

# Noise Action Plan Contours for Heathrow Airport 2015

**ERCD REPORT 1604**



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## Summary

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1. This report presents 2015  $L_{\text{day}}$ ,  $L_{\text{evening}}$ ,  $L_{\text{night}}$ ,  $L_{\text{den}}$  and  $L_{\text{eq},6.5\text{hr night}}$  noise contours for Heathrow Airport, and compares them with the contours from the previous year. N65 and N70 annual 16-hour day contours, and N60 annual 8-hour night contours, have also been produced. Long-term trends from years 2006 to 2015 are examined. This study was commissioned by Heathrow Airport Limited as part of their ongoing Noise Action Plan commitments.
2. Aircraft movements during the 2015  $L_{\text{day}}$  12-hour period rose by 0.1%. There was a 2% percentage increase in movements for the  $L_{\text{evening}}$  4-hour period, but a 1% decrease over the  $L_{\text{night}}$  8-hour period. There was a reduction in night-time departures due to efforts on reducing late running departures. Total movements over the 2015  $L_{\text{den}}$  annual average 24-hour period (1297.9) were 0.4% higher than in 2014 (1292.8). Movements were 0.3% lower for the 2015  $L_{\text{eq},6.5\text{hr night}}$  period compared to 2014.
3. The largest increase in movements over the 2015 annual average 24-hour period was for the Airbus A320 with IAE V2500 engines (+30 movements). The Airbus A380 had an increase of 10 movements per 24-hour day in 2015. There were also increases for the Boeing 787-8 (+11) and Boeing 787-9 (+9). The largest decreases in movements were for the Airbus A319 with IAE V2500 engines (-23) and the Boeing 747-400 with Rolls-Royce engines (-9). There were also reductions in movements of the Boeing 767-300 with Rolls-Royce engines (-7) and the Airbus A320 with CFM56 engines (-7).
4. The estimated percentage of aircraft in the fleet mix meeting the ICAO Chapter 4 noise standard has risen from 94% in 2006 to 99% in 2015.
5. The noise modelling results showed that the  $L_{\text{day}}$ ,  $L_{\text{evening}}$ ,  $L_{\text{night}}$  and  $L_{\text{den}}$  contour band areas in 2015 were nearly all smaller than in 2014. A similar result was also seen for the cumulative contour areas. For example, the 2015  $L_{\text{den}}$  55 dBA contour area was 200.0 km<sup>2</sup>, 5% smaller than in 2014 (210.7 km<sup>2</sup>). The area reductions can be attributed to a switch to more modern, quieter aircraft types such as the Airbus A380 and Boeing 787-8/9, and also to reductions in the noise levels of certain ANCON aircraft types as identified by noise measurements undertaken in 2015<sup>1</sup>. The year 2015  $L_{\text{eq},6.5\text{hr night}}$  48 dBA contour area decreased by 9% to 33.0 km<sup>2</sup> following a reduction in movements of the Boeing 747-400

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<sup>1</sup> See ERCD Report 1601: Noise Exposure Contours for Heathrow Airport 2015 (to be published). ANCON aircraft types such as the EA38R on departure and the EA320V and EA319V on arrival were found to be quieter.

with Rolls-Royce engines from 4.2 to 3.0. This was the smallest ever  $L_{eq,6.5hr\ night}$  48 dBA area calculated for Heathrow.

