily noise quota was approximately 70 percent lower over the same periods. All other things being equal, a 70 percent reduction in noise quota is approximately equivalent to a

[19] British Airways operates a fleet of narrow-body and wide-body aircraft and typically accounts for approximately half of all operations at Heathrow.

5 dB reduction in average noise exposure. After a further temporary increase over the Christmas 2020 period, aircraft movements then remained at relatively low levels through to the end of May 2021[13], at which point movements started to increase again, reaching approximately 60 percent of pre-pandemic movement levels by December 2021.

4.5 Following the removal in March 2022 of all remaining Covid-19 travel restrictions for international arrivals in the UK, movement numbers at Heathrow reached approximately 85 to 90 percent of pre-pandemic levels during the remaining months of 2022.

4.6

Figure 14 Daily Heathrow movements, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)

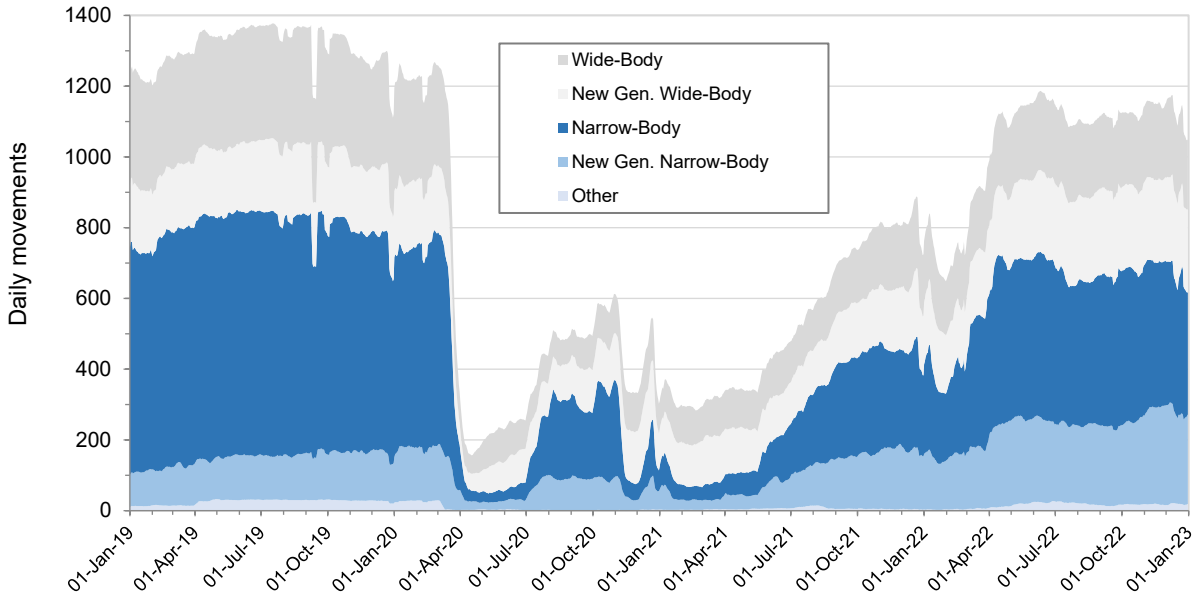
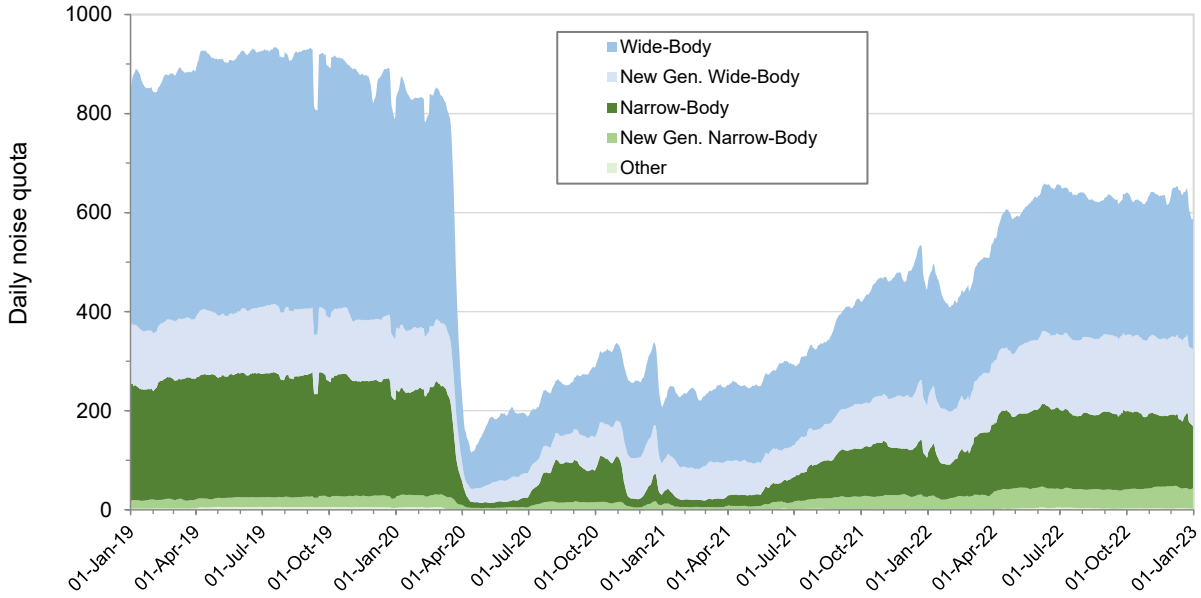


Figure 15 Daily quota usage at Heathrow, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



4.7 Figures 16, 17 and 18 show the numbers of Heathrow movements for the 16 hour day (07:00-23:00), 8 hour night (23:00-07:00) and 6.5 hour night (23:30-06:00), with results shown separately for arrivals and departures. The results show that night movements at Heathrow are dominated by arrivals. The large spike in the number of night-time departures shown in Figure 18 during 2019 (and to a lesser extent in Figure 17) was due to storms across Europe on 25/26 July 2019 causing a significant number of departures to be delayed into the night period. Several other spikes can also be seen for night-time departures during 2022. These were mainly caused by disruptions and delays due to either industrial action by airport workers or ATC restrictions.

Figure 16 Daily Heathrow movements, 16 hr day
(1 January 2019 - 31 December 2022, 7 day rolling average)

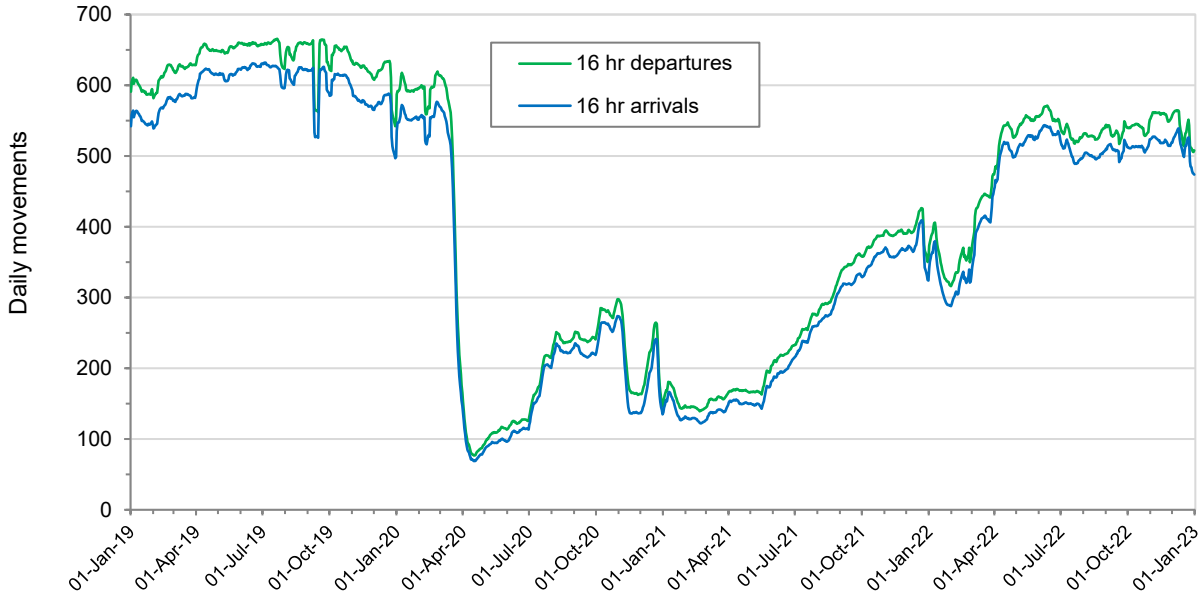


Figure 17 Daily Heathrow movements, 8 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

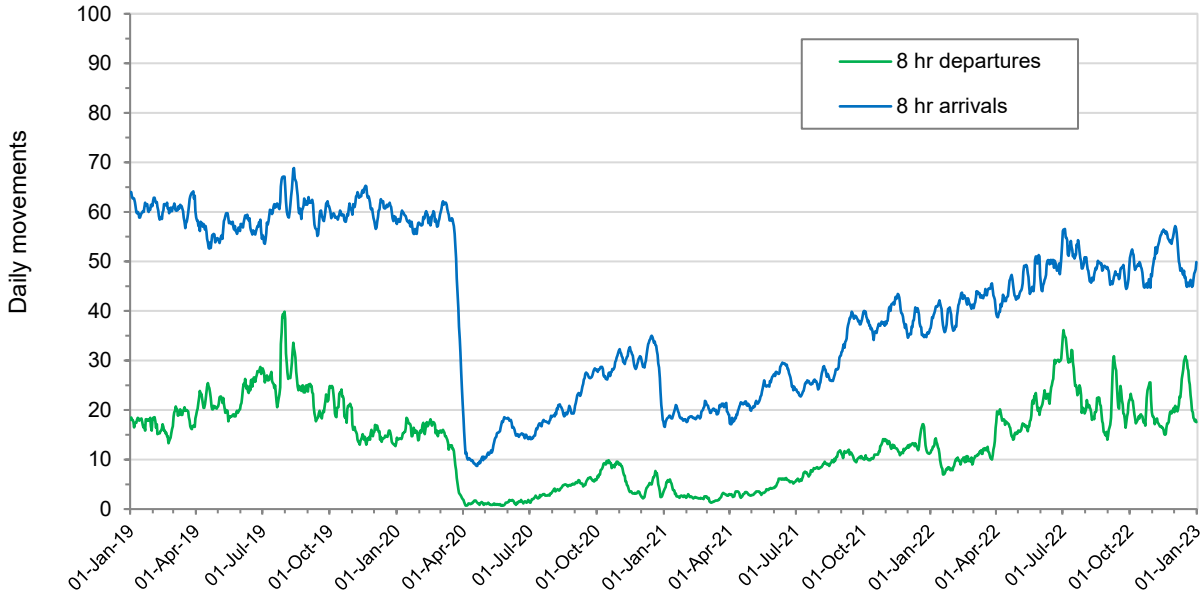
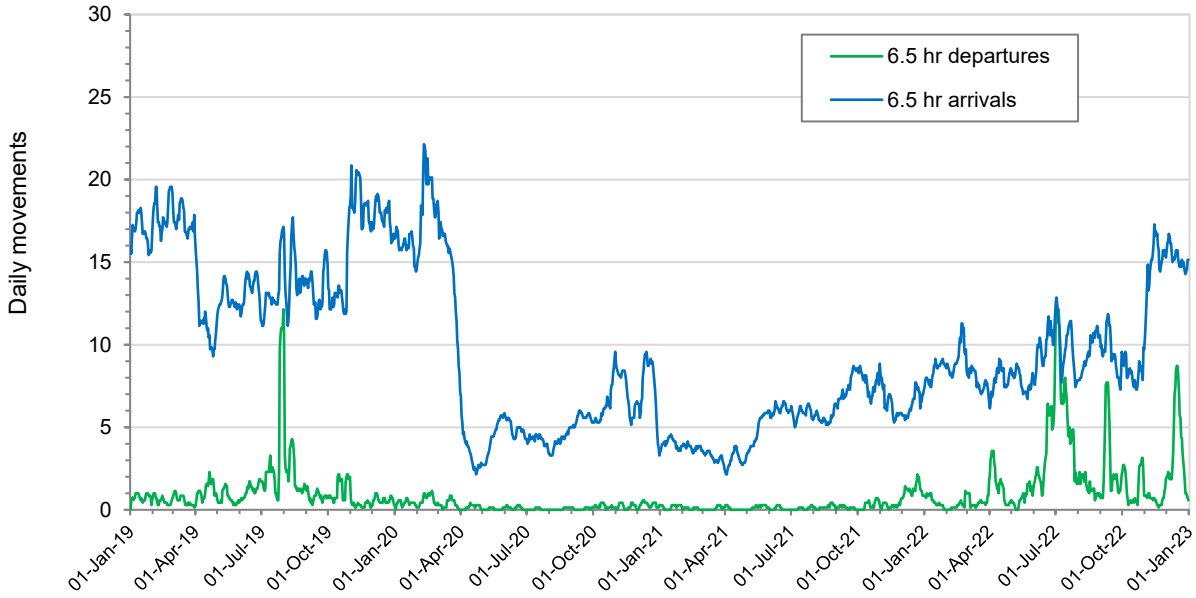


Figure 18 Daily Heathrow movements, 6.5 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)



Average QC per movement

4.8 Figure 19 shows the average daily QC value per movement at Heathrow (24 hour), with results shown separately for wide-body and narrow-body aircraft. Separate results are not shown for the 'other' category due to the significantly smaller sample sizes but are included in the results for 'All aircraft'. The results show that wide-body aircraft are generally noisier than smaller narrow-body aircraft, as reflected in the higher QC values for the wide-body types.

4.9 The results show a marked reduction in the average QC value for wide-body aircraft immediately following the lockdown in March 2020, largely as a result of the permanent withdrawal of Boeing 747-400 passenger operations by British Airways[20]. Prior to the lockdown the 747-400 was the noisiest wide-body aircraft in regular service at Heathrow[21]. A similar (albeit smaller) reduction in the average QC value for narrow-body aircraft is also visible in the results over the same period, caused by proportionally more older and noisier narrow-body aircraft such as the Airbus A319 and A320[22] being taken out of service immediately following the lockdown.

4.10 The increase in the average QC value for 'All aircraft' in the months immediately following the first lockdown (and during the subsequent lockdowns[17]) is due to

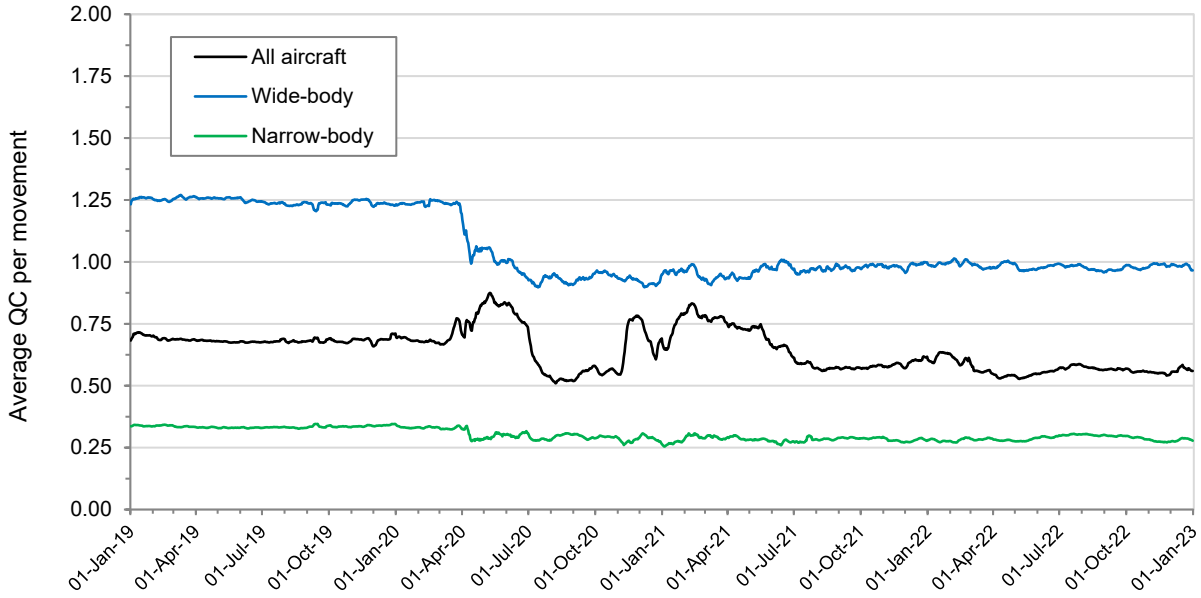
[20] The Boeing 747-400s operated by British Airways were QC/2 on arrival and QC/4 on departure.

[21] Some Boeing 747-400 freighter services continued to operate at Heathrow following the lockdown in March 2020.

[22] The A320 for example is typically QC/0.25 on arrival and QC/0.5 on departure. By comparison the newer and quieter A320neo is typically QC/0.125 on both arrival and departure.

the higher proportion of larger (and relatively noisier) wide-body types in the remaining fleet, as indicated in Figure 14. The annual average QC per movement at Heathrow in 2019 was 0.68, compared with an average of 0.56 in 2022.

Figure 19 Average daily QC per movement at Heathrow, 24 hr (1 January 2019 - 31 December 2022, 7 day rolling average)



4.11 Figures 20, 21 and 22 show the average QC value per movement at Heathrow for the 16 hour day (07:00-23:00), 8 hour night (23:00-07:00) and 6.5 hour night (23:30-06:00), with results shown separately for arrivals and departures. Again, the results illustrate that, on average, arrivals have a lower QC value compared to departures.

4.12 In Figure 20, the increase in the average QC value per movement during the daytime following the lockdown in March 2020 is due to the higher proportion of larger wide-body types in the remaining fleet. In Figure 21, the marked increase in average QC per departure at night in the months immediately following the first lockdown is due to the significant reduction in the numbers of quieter narrow-body types that operated at night.

4.13 Due to the higher proportion of wide-body arrivals and lower proportion of wide-body departures during the 8 hr night compared to the 16 hour day, the average QC per arrival at night is generally slightly higher than during the day whereas the average QC per departure at night is slightly lower (Figures 20 and 21).

4.14 The large and volatile variations in average QC per departure visible in Figure 22 are due to the typically low numbers of departures (and often no departures) during the 6.5 hour night. A small but gradual reduction in average QC per arrival over time can also be seen in Figure 22, until the marked increase in average QC towards the end of March 2021, coinciding with the start of the summer 2021 scheduling season. This increase was due largely to the temporary replacement

of some quieter Airbus A350 services (classified QC/0.5 on arrival) with older Boeing 777s (classified QC/1). The average QC per arrival then reduces again from July 2021 as a greater proportion of quieter aircraft types are operated during the 6.5 hour night.

Figure 20 Average QC per movement at Heathrow, 16 hr day
(1 January 2019 - 31 December 2022, 7 day rolling average)

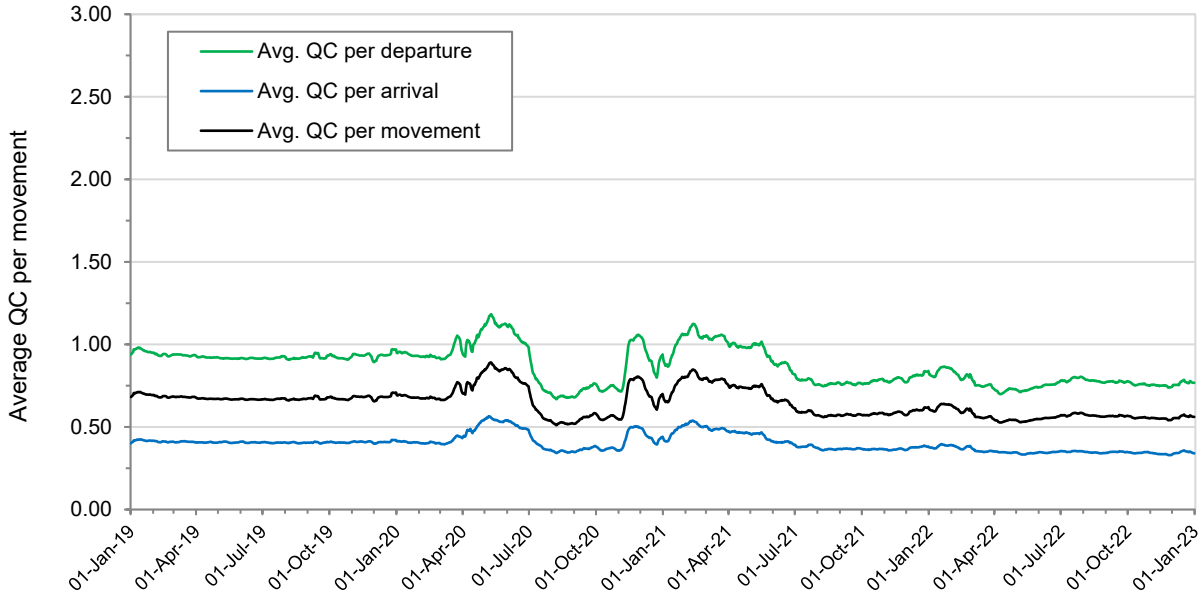


Figure 21 Average QC per movement at Heathrow, 8 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