6. Population and household counts for the 2015  $L_{day}$  contours decreased from 2014, broadly in line with the area reductions. However, the population and household counts for the 2015  $L_{evening}$ ,  $L_{night}$  and  $L_{den}$  contours increased at some of the contour levels despite the area reductions. This was mainly due to changes in contour shape over populated areas. The year 2015  $L_{eq,6.5hr\ night}$  48 dBA population and household counts reduced in line with the fall in area.
7. Examining the long-term trends, it was observed that the  $L_{day}$  55-60 dBA contour band area has been fairly steady since 2009 after the initial high in 2006, though it dipped in 2010 and 2015. Populations and households fell to a low in 2010 after dropping from the 2006 peak. Movements were also at a low in 2010. After rising in 2011, the population and household counts remained relatively steady until 2014, before decreasing in 2015 in line with the reduction in area.
8. The area, population and households within the  $L_{evening}$  55-60 dBA contour band decreased in 2009 from the 2006 peak as movements declined, but rose again to a high in 2011 as movements recovered. Since 2011 the area, population and households have followed a downward trend. Movements declined between 2011 and 2014, before rising in 2015.
9. For the  $L_{night}$  50-55 dBA contour band, aircraft movements and contour areas have been relatively stable since 2011. Prior to 2011 the area was higher but also at a steady level. The  $L_{night}$  population and household counts traced a downward trend from 2009 to 2012, but then increased from 2013 to 2015. There was a major update to the population database in 2013, when data from the latest 2011 Census was used for the first time, and runway resurfacing works in 2013 and 2014 affected the contour shape. A higher percentage of westerly movements and a reversion to a 'normal' split between the northern and southern runways influenced the contour shape in 2015.
10. After the 2006 base year high,  $L_{den}$  55-60 dBA contour areas were fairly flat between 2009 and 2013, but since then have fallen as the Heathrow fleet continued its switch to more modern and quieter types such as the Airbus A380 and Boeing 787-8/9. Populations and households have declined since 2011. Movements have been at a relatively steady level between 2006 and 2015, apart from a dip in 2010.
11. The  $L_{eq,6.5hr\ night}$  48 dBA area was at a high in the 2006 base year, but after dipping in 2009 and rising to a high in 2010, has been trending downwards ever since. Movements since 2011 have been steady. Following two years of population decreases in 2011 and 2012, the population rose in 2013 due to an extension of the contour over west London in line with the northern runway (the southern runway was resurfaced in 2013). However, in 2014 the population

count returned to near 2012 levels as the contour area reduced, and declined further in 2015 as more movements of the Boeing 747-400 with Rolls-Royce engines were phased out.

12. Between the 2006 base year and 2015 there has been a 48% reduction in movements by the noise dominant Boeing 747-400 aircraft in the annual 24-hour period. Newer aircraft types such as the Airbus A380 and Boeing 787 were not in service in 2006, but by 2015 there were on average 40 movements of the Airbus A380 and 43 movements of the Boeing 787-8/9 over the 24-hour period.
13. The 2015 *cumulative* contour areas were below 2006 base year levels for all the noise metrics considered. For example, the 2015  $L_{den}$  55 dBA contour area of 200.0 km<sup>2</sup> was 18% smaller than the area in 2006 (244.7 km<sup>2</sup>). Despite the area decreases, population counts for some contour levels were higher in 2015. This was due to population encroachment around Heathrow between 2006 and 2015. Had the population database remained unchanged between 2006 and 2015, the population and household counts for the 2015 contours would have all been lower than in 2006.
14. An analysis of  $L_{den}$  noise changes between 2006 and 2015 (assuming 2006 base year runway modal splits) revealed that most areas within the 2015  $L_{den}$  55 dBA contour have experienced noise reductions of up to 3 dB. There were a few areas that were exposed to increases in noise levels of less than 1 dB. The largest of these areas was over Windsor Great Park, and resulted from a higher movement rate on the CPT/SAM/GOG westerly departure routes<sup>2</sup> in 2015 compared to 2006. Around 9% of the area considered for noise changes was exposed to increases in noise.
15. An analysis of  $L_{night}$  noise changes between 2006 and 2015 (assuming the 2006 base year  $L_{night}$  runway modal split) showed that the vast majority of areas experienced reductions in noise levels of up to 3 dB. Around 3% of the area considered for noise changes was exposed to increases in noise.
16. N65 and N70 annual 16-hour day, and N60 annual 8-hour night contours, have also been produced. The results showed that the areas of the N65 and N70 day contours, and N60 night contours, have decreased between 2006 and 2015. This reflects the phase-out of the noisiest aircraft types such as the Boeing 747-400 and the introduction of more modern, quieter types, e.g. Airbus A380, Boeing 787-8/9.
17. An analysis of noise changes for N65 and N70 between 2006 and 2015 (assuming the 2006 base year modal split) also showed that most areas experienced reductions in the number of N65 or N70 noise events. However,

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<sup>2</sup> Heathrow 2015 NPR/SID routes are shown in **Figure 1** of Appendix B. The GOG westerly departure route replaced SAM in 2015.

there were some locations where the numbers of N65/N70 events increased due to the redistribution of traffic on certain routes, or a shift in the positioning of a departure mean track. Around a quarter of the area considered for the N65 and N70 changes was exposed to increases of more than 10 events.