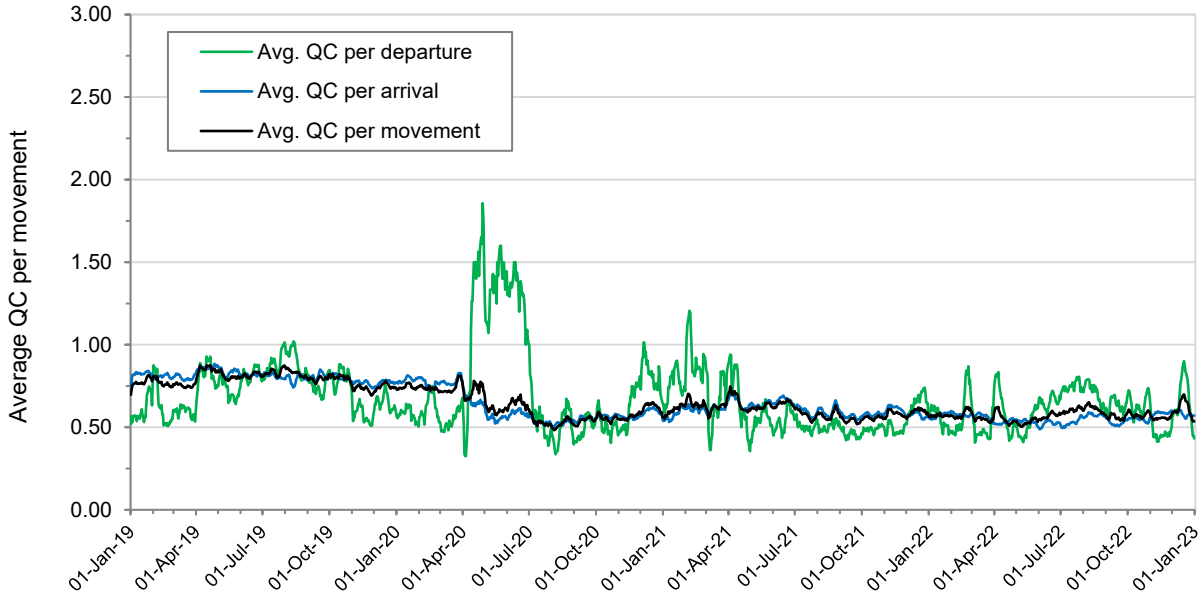
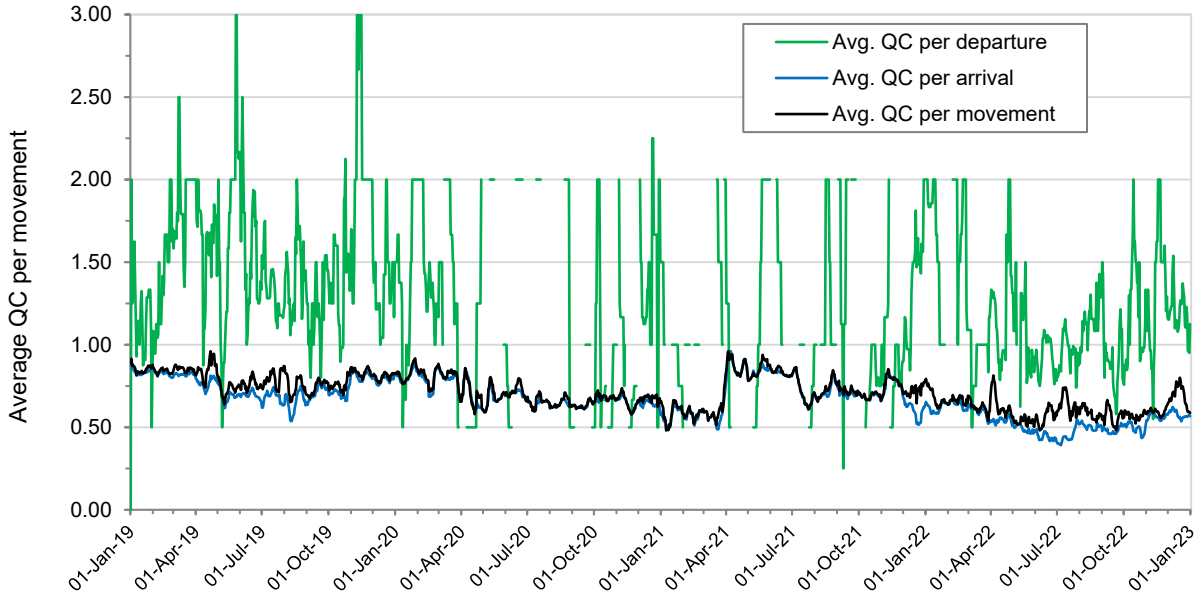


Figure 22 Average QC per movement at Heathrow, 6.5 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

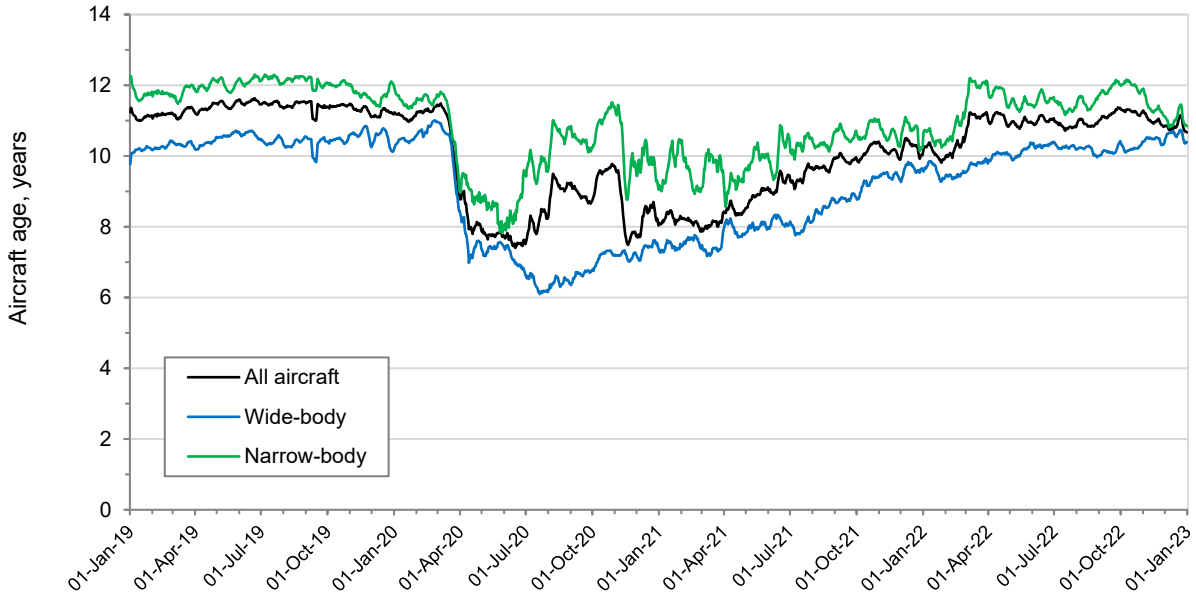


Average aircraft age

4.15 Figure 23 shows the average age of aircraft at Heathrow. The results show a marked reduction in the average age of both wide-body and narrow-body aircraft immediately following the lockdown in March 2020, due to a higher proportion of older aircraft being removed from service[23]. An increase in the average age of narrow-body aircraft is also visible from June 2020 onwards as more older aircraft that had previously been removed from service were brought back into operation. A similar trend is also visible from August 2020 onwards for wide-body aircraft, but to a lesser extent. By 2022, the average age of the Heathrow fleet as a whole broadly returned to the average age immediately prior to the pandemic.

[23] Older wide-body types at Heathrow include the Boeing 747-400 and 767-300, with an average age of 23 years and 20 years respectively, as of March 2020. Older narrow-body types include the Airbus A319 and A320 with an average age of 18 years and 12 years respectively.

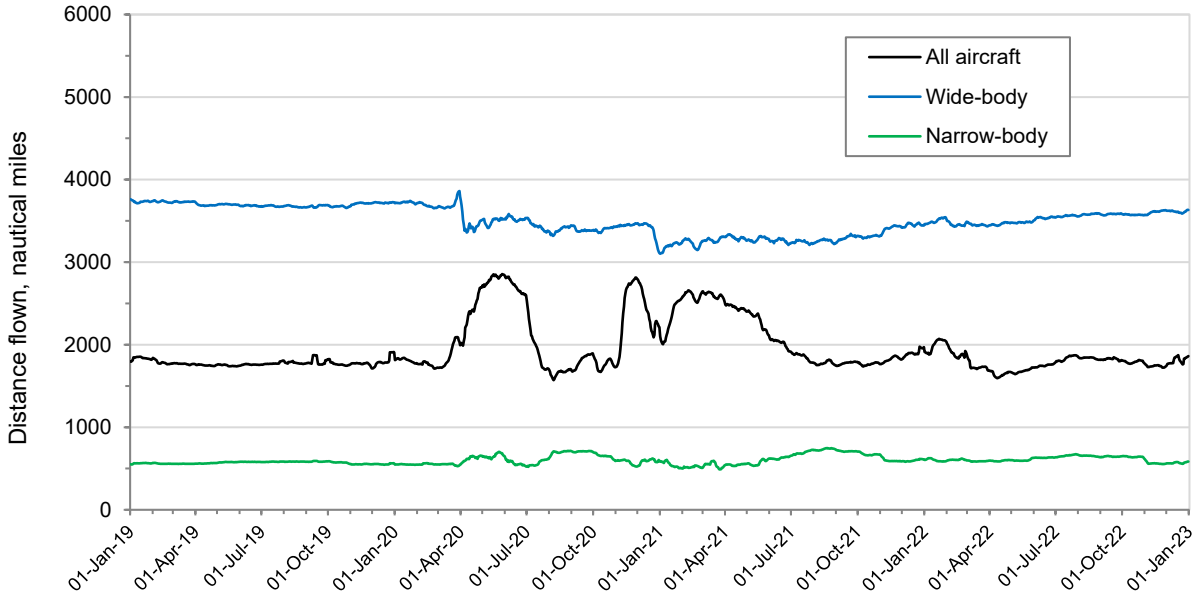
Figure 23 Average aircraft age at Heathrow, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



Average distance flown

4.16 Figure 24 shows the average distance flown from Heathrow, with results shown separately for wide-body and narrow-body aircraft. Results for the 'Other' category are not shown separately but are included in the results for 'All aircraft'. The results show that wide-body aircraft typically fly much longer routes compared to smaller narrow-body aircraft. The short-term increase in the average distance flown for all aircraft immediately following the lockdown in March 2020 (and subsequently between November 2020 and June 2021) is due to the higher proportion of wide-body types in the remaining fleet during those periods (see Figure 14).

Figure 24 Average distance flown to/from Heathrow, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



4.17 To provide further insight on the distances flown by aircraft operating from Heathrow, Figures 25 and 26 show the different route categories flown by narrow-body and wide-body aircraft respectively. In each figure, aircraft movements have been grouped as follows:

- Short-haul flights under 1,500 km (<810 NM)
- Medium-haul flights between 1,500 and 3,500 km (810-1,890 NM)
- Long-haul flights over 3,500 km (>1,890 NM)

4.18 The results show, unsurprisingly, that narrow-body aircraft at Heathrow typically fly short-haul routes whereas larger wide-body aircraft typically fly long-haul routes. The results also show that since the start of the pandemic there has generally been a greater variation in the different route categories flown within the narrow-body fleet, although the percentage of operations within in each route category returned to the pre-pandemic situation towards the end of 2022.

Figure 25 Route categories flown by narrow-body aircraft at Heathrow, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)

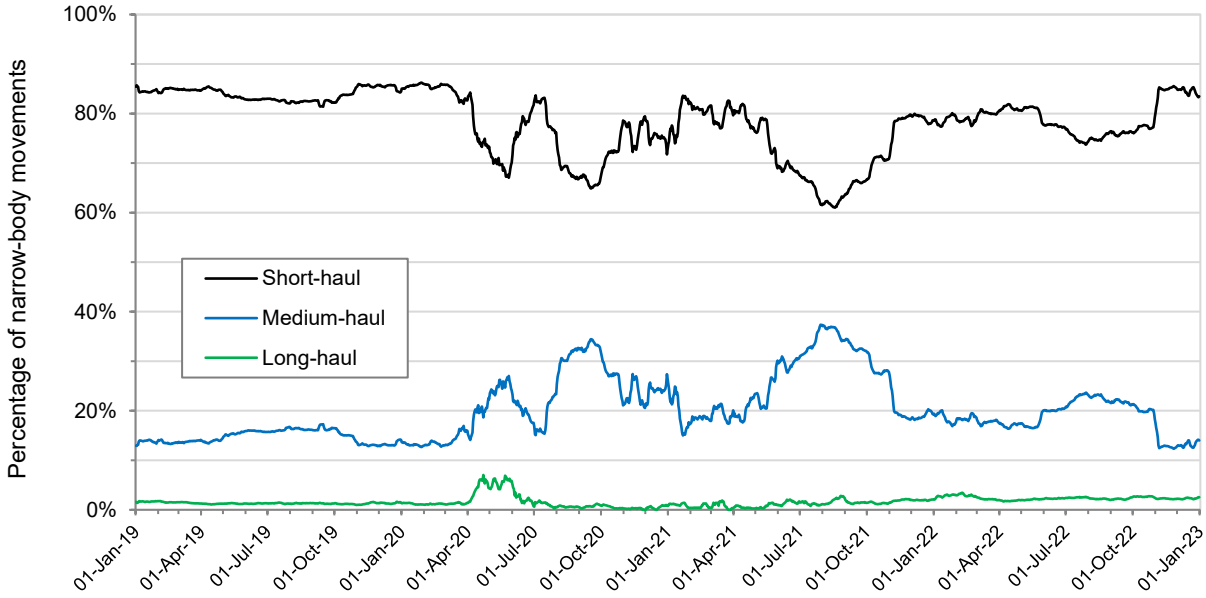
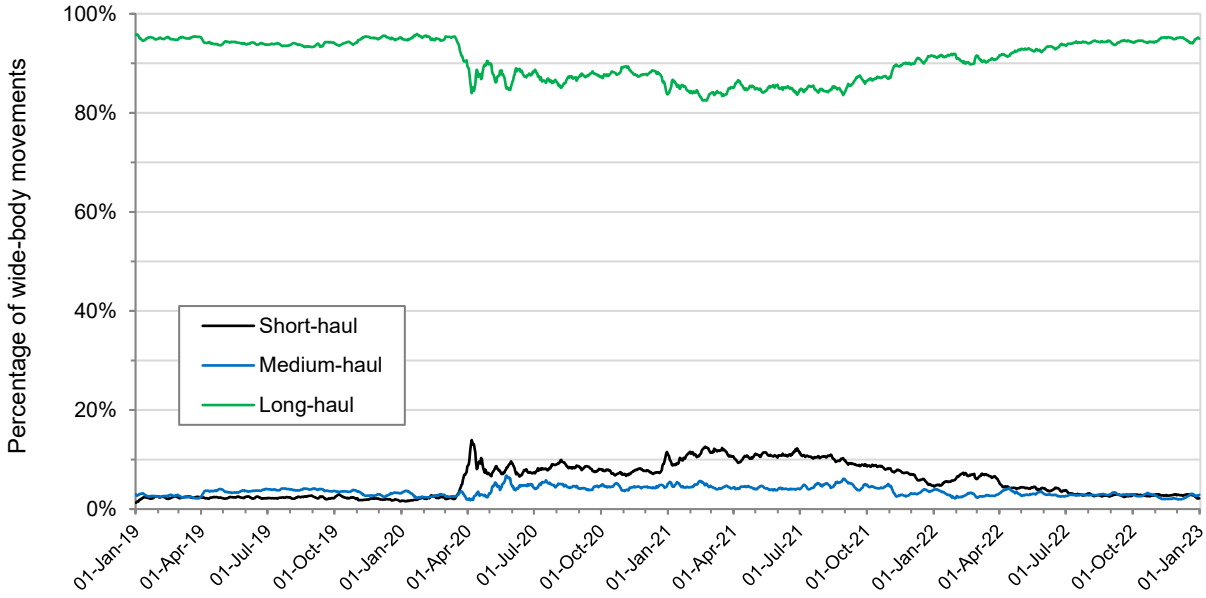


Figure 26 Route categories flown by wide-body aircraft at Heathrow, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



Chapter 5

Stansted Airport

Daily aircraft movements and noise quota

5.1 Figure 27 presents the daily numbers of aircraft movements at Stansted since 1 January 2019. Figure 28 presents the corresponding daily quota usage over the same period. In each figure, aircraft movements have been grouped into the following broad categories of aircraft based on size and where applicable the level of aircraft noise reduction technology:

- Wide-body
- 'New Generation' Wide-body
- Narrow-body
- 'New Generation' Narrow-body
- Other

5.2 A summary of aircraft types included in each category is provided in Appendix B.

5.3 The results in Figures 27 and 28 show a significant reduction in the numbers of movements and associated quota usage at Stansted in the months immediately following lockdown in March 2020, largely for the narrow-body fleet which normally dominate operations at Stansted[24]. The results for 2019 and 2022 also illustrate the significant increase in movements that normally occurs during the summer months.

5.4 The results show a temporary increase in Stansted movements and daily noise quota from July 2020 onwards, following the introduction of the UK travel corridors on 10 July 2020[12]. Despite this increase, aircraft movements at Stansted during August and September 2020 were approximately 50 percent lower compared to the same months in 2019. The total noise quota was also approximately 50 percent lower over the same periods. All other things being equal, a 50 percent reduction in noise quota is equivalent to a 3 dB reduction in average noise exposure.

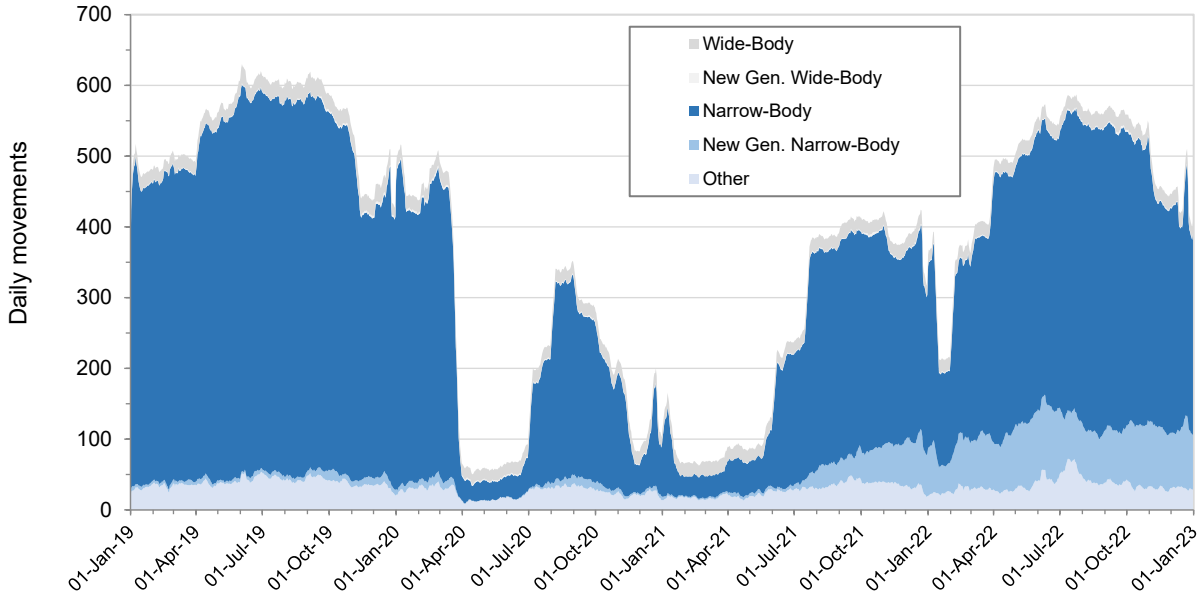
5.5 There was a subsequent decrease in movements and noise quota from the end of September 2020, which then remained at low levels over the Christmas 2020 period through to the end of May 2021[13], at which point movements started to increase again, reaching approximately 65 percent of peak 2019 movement levels over the second half of 2021. There was also a gradual increase in the

[24] Ryanair operates a fleet of Boeing 737 (narrow-body) aircraft and typically accounts for more than 60 percent of all operations at Stansted.

numbers of New Generation narrow-body aircraft at Stansted over the second half of 2021 as a result of the entry into service of Ryanair's new Boeing 737 MAX aircraft[25].