## Chapter 1

# Introduction

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- 1.1 This report presents the 2015 noise exposure contours that have been generated for the Heathrow Airport Ltd (HAL) Noise Action Plan by the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA). Noise contours have been produced for the following noise metrics:
- $L_{day}$ ,  $L_{evening}$ ,  $L_{night}$ ,  $L_{den}$  and  $L_{eq,6.5hr\ night}$ ;
  - N65 and N70 for the annual average 16-hour day (0700-2300 local time); and
  - N60 for the annual average 8-hour night period (2300-0700 local time).
- 1.2 The  $L_{day}$ ,  $L_{evening}$ ,  $L_{night}$  and  $L_{den}$  contours were based on annual movement data for the 2015 calendar year, whilst the  $L_{eq,6.5hr\ night}$  contour was based on data from the combined 2015 summer and 2015-16 winter night quota seasons (i.e. the period from 29 March 2015 to 27 March 2016).
- 1.3 The year 2015 Noise Action Plan contours are compared with those from 2014 (Ref 1) to assess the changes in area, population and households enclosed. The long-term contour trends from 2006 to 2015 are also examined.

## Chapter 2

# Noise modelling methodology

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## ANCON model

- 2.1 The noise contours were calculated with the latest version of the UK civil aircraft noise model ANCON (version 2.3), which is developed and maintained by ERCD on behalf of the Department for Transport (DfT). A technical description of the ANCON model can be found in R&D Report 9842 (Ref 2).

## Flight tracks, profiles and noise data

- 2.2 Mean departure and arrival flight tracks generated for the DfT 2015 Heathrow noise exposure contours<sup>3</sup> were employed in the modelling. Mean tracks are the mathematical representation of an NPR/SID route swathe, consisting of a central track that defines the average aircraft position along the swathe. They are calculated from samples of radar data extracted over the relevant time period. Lateral dispersions across the route swathe are modelled by multiple sub-tracks derived from a statistical analysis of the underlying radar track data. The Heathrow NPR/SID routes for 2015 are shown in Appendix B, **Figure 1**.
- 2.3 Average flight profiles of height, speed and thrust were also based on data derived for the DfT 2015 Heathrow contours. These profiles represent the aircraft heights, speeds and thrust settings at various distances from the runway, averaged across all the routes for each ANCON aircraft type (for departures and arrivals separately).
- 2.4 Noise levels for each ANCON type are checked and updated each year according to the latest noise measurements, so they represent the best available data.

## Traffic data

- 2.5 The contours were calculated using 2015 movement data extracted from the Heathrow Noise and Track Keeping (NTK) system, which stores radar data supplemented by daily flight plans. Breakdowns of the aircraft movements by ANCON aircraft type for the average 12-hour day (0700-1900 local time), 4-hour evening (1900-2300 local time), 8-hour night (2300-0700 local time), 24-hour day and 6.5-hour night (2330-0600 local time) are summarised in **Tables C1-C5** of Appendix C. (Note: The annual traffic numbers have been divided by 365 in the

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<sup>3</sup> See ERCD Report 1601: Noise Exposure Contours for Heathrow Airport 2015 (to be published). These contours are based on the 92-day summer period, 16 June to 15 September.

tables to provide an ‘average day’ figure). Detailed descriptions of individual ANCON aircraft types are provided in **Table D1** of Appendix D.

- 2.6 The annual average 24-hour daily movements for the base year 2006 (Ref 3) and years 2009-2015 are summarised in **Table 1**. It can be seen that total movements decreased in both 2009 and 2010 relative to 2006, with the 2010 total 5% lower than in 2006. However, in 2011 the total rose by 6% to a level 1% above the 2006 total. Movements dropped back in 2012 to a level 1% below that in 2006, and since then have remained at a steady level.

**Table 1 Heathrow annual average 24-hour movements for years 2006 & 2009-2015**

Year	Total daily movements	Percentage change relative to 2006	Total annual movements
2006	1307.6	(n/a)	477,274
2009	1277.2	-2%	466,178
2010	1245.8	-5%	454,717
2011	1317.1	+1%	480,742
2012	1297.9	-1%	473,734
2013	1293.1	-1%	471,982
2014	1292.8	-1%	471,872
<b>2015</b>	<b>1297.9</b>	<b>-1%</b>	<b>473,734</b>