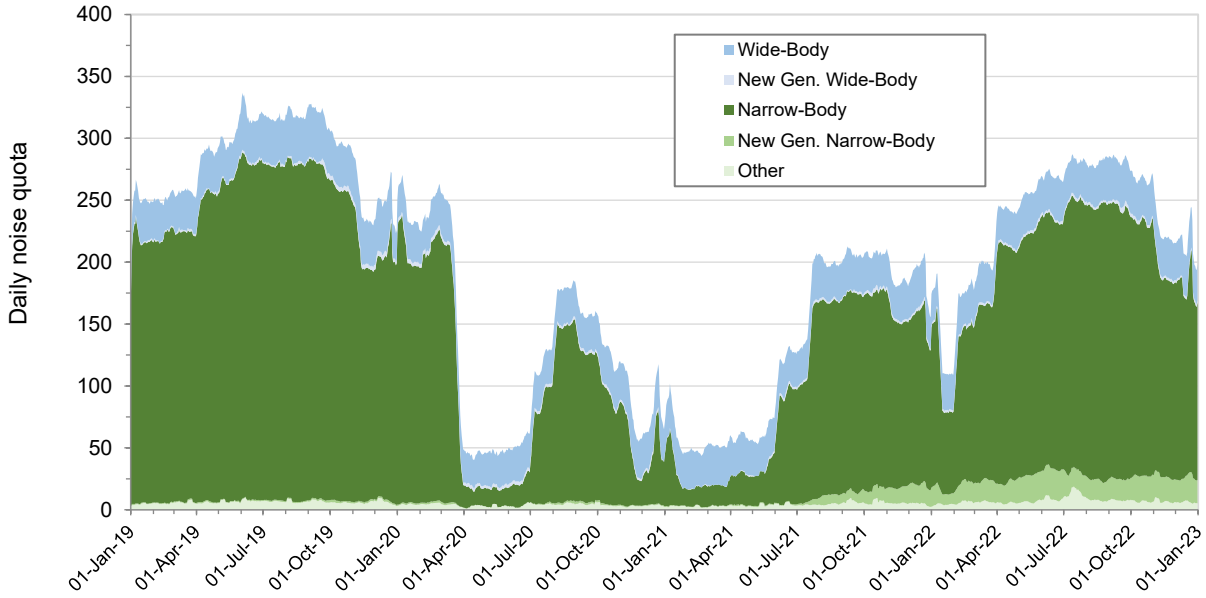
5.6 Following the removal in March 2022 of all remaining Covid-19 travel restrictions for international arrivals in the UK, movement numbers at Stansted reached approximately 95 percent of pre-pandemic levels through the remainder of 2022.

Figure 27 Daily Stansted movements, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



[25] Ryanair has ordered 210 new Boeing 737 MAX 8200 aircraft with deliveries taking place between Spring 2021 and December 2024. https://corporate.ryanair.com/news/ryanair-orders-75-boeing-max-8200-aircraft-210-in-total/ (accessed 03/10/2023). Ryanair's 737 MAX 8200 aircraft are classified QC/0.25 on arrival and either QC/0.125 or QC/0.25 on departure depending on the certificated take-off weight. In May 2023 Ryanair also placed a firm order for 150 new 737 MAX 10 aircraft (with options for 150 more) for delivery between 2027 and 2033. https://corporate.ryanair.com/news/ryanair-orders-300-boeing-737-max-10-aircraft-worth-40bn/ (accessed 03/10/2023).

Figure 28 Daily quota usage at Stansted, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



5.7 Figures 29, 30 and 31 show the numbers of Stansted movements for the 16 hour day (07:00-23:00), 8 hour night (23:00-07:00) and 6.5 hour night (23:30-06:00), with results shown separately for arrivals and departures. Again, the results for 2019 and 2022 illustrate the significant increase in movements that normally occurs during the summer months. The results also show that night movements at Stansted are generally dominated by arrivals. In addition, night-time movement numbers at Stansted during summer 2022 exceeded those for summer 2019.

Figure 29 Daily Stansted movements, 16 hr day
(1 January 2019 - 31 December 2022, 7 day rolling average)

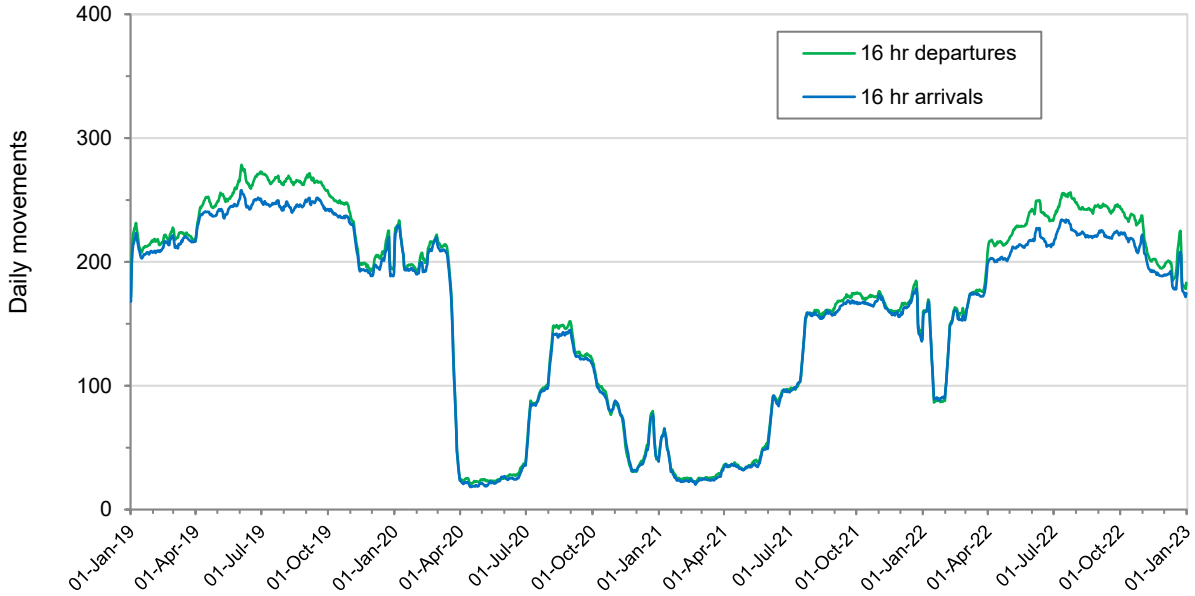
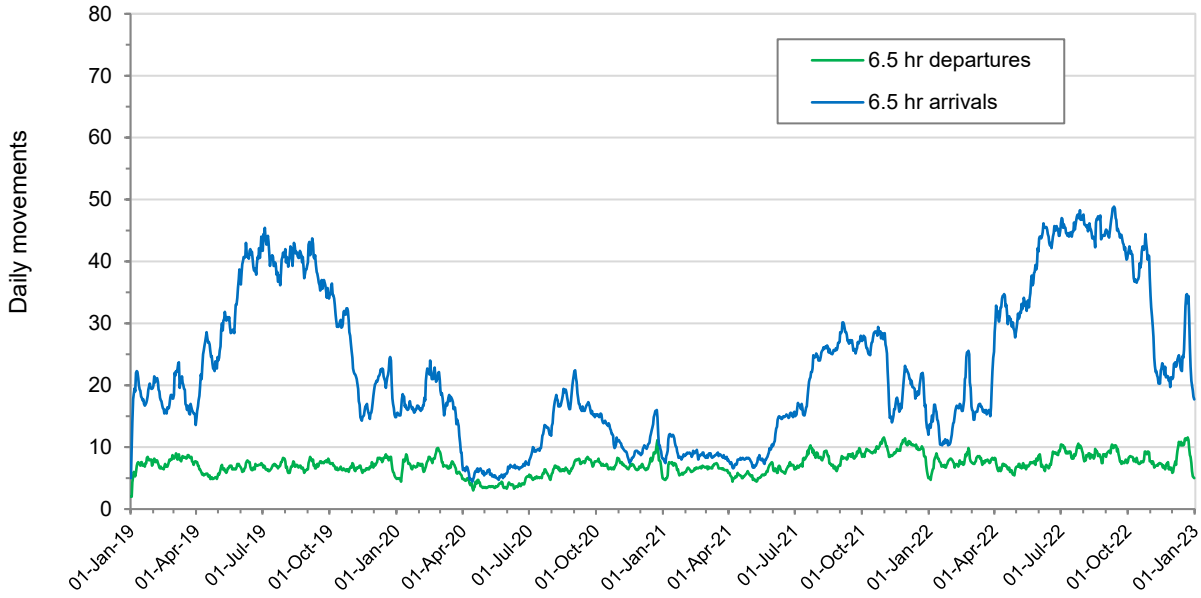


Figure 30 Daily Stansted movements, 8 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

Figure 31 Daily Stansted movements, 6.5 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

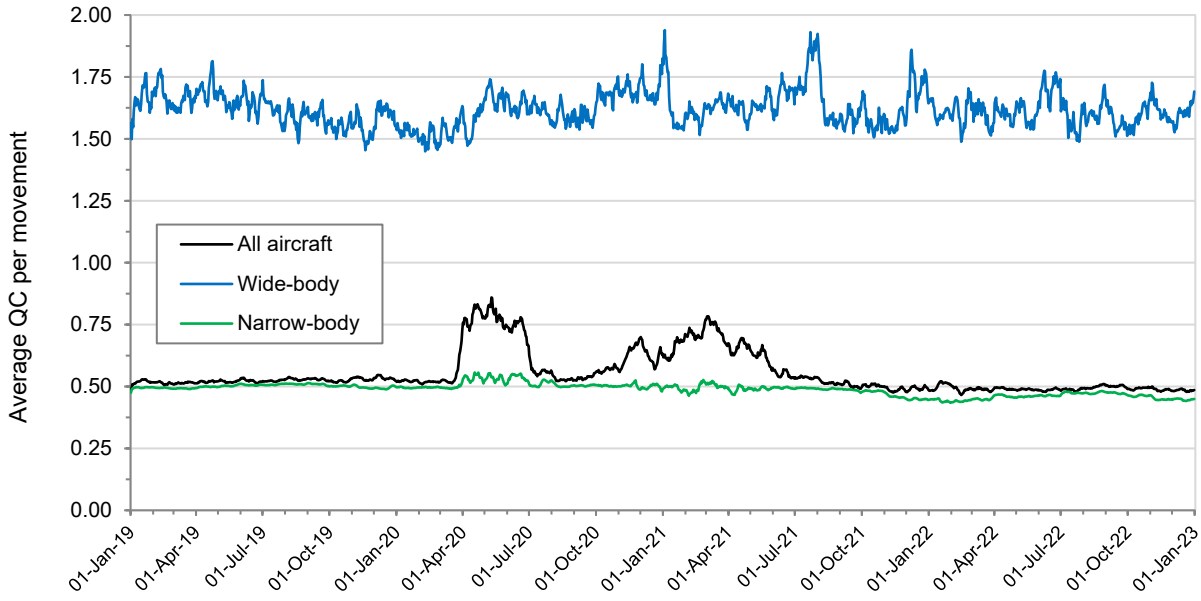


Average QC per movement

5.8 Figure 32 shows the average daily QC value per movement at Stansted (24 hour), with results shown separately for wide-body and narrow-body aircraft. Separate results are not shown for the 'Other' category but are included in the results for 'All aircraft'. The results show that wide-body aircraft are generally noisier than smaller narrow-body aircraft, as reflected in the higher QC values for the wide-body types.

5.9 The increase in the average daily QC value for 'All aircraft' in the months immediately following the lockdown in March 2020 is due to the significant reduction in the numbers of quieter narrow-body types and the resulting increased proportion of larger (and relatively noisier) wide-body types in the remaining fleet, as indicated in Figure 27. The average QC for all aircraft then temporarily returns to pre-lockdown levels once movements of narrow-body aircraft start to increase from July 2020 onwards. A further temporary increase in the average QC value then occurs between November 2020 and May 2021, which again is due to the reduction in the relative numbers of quieter narrow-body types over that period. The annual average QC per movement at Stansted in 2019 was 0.52, compared with an average of 0.49 in 2022.