## Aircraft noise classes

- 2.7 The 2015 Heathrow fleet mix can be considered in terms of aircraft ‘Noise Class’ categories A-H<sup>4</sup>, which are ranked in ascending order of noise emission, i.e. from the quietest to the noisiest. Noise Class percentage breakdowns are summarised in **Table 2** for the 2015 annual 24-hour period, along with percentages from the 2006 base year for comparison.
- 2.8 It can be seen that 99.99% of movements were within Noise Classes C, D and E. The proportion of narrow-body jet aircraft (Noise Class C) decreased by 2% between 2006 and 2015. There was also a reduction (by 4%) in the proportion of wide-body 3- or 4-engine types (Noise Class E). However, the proportion of wide-body twin-engine aircraft (Noise Class D) increased by 8% between 2006 and 2015.

<sup>4</sup> Renamed as A-H from 2015 onwards (previously 1-8) to avoid possible confusion with ICAO noise Chapters. See ERCD Report 1601: Noise Exposure Contours for Heathrow Airport 2015 (to be published).

**Table 2 Heathrow 2015 annual average 24-hour movements by Noise Class**

Noise Class	Description	2015 total	2015 percentage	2006 percentage
A	Small propeller	0.04	0.01%	0.03%
B	Large propeller	0.15	0.00%	0.63%
C	Narrow-body jets (e.g. Airbus A320, Boeing 737-800)	816.88	63.01%	65.35%
D	Wide-body twins (e.g. Boeing 777, Boeing 787)	345.96	26.07%	18.45%
E	Wide-body 3,4 engine (e.g. Boeing 747-400, Airbus A380)	134.83	10.91%	15.22%
F	1 <sup>st</sup> generation wide-body 3,4 engine (e.g. Boeing 747-100)	0.00	0.00%	0.30%
G	2 <sup>nd</sup> generation narrow-body twins (e.g. Boeing 737-200)	0.01	0.00%	0.00%
H	1 <sup>st</sup> generation narrow-body 3,4 engine (e.g. Boeing 727)	0.00	0.00%	0.01%
	Total	<b>1297.86</b>	100.00%	100.00%

Note: Totals may not sum exactly due to rounding.

- 2.9 The chart in **Figure 2** of Appendix B illustrates the breakdown of total movements by Noise Class for years 2006 and 2009-2015. Movements over the annual average 24-hour period in 2015 by ANCON aircraft type are summarised in **Table C4**. They are described in more detail in the following paragraphs.
- 2.10 Numbers within Noise Class C (narrow-body aircraft such as the Airbus A319, A320 and A321) dropped between 2006 and 2010, but increased in 2011 to a level higher than in 2006, before dropping back to near 2009 levels in 2013 through to 2015 (**Figure 2**). Around two-thirds of movements in 2015 were within Noise Class C. The ANCON type EA320V had the highest increase per 24-hour day in 2015 (+30 movements), and the EA321V also increased, by 7 movements. They were offset by decreases for the EA319V (-23 movements), EA320C (-7) and EA321C (-5). The Airbus A319/320/321 aircraft family accounted for 90% of total Noise Class C movements in 2015.
- 2.11 The next largest grouping was Noise Class D (wide-body twin-engine aircraft such as the Boeing 777-200/300 and Boeing 787-8/9), which accounted for about a quarter of total movements in 2015. These have risen steadily in frequency between 2009 and 2015 (**Figure 2**). The largest increases within Noise Class D in 2015 were for the ANCON types B788 (+11 movements) and B789 (+9). The largest decrease was for the B763R, which was down by 7 movements. The newest aircraft types, i.e. the Boeing 787-8/9 (and to a lesser extent the Airbus A350), accounted for 12% of all Noise Class D movements.
- 2.12 Movements of the Noise Class E grouping (wide-body 3- and 4-engine aircraft such as the Boeing 747-400 and Airbus A380) decreased in both 2009 and



2010, and since the small rise seen in 2011, have declined through to 2015 (**Figure 2**). A tenth of the total movements were within Noise Class E in 2015. The largest movement reduction in 2015 was for the ANCON aircraft type B744R (-9 movements). There were increases in movements of the EA38GP (+5) and EA38R (+5). The more modern Airbus A380 aircraft accounted for 30% of total Noise Class D movements in 2015.

### Fleet mix by ICAO noise Chapter

- 2.13 An analysis of the certification noise levels of aircraft operating at Heathrow in 2015 indicated that an estimated 99.00% of the fleet were compliant with the ICAO Chapter 4 noise standard, with the remainder meeting the Chapter 3 noise standard.
- 2.14 In the 2006 base year, the estimated percentage of Chapter 4-compliant aircraft was 94%, and by 2009 this had risen to 95%. The figure was higher in 2010 and 2011 (96% in both years), and in 2012 and 2013 the compliance level had reached an estimated 97%. The compliance level was at its highest in 2014 and 2015 at an estimated 99%.

### Runway modal splits

- 2.15 The noise contours were modelled with the 2015 actual West/East (W/E) runway modal splits, which are summarised in **Table 3** along with the modal splits for the previous year, and also the 5-year rolling average. In 2015 there were 2% more westerly movements over the average 24-hour period compared to 2014.

**Table 3 Heathrow runway modal splits**

Time period	2015 split (W/E percentage)	2014 split (W/E percentage)	5-year average 2011-2015 (W/E percentage)
12-hour day	72 / 28	69 / 31	71 / 29
4-hour evening	72 / 28	70 / 30	71 / 29
8-hour night	72 / 28	69 / 31	71 / 29
<b>24-hour day</b>	<b>72 / 28</b>	<b>70 / 30</b>	<b>71 / 29</b>
6.5-hour night	72 / 28	67 / 33	71 / 29

Note: The 6.5-hour night covers the period from the end of March in one year to the end of March in the following year. The 5-year average has been calculated over the period 2011-2015.

- 2.16 A higher proportion of westerly movements at Heathrow tends to cause an increase in contour area. Conversely, a higher proportion of easterly movements at Heathrow tends to reduce the contour area. During easterly operations, departures from Runway 09L are restricted by the Cranford Agreement, resulting in the majority of departures operating from Runway 09R, whilst landings are on

Runway 09L. This concentrates traffic onto fewer flight paths, reducing the contour area.

## Population database

- 2.17 Estimates were made of the population and households enclosed within the noise contours. The population data used in this report for the 2015 contours are a 2015 update of the latest 2011 Census supplied by CACI Limited<sup>5</sup>.
- 2.18 The CACI population database contains data referenced at the postcode level. Population and household numbers associated with each postcode are assigned to a single co-ordinate located at the postcode's centroid.
- 2.19 Within the extent of the 2015  $L_{den}$  55 dBA cumulative contour, the population count was 1% higher with the 2015 population database compared to the 2014 database.

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<sup>5</sup> [www.caci.co.uk](http://www.caci.co.uk)

## Chapter 3

# Results

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### 2015 contour results and comparisons with 2014

- 3.1 The following Noise Action Plan contours for 2015 are displayed in **Figures 3-7** (Appendix B) respectively, overlaid onto the 2014 contours:
- $L_{\text{day}}$ , from 55 to 75 dBA in 5 dB steps;
  - $L_{\text{evening}}$ , from 55 to 75 dBA in 5 dB steps;
  - $L_{\text{night}}$ , from 50 to 70 dBA in 5 dB steps;
  - $L_{\text{den}}$ , from 55 to 75 dBA in 5 dB steps;
  - $L_{\text{eq,6.5hr night}}$ , 48 dBA.
- 3.2 The estimated areas, populations and households within the above 2015 contours are summarised in **Tables 4-8** respectively, along with the results for 2014. As already noted, the 2015 population and household figures are based on a 2015 update of the 2011 Census supplied by CACI Ltd. (The 2014 population and household figures are based on a 2014 update of the 2011 Census).
- 3.3 The statistics for  $L_{\text{day}}$ ,  $L_{\text{evening}}$ ,  $L_{\text{night}}$  and  $L_{\text{den}}$  are presented in 5 dB contour bands (e.g. 55-60 dBA), in line with the requirements of the Environmental Noise Directive, and are not cumulative as is the case for the average summer day  $L_{\text{eq}}$  contours published by the DfT.
- 3.4 However, for reference purposes, the 2014 and 2015 results are also provided in *cumulative* format in **Tables C6-C10** of Appendix C. In addition, a comparison between the cumulative 2006 base year and 2015 results is provided in **Tables C11-C15**. All the population and household figures in these tables are based on data supplied by CACI Ltd with the respective annual updates.
- 3.5 Percentage changes in contour area are not necessarily accompanied by similar changes in enclosed population and households because populations are unevenly distributed around the airport. Thus the population and household counts can be quite sensitive to changes in contour shape.
- 3.6 Changes in contour population counts from year to year are also influenced by the effects of the annual update to the population database. Within the region bounded by the 2015  $L_{\text{den}}$  55-60 dBA contour band, there was a 1% increase in the population and households between 2014 and 2015.