Figure 32 Average daily QC per movement at Stansted, 24 hr (1 January 2019 - 31 December 2022, 7 day rolling average)



5.10 Figures 33, 34 and 35 show the average QC value per movement at Stansted for the 16 hour day (07:00-23:00), 8 hour night (23:00-07:00) and 6.5 hour night (23:30-06:00), with results shown separately for arrivals and departures. The results illustrate that aircraft on arrival generally have a lower QC value compared to departure.

5.11 The increases in the average QC value per movement visible in all three figures are due to the significant reduction in the numbers of quieter narrow-body types that operated in the months immediately following the lockdown in March 2020 and also between November 2020 and May 2021 (during subsequent lockdowns). The average QC for each period of the day then returns to similar pre-lockdown levels once movements of narrow-body aircraft start to increase following the easing of international travel restrictions on 17 May 2021.

Figure 33 Average QC per movement at Stansted, 16 hr day
(1 January 2019 - 31 December 2022, 7 day rolling average)

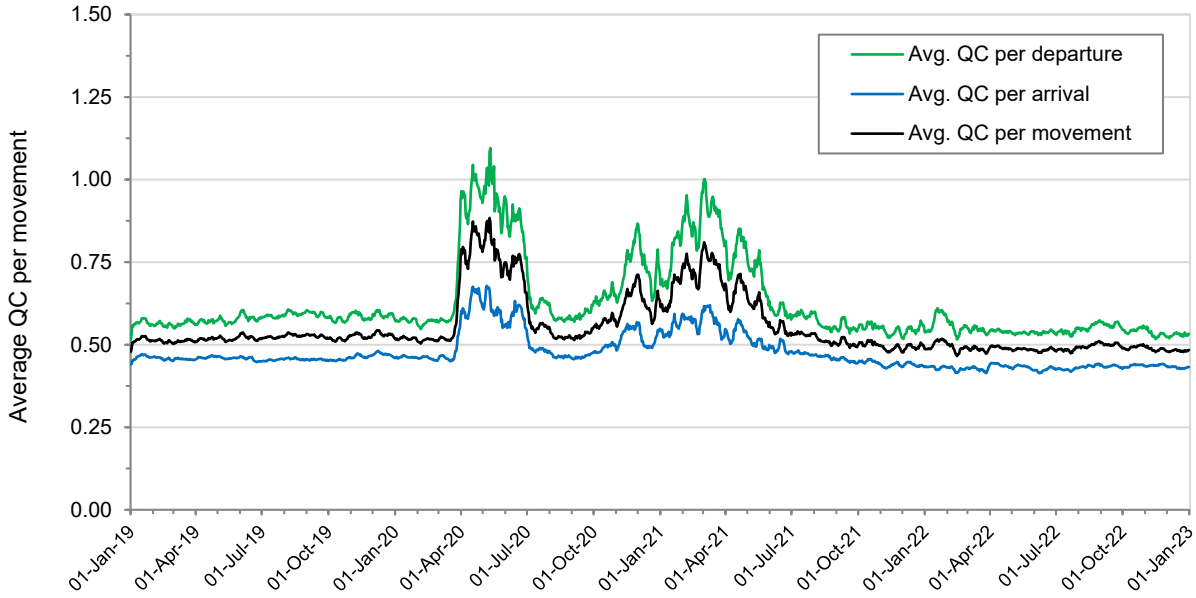


Figure 34 Average QC per movement at Stansted, 8 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)

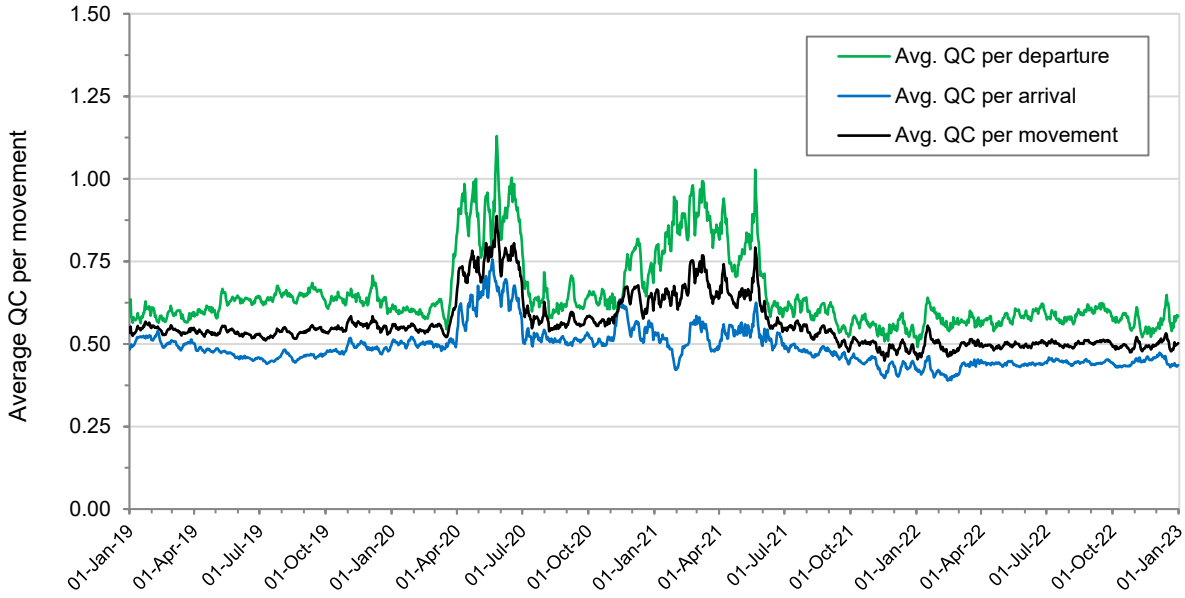
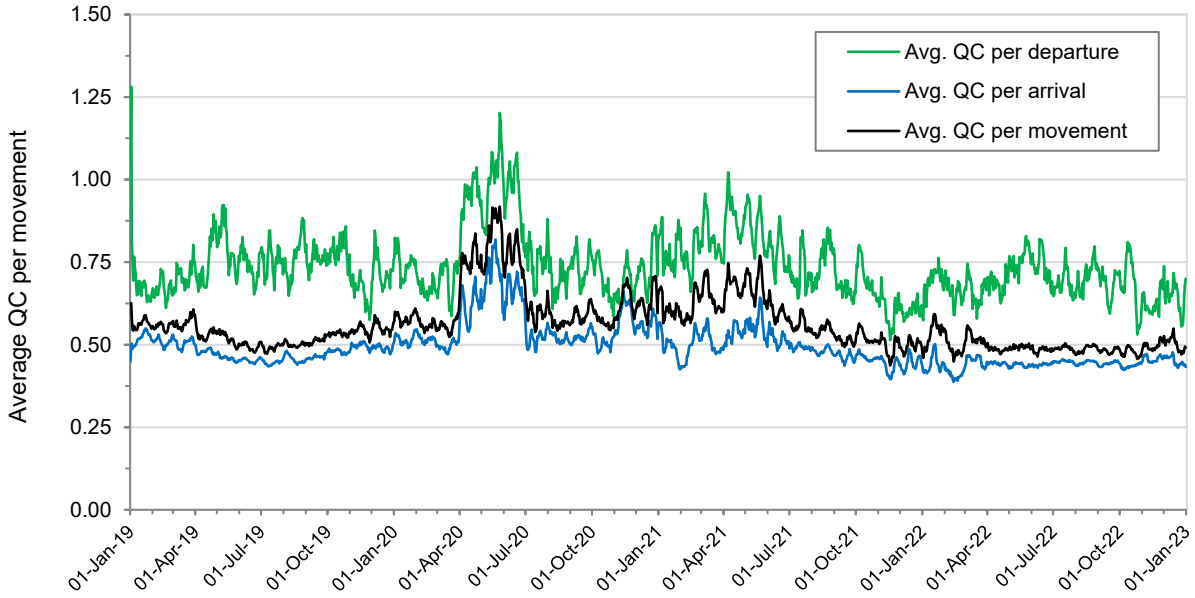


Figure 35 Average QC per movement at Stansted, 6.5 hr night
(1 January 2019 - 31 December 2022, 7 day rolling average)



Average aircraft age

5.12 Figure 36 shows the average age of aircraft at Stansted. The results show a marked reduction in the average age of the wide-body fleet from July 2019 onwards, due to airlines replacing some older wide-body types with newer aircraft types. This included the replacement of older FedEx Airbus A300 freighters (QC/1 arrival, QC/2 departure) with newer Boeing 767-300 freighters (QC/0.5 arrival, QC/2 departure).

5.13 The large increase in the average age of narrow-body aircraft in the months immediately following lockdown in March 2020 (and subsequently following the start of the second and third national lockdowns in November 2020 and January 2021, respectively) is due to the significant reduction in the numbers of Boeing 737-800 movements operated by Ryanair. Ryanair 737-800s (QC/0.5 on arrival and departure) normally dominate the Stansted fleet, with a relatively low average age of approximately 8 years in 2019. By 2022, the average age of the Stansted fleet as a whole remained slightly higher than the average age immediately prior to the pandemic, primarily due to the lower proportion of younger aircraft in the narrow-body fleet[26].

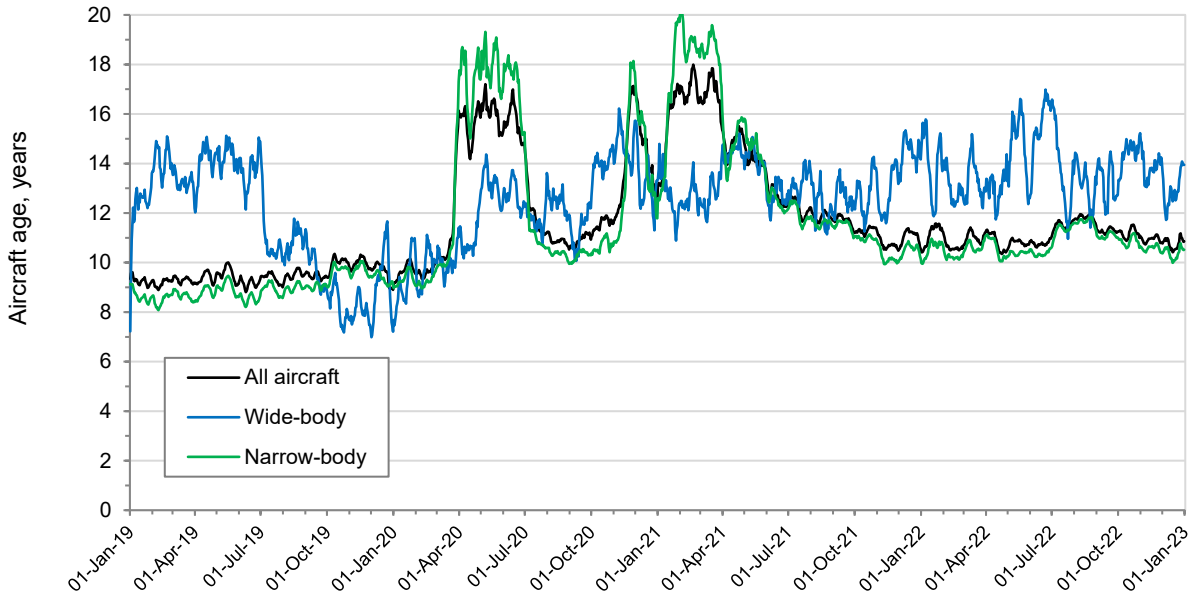
5.14 The increase in the average age of wide-body types following the lockdown in March 2020 is due to the higher proportion of older aircraft such as the 747-400F[27] freighter (typically QC/2 on arrival and QC/4 on departure) and the

[26] Delays to deliveries of new aircraft (including Ryanair's 737 MAX aircraft) during 2020 and 2021 are also likely to have contributed to the slight increase in average aircraft age by 2022.