### $L_{\text{day}}$ contours

- 3.7 Total movements in the 2015  $L_{\text{day}}$  period increased by 0.1%, from 2014 (see **Table C1**). The largest movement increases were for the ANCON aircraft types

EA320V (+21), B788 (+7) and B789 (+6). They were offset by reductions in movements of the EA319V (-18), B744R (-8) and EA320C (-5). The departure noise dominant Boeing 747-400 aircraft had 9 fewer movements on average in 2015, whilst movements of the Airbus A380 increased by 9.

- 3.8 The outermost 55-60 dBA band area for  $L_{day}$  was 6% smaller in 2015 and there were also area decreases at the higher bands of up to 4% (see **Table 4**). (Note: the *cumulative*  $L_{day}$  contour areas reduced at all levels by up to 5%, as shown in **Table C6**). The area changes can be attributed to: (a) the ongoing replacement of older, noisier aircraft (e.g. the Boeing 747-400) by quieter types such as the Airbus A380, and (b) reductions in noise produced by certain ANCON aircraft types, such as the EA38R on departure, and EA320V and EA319V on arrival, as identified by noise measurements undertaken in 2015<sup>6</sup>.

**Table 4 Heathrow 2014 and 2015  $L_{day}$  contour band area, population and household estimates**

$L_{day}$ (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
55 – 60	102.9	96.4	-6%	330.3	311.9	-6%	133.8	126.9	-5%
60 – 65	33.9	33.3	-2%	104.4	102.5	-2%	39.8	39.2	-2%
65 – 70	16.2	15.7	-3%	18.4	18.3	-1%	6.9	6.9	0%
70 – 75	4.8	4.6	-4%	2.1	1.8	-14%	0.8	0.6	-25%
> 75	2.9	2.8	-3%	< 0.1	< 0.1	(n/a)	< 0.1	< 0.1	(n/a)

Note: Areas are given in km<sup>2</sup>, and populations (pop) and households (house) in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.

- 3.9 Population counts for the 55-60 dBA contour band in 2015 were 6% lower than in 2014, and also lower at the other contour bands. Similar percentage changes were found for the household counts. The 4% decrease in area at the 70-75 dBA contour band resulted in a 14% decrease in population and a 25% decrease in households.
- 3.10 The 2015  $L_{day}$  contours are compared against the 2014  $L_{day}$  contours in **Figure 3**. The 55 dBA contour lobe that turns to the north-east of the airport has retracted due to movement decreases of 38% by the noise dominant Boeing 747-400

<sup>6</sup> See ERCD Report 1601: Noise Exposure Contours for Heathrow Airport 2015 (to be published). ANCON aircraft types such as the EA38R on departure and the EA320V and EA319V on arrival were found to be quieter. Because of the large number of factors that contribute to the measured noise data (e.g. different airlines, operating procedures etc.), it is difficult to disentangle the noise changes and attribute them to specific factors, such as a change in operational procedure.

aircraft on the Runway 09L/09R BUZ/BPK<sup>7</sup> routes. An extension of the 55 dBA contour can be seen over Windsor Forest. This was caused by aircraft reverting to the standard CPT/SAM/GOG<sup>8</sup> departure routes following the end of the departure trials in 2014, which had shifted some of the westerly departures over the eastern side of Windsor Great Park.

### Levening contours

- 3.11 Total movements in the 2015  $L_{\text{evening}}$  period increased by 2% from 2014 (see **Table C2**). The largest movement increases were for the ANCON aircraft types EA320V (+8), B788 (+3) and B789 (+2). These changes were offset by movement decreases for the EA319V (-3), EA346 (-2) and B763R (-2).
- 3.12 The area of the 55-60 dBA  $L_{\text{evening}}$  contour band decreased by 7% in 2015 (see **Table 5**). There were also reductions in area at all the higher contour bands. (Note: the *cumulative*  $L_{\text{evening}}$  contour areas reduced at all levels by up to 5%, as shown in **Table C7**). These area changes can be attributed to: (a) the replacement of older, noisier aircraft by quieter types such as the Boeing 787-8/9, and (b) reductions in noise produced by certain ANCON aircraft types, such as the EA38R on departure, and EA320V and EA319V on arrival, as identified by noise measurements undertaken in 2015.

**Table 5 Heathrow 2014 and 2015  $L_{\text{evening}}$  contour band area, population and household estimates**

$L_{\text{evening}}$ (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
55 – 60	91.5	85.4	-7%	271.2	260.9	-4%	108.3	104.8	-3%
60 – 65	29.7	29.1	-2%	83.9	82.4	-2%	31.9	31.3	-2%
65 – 70	14.2	13.9	-2%	11.6	12.0	+3%	4.4	4.6	+5%
70 – 75	4.2	4.1	-2%	0.8	0.8	0%	0.3	0.3	0%
> 75	2.7	2.6	-4%	0.0	0.0	(n/a)	0.0	0.0	(n/a)

Note: Areas are given in km<sup>2</sup> and populations/households in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.

- 3.13 Reductions in population and household counts were found in the two outermost contour bands; however, there were increases for the 65-70 dBA band, which were caused by changes to the contour shape over populated areas.
- 3.14 The 2015  $L_{\text{evening}}$  contours are compared against the 2014  $L_{\text{evening}}$  contours in **Figure 4**. The 55 dBA departure contour lobe turning to the north-east of the airport retracted in 2015, following a 17% reduction in movements on the

<sup>7</sup> Heathrow 2015 NPR/SID routes are shown in **Figure 1** of Appendix B.

<sup>8</sup> The GOG departure route replaced SAM in 2015.

Runway 09L/09R BUZ/BPK routes. Similar to the  $L_{day}$  contours, the changes to the shape of the 55 dBA contour over Windsor Great Park can be attributed to the ending of the westerly departure trial in 2014, and subsequent reversion of traffic back onto the standard CPT/SAM/GOG routes in 2015.

### $L_{night}$ contours

- 3.15 Total movements over the 2015  $L_{night}$  period decreased by 1% from 2014 (see **Table C3**). Arrivals constituted 76% of total  $L_{night}$  movements. The largest movement decreases were for the ANCON aircraft types EA319V (-1.7), B744R (-1.2), B764 (-1.1) and B763R (-1.0). There were movement increases for ANCON types such as the B789 (+1.3), EA38R (+1.0) and B773G (+0.8). The total night-time departures reduced by 1.4 from 19.5 (in 2014) to 18.1 (in 2015) due to the work on decreasing late running departures. Night-time arrivals reduced by 0.7 from 76.6 (in 2014) to 75.9 (in 2015).
- 3.16 The area of the outermost  $L_{night}$  50-55 dBA contour band was smaller in 2015 and area decreases of up to 6% were found at some of the higher contour bands (see **Table 6**). (Note: the *cumulative*  $L_{night}$  contour areas reduced at most levels by up to 3%, as shown in **Table C8**). The area reductions can be attributed to the 0.9% fall in total movements (mostly due to the work on late running departures) and a switch to quieter aircraft such as the Boeing 787 and Airbus A380.

**Table 6 Heathrow 2014 and 2015  $L_{night}$  contour band area, population and household estimates**

$L_{night}$ (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
50 – 55	47.9	47.7	0%	153.7	155.8	+1%	61.6	62.6	+2%
55 – 60	18.1	17.8	-2%	49.7	55.0	+11%	18.7	20.9	+12%
60 – 65	5.8	5.6	-3%	11.0	11.2	+2%	4.1	4.1	0%
65 – 70	1.7	1.6	-6%	1.1	1.3	+18%	0.4	0.5	+25%
> 70	1.4	1.4	0%	0.0	0.0	(n/a)	0.0	0.0	(n/a)

Note: Areas are given in  $km^2$  and populations/households in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.

- 3.17 In contrast to the area reductions, there were increases in population and households within most contour bands - these were due to changes in the contour shape that arose from the higher percentage of westerly movements and the shift in traffic back onto the northern runway, following the northern runway resurfacing works in 2014.
- 3.18 The 2015  $L_{night}$  contours are compared against the 2014  $L_{night}$  contours in **Figure 5**. It can be seen that arrival noise was dominant over the night period. The westerly departure contour lobe, which turns to the south, retracted in spite

of the higher proportion of westerly departures in 2015. This was due to the 8% fewer movements on the 27L/27R DET routes in 2015 and the shift in departure traffic back onto the northern runway as mentioned above.