[27] The average age of the 747-400F freighter at Stansted in 2019 was approximately 20 years.

MD-11F[28] freighter (QC/2 on arrival and departure) in the remaining wide-body fleet[29]. For example, whilst overall numbers of MD-11F movements increased from April 2020 onwards, movements of much newer Boeing 777-300ER passenger aircraft at Stansted stopped almost entirely through the remainder of 2020 and during 2021.

Figure 36 Average aircraft age at Stansted, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



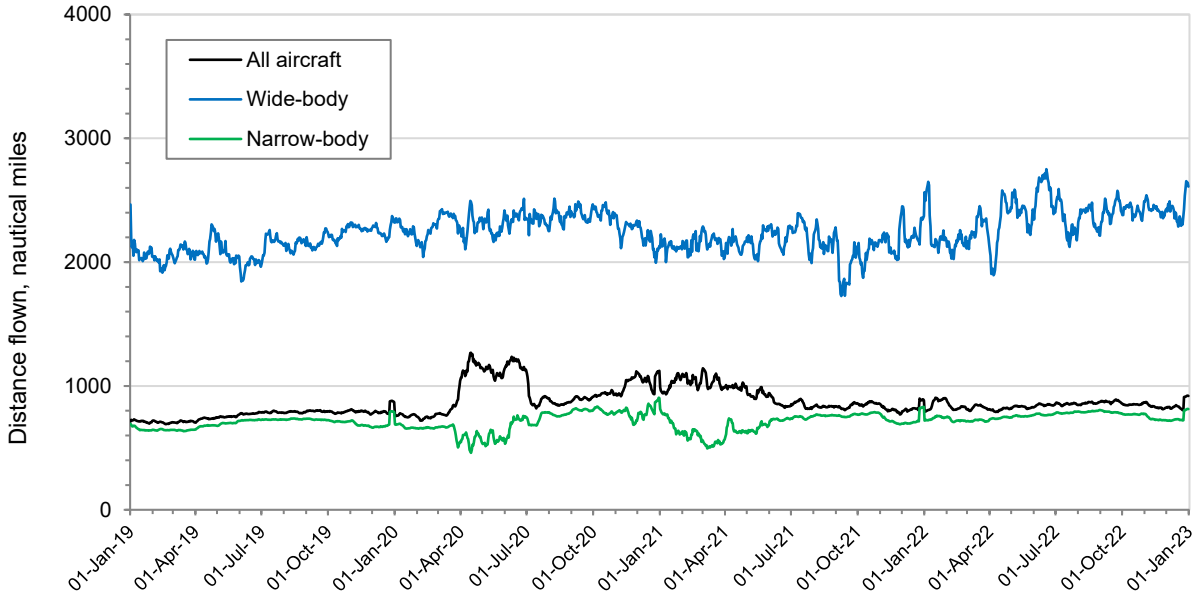
Average distance flown

5.15 Figure 37 shows the average distance flown from Stansted, with results shown separately for wide-body and narrow-body aircraft. Results for the 'Other' category are not shown separately but are included in the results for 'All aircraft'. The results show that wide-body aircraft typically fly much longer routes compared to smaller narrow-body aircraft. The short-term increase in the average distance flown for all aircraft immediately following the lockdown in March 2020 is due to the higher proportion of wide-body types in the remaining fleet (see Figure 27).

[28] The average age of the MD-11F freighter at Stansted in 2019 was approximately 26 years.

[29] Overall numbers of freighter movements at Stansted in 2022 were similar compared to 2019.

Figure 37 Average distance flown to/from Stansted, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



5.16 To provide further insight on the distances flown by aircraft operating from Stansted, Figures 38 and 39 show the different route categories flown by narrow-body and wide-body aircraft respectively. In each figure, aircraft movements have been grouped as follows:

- Short-haul flights under 1,500 km (<810 NM)
- Medium-haul flights between 1,500 and 3,500 km (810-1,890 NM)
- Long-haul flights over 3,500 km (>1,890 NM)

5.17 The results show, unsurprisingly, that narrow-body aircraft at Stansted typically fly short-haul routes (and to a lesser extent medium-haul). Larger wide-body aircraft at Stansted on the other hand typically fly long-haul routes. However, Figure 39 also shows that a significant proportion of wide-body aircraft also fly short-haul routes (with only a small proportion flying medium-haul). Almost all of these short-haul wide-body operations are freighter aircraft flying to a number of different cargo hubs across Europe.

Figure 38 Route categories flown by narrow-body aircraft at Stansted, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)

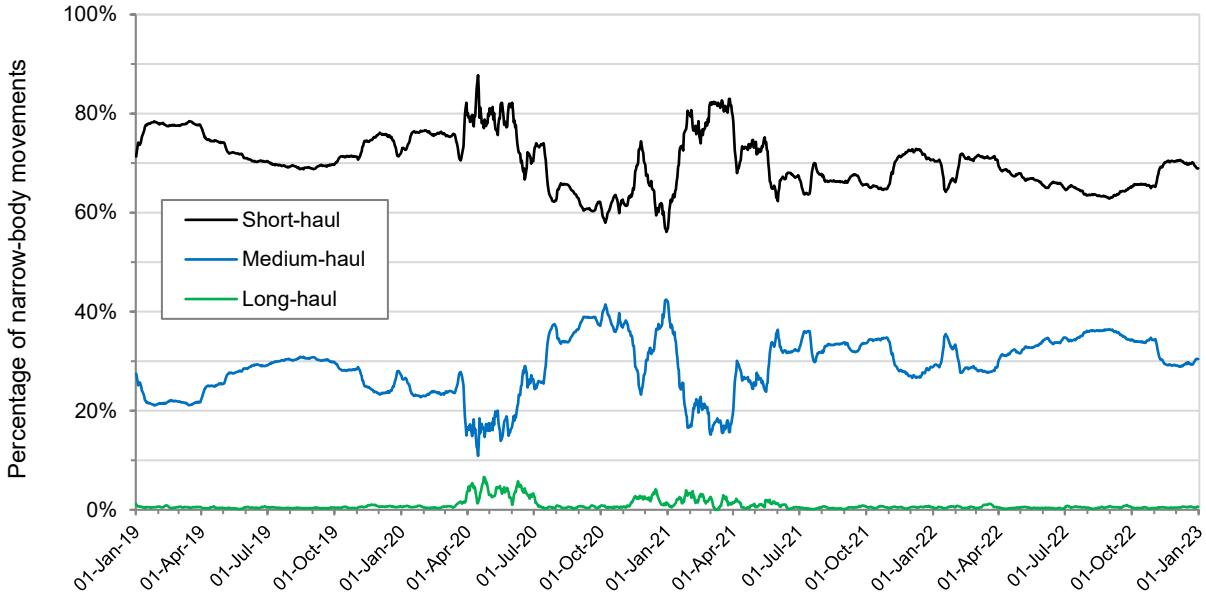
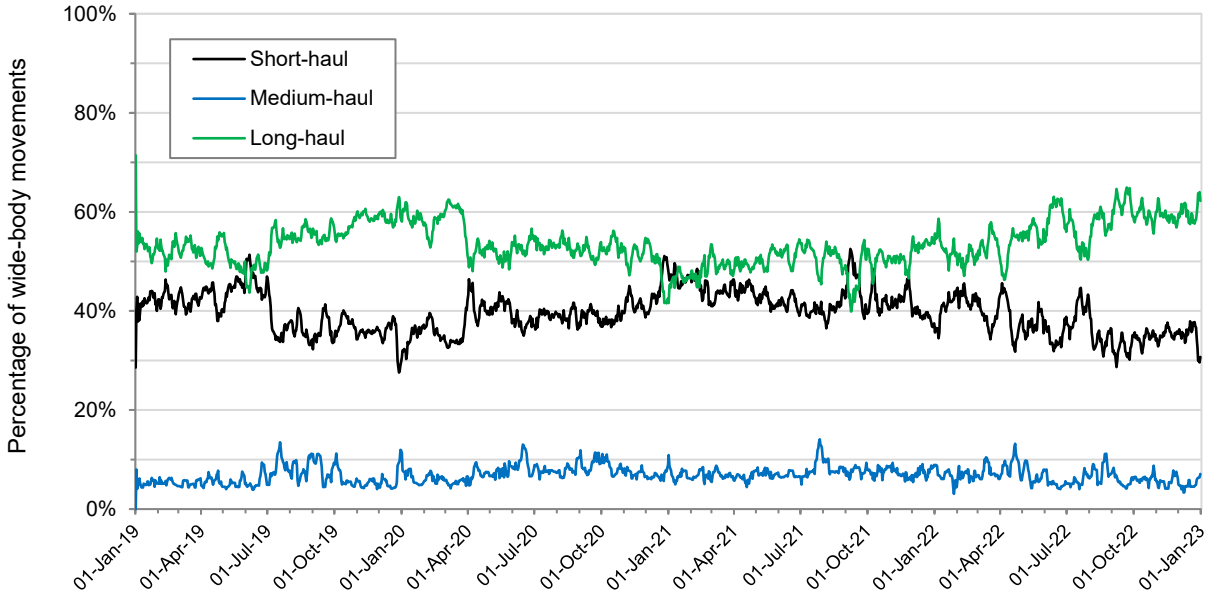


Figure 39 Route categories flown by wide-body aircraft at Stansted, 24 hr
(1 January 2019 - 31 December 2022, 7 day rolling average)



Chapter 6

Conclusions

6.1 The study has provided an insight into the impact of the Covid-19 pandemic on aircraft operations at Gatwick, Heathrow and Stansted airports and the possible knock-on effect on noise, based on a review of aircraft operations between 1 January 2019 and 31 December 2022.

Daily aircraft movements and noise quota

6.2 The results showed a significant reduction in the numbers of movements and associated noise quota usage at all three airports in the months following the introduction of lockdown restrictions in March 2020, but particularly at Gatwick where there was often fewer than 10 movements per day between April and June 2020.