### L<sub>den</sub> contours

- 3.19 The total annual 24-hour aircraft movements were 0.4% higher in 2015 compared to 2014 (see **Table C4**). Increases in average 24-hour movements of the ANCON aircraft types EA320V (+30), B788 (+11), B789 (+9), EA321V (+7), EA38GP (+5) and EA38R (+5), were offset by decreases for the EA319V (-23), B744R (-9), B763R (-7), EA320C (-7) and EA321C (-5). There was a 13% reduction in movements of the noise dominant Boeing 747-400 aircraft in 2015 compared to the previous year.
- 3.20 The area of the outermost L<sub>den</sub> 55-60 dBA contour band in 2015 decreased by 7% from 2014 (see **Table 7**). The higher contour band areas were also smaller, by up to 5%. (Note: the *cumulative* L<sub>den</sub> contour areas reduced at all levels by up to 5%, as shown in **Table C9**). This resulted from the ongoing switch to more modern, quieter aircraft such as the Boeing 787-8/9 and Airbus A380, as well as reductions in noise produced by certain ANCON aircraft types, such as the EA38R on departure, and EA320V and EA319V on arrival, as identified by noise measurements undertaken in 2015.

**Table 7 Heathrow 2014 and 2015 L<sub>den</sub> contour band area, population and household estimates**

L <sub>den</sub> (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
55 – 60	133.0	123.5	-7%	504.8	492.7	-2%	210.7	206.9	-2%
60 – 65	47.0	46.7	-1%	152.2	155.0	+2%	59.8	61.0	+2%
65 – 70	20.5	19.9	-3%	42.1	42.4	+1%	15.9	16.0	+1%
70 – 75	6.5	6.3	-3%	5.1	5.3	+4%	1.9	2.0	+5%
> 75	3.7	3.5	-5%	0.2	0.1	-50%	0.1	< 0.1	(n/a)

Note: Areas are given in km<sup>2</sup> and populations/households in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.

- 3.21 The population and household counts reduced by 2% for the 55-60 dBA contour band in 2015, in line with the 7% decrease in area. At the higher contour bands, however, there were some increases in population and households. These can be attributed to changes in contour shape caused by the higher percentage of westerly movements in 2015 and to a return to more even distributions of traffic across the northern and southern runways over the night period, following the completion of the northern runway resurfacing programme in 2014.



3.22 The 2015  $L_{den}$  contours are compared against the 2014  $L_{den}$  contours in **Figure 6**. Similar to the  $L_{day}$  and  $L_{evening}$  contours, the 55 dBA contour lobe that turns to the north-east of the airport has retracted due to movement decreases by the noise dominant Boeing 747-400 aircraft on the Runway 09L/09R BUZ/BPK routes. The changes to the shape of the 55 dBA contour over Windsor Great Park resulted from the shift in westerly departure traffic back onto the standard CPT/SAM/GOG routes after the departure trials in 2014 ended.

### $L_{eq,6.5hr}$ night contours

3.23 Total movements in the 6.5-hour night period decreased by 0.3% compared to the previous year (see **Table C5**). The largest reductions were for the ANCON aircraft types B744R and EA346, which were down by 1.2 and 0.7 movements respectively per 6.5-hour night. The decreases were partially offset by an increase of 1.0 per 6.5-hour night for the B789, and increases of 0.4 for the B772G and B772R, and 0.3 for the B788. Total 6.5-hour night departures reduced by 0.4 from 1.5 (in 2014) to 1.1 (in 2015), reflecting the work on decreasing late running departures. Total 6.5-hour night arrivals increased by 0.4 from 14.5 (in 2014) to 14.9 (in 2015).

3.24 The 48 dBA  $L_{eq,6.5hr}$  night contour area of 33.0 km<sup>2</sup> in 2015 was 9% smaller than in 2014 (see **Table 8**). This decrease was mainly due to a 29% reduction in movements of the noise dominant ANCON aircraft type, the B744R. The 2015 area was the smallest ever calculated for the 6.5-hour night period at Heathrow.

**Table 8 Heathrow 2014 and 2015  $L_{eq,6.5hr}$  night contour band area, population and household estimates**

$L_{eq,6.5hr}$ night (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
> 48	36.3	33.0	-9%	107.5	105.5	-2%	41.5	40.3	-3%

Note: Areas are given in km<sup>2</sup> and populations/households in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.

3.25 Populations