6.3 Despite the opening of travel corridors during July 2020, aircraft movements during August and September 2020 (normally two of the busiest months of the year at all three airports) were significantly lower compared to the same months in 2019 and remained at these exceptionally low levels through the first half of 2021. Aircraft movements at all three airports then increased from July 2021 as a result of further easing of travel restrictions and the resumption of international travel (resulting in greater consumer confidence and thus bookings) but remained well below pre-pandemic levels for the remainder of 2021, particularly at Gatwick.

6.4 Following the removal in March 2022 of all remaining Covid-19 travel restrictions for international arrivals in the UK, overall movement numbers at Gatwick and Heathrow reached approximately 85 to 90 percent of pre-pandemic levels during the remaining months of 2022. At Stansted, overall movement numbers reached approximately 95 percent of pre-pandemic levels. In addition, during the peak summer months of 2022 (June – September) night-time movement numbers at Stansted exceeded those for summer 2019, whereas night-time movements at Gatwick and Heathrow over the same months in summer 2022 remained below 2019 levels.

Average QC per movement

6.5 There was a slight reduction in the average QC per movement at Gatwick from mid-July 2020, due to a greater proportion of more modern and quieter narrow-body aircraft being re-introduced back into the Gatwick fleet over summer 2020. Overall, the annual average QC per movement for all aircraft at Gatwick reduced slightly between 2019 and 2022, falling from 0.52 to 0.44.

6.6 At Heathrow there was a significant reduction in the average QC value for wide-body aircraft from March 2020, largely as a result of the permanent withdrawal of Boeing 747-400 passenger operations. There was also a marked short-term increase in the average QC per arrival at Heathrow during the 6.5 hour night towards the end of March 2021, due largely to the replacement of some quieter Airbus A350 services with older and noisier Boeing 777s. Overall, the annual average QC per movement for all aircraft at Heathrow reduced slightly between 2019 and 2022, falling from 0.68 to 0.56.

6.7 At Stansted there was a short-term increase in the average QC per movement immediately following the lockdown in March 2020 (and subsequently between November 2020 and May 2021) due to a significant reduction in the numbers of quieter narrow-body types. In June 2021, the average QC per movement returned to similar pre-lockdown levels once movements of narrow-body aircraft increased again following the easing of international travel restrictions. Overall, the annual average QC per movement for all aircraft at Stansted reduced slightly between 2019 and 2022, falling from 0.52 to 0.49.

Average aircraft age

6.8 Overall, there was a marked reduction in the average age of aircraft at Gatwick and Heathrow immediately following the introduction of lockdown restrictions in March 2020. This was due to a higher proportion of older aircraft being removed from service (either temporarily or permanently). At Heathrow, there was a subsequent increase in average aircraft age from June 2020 onwards as older aircraft were brought back into operation as needed to meet demand. By 2022, the average ages of the fleets at both Gatwick and Heathrow broadly returned to the average ages immediately prior to the pandemic.

6.9 At Stansted there was an increase in the average age of narrow-body aircraft in the months immediately following lockdown in March 2020, due to the significant reduction in the numbers of relatively new Boeing 737-800 movements (with an average age at Stansted of approximately 8 years in 2019). By 2022, the average age of the Stansted fleet as a whole remained slightly higher that the average age immediately prior to the pandemic, primarily due to the lower proportion of younger aircraft in the narrow-body fleet.

Average distance flown

6.10 There were short-term changes in the average distances flown across all three airports immediately following the lockdown in March 2020 (and during subsequent lockdowns), although average distances flown generally returned to pre-lockdown levels by the second half of 2021.

APPENDIX A

The Quota Count (QC) system

A1. The Night Flying Restrictions at Gatwick, Heathrow and Stansted airports specify a night period (23:00-07:00 hours) during which the noisiest types of aircraft may not be scheduled to land or take off. In addition, between 23:30 and 06:00 hours (the night quota period) aircraft movements are restricted by movement limits and noise quotas that are set by the Department for Transport (DfT) for each summer and winter season.

A2. The noise quotas are designed to encourage the use of quieter aircraft. Movements at each airport count against the airport's noise quota according to their Quota Count (QC) classifications. The movement limits, noise quotas and QC classifications of individual aircraft types are set out in a Notice which is published each season in a Supplement to the UK Aeronautical Information Publication[30] (AIP), which gives effect to the night restrictions.

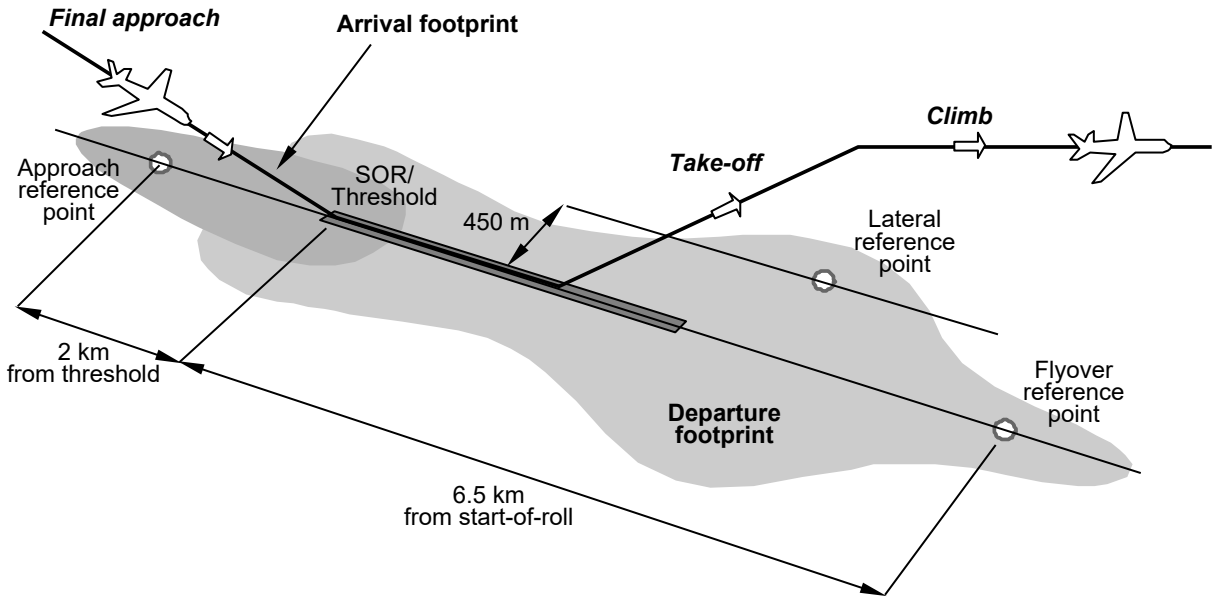
A3. The QC classifications are intended to indicate each aircraft's relative contribution to the total impact of aircraft noise on the airport surroundings. Noisier aircraft types carry a higher QC classification. The classification of aircraft for this purpose is based on their ICAO certificated noise levels and each aircraft type is classified separately for arrival and departure.

A4. The certification procedure, specified in Chapter 3 of ICAO Annex 16[31], requires the determination of arrival and departure EPNLs, see Figure A1. Three reference measurement points are specified: *approach*, under a 3-degree descent path 2 km from the runway threshold; *lateral*, 450 m to the side of the initial climb after take-off, at the longitudinal position where noise is greatest; and *flyover*, under the departure climb path, 6.5 km from start-of-roll (SOR).

[30] https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/aip-supplements/ (accessed 03/10/2023)

[31] Annex 16 – Environmental Protection, Volume I – Aircraft Noise, ICAO, Eighth Edition, July 2017

Figure A1 Aircraft noise reference points (in relation to illustrative noise footprints)



A5. Classifications for departures are based on the average of the lateral and flyover EPNLs, and for arrivals after subtracting 9 EPNdB from the approach EPNL. Further technical details can be found in ERCD Report 0204[32].

A6. The aircraft QC classifications were, as a matter of policy, based on official certificated noise levels because these are (i) generally considered to be reliable indicators of aircraft noise performance, (ii) available for practically every civil transport aircraft in current operation, (iii) openly published and therefore readily applied by administrators of the scheme, and (iv) correlated with noise footprint areas, which were taken to be appropriate measures of 'noise impact'.

A7. The central feature of the classification system is that each aircraft is given a QC rating, which increases by a multiple of two in step with the 3-decibel (dB) doubling of noise energy principle (e.g. QC/1, QC/2, QC/4, etc.). The underlying principle of the scheme is to encourage the use of quieter aircraft by making each movement of a noisier type use more of the total available quota set for each airport. All other things being equal, a 50 percent reduction in total noise quota is equivalent to a 3 dB reduction in average noise exposure.

[32] ERCD Report 0204, *Review of the Quota Count (QC) System: Re-analysis of the Differences between Arrivals and Departures*, Civil Aviation Authority, November 2002

A8. Different types of aircraft (based on airframe, engine type and maximum take-off or landing weight) are classified separately for landing and take-off on the basis of their certificated noise levels into one of the following QC categories:

Noise Classification, EPNdB	**Quota Count**
Below 81	0
81 - 83.9	0.125
84 - 86.9	0.25
87 - 89.9	0.5
90 - 92.9	1
93 - 95.9	2
96 - 98.9	4
99 - 101.9	8
Greater than 101.9	16

APPENDIX B

Aircraft type categories

Aircraft Category	Aircraft Type (list not exhaustive)
Wide-body	Airbus A300
	Airbus A310
	Airbus A330
	Airbus A340
	Boeing 747-200/-400
	Boeing 767
	Boeing 777
	MD-11F
New Generation Wide-body	Airbus A330neo
	Airbus A350
	Airbus A380
	Boeing 747-8
	Boeing 787
Narrow-body	Airbus A318/A319/A320/A321
	Boeing 737 NG
	Boeing 757
	Embraer ERJ-170/-190
	MD-83/-87
New Generation Narrow-body	Airbus A220
	Airbus A319neo/A320neo/A321neo
	Boeing 737 MAX
Other (including Business and Regional Jets)	Business Jets BAe 146/Avro RJ Embraer ERJ-135/-145 Small/Large Propeller

Glossary

AIP	UK Integrated Aeronautical Information Publication. A manual containing thorough details of regulations, procedures and other information pertinent to flying aircraft in the UK.
Aircraft movement	Any aircraft take-off or landing at an airport. These could be either commercial or non-commercial flights. For airport traffic purposes one arrival and one departure are counted as two movements.
ICAO	International Civil Aviation Organization.
NTK	Noise and Track-Keeping monitoring system. The NTK system associates air traffic control radar data with related data from both fixed (permanent) and mobile noise monitors at prescribed positions on the ground.
QC	Quota Count. The basis of the London airports' night flying restrictions regime. Noisier aircraft types carry a higher QC classification. The classifications are based on ICAO certificated noise levels and each aircraft type is classified separately for arrival and departure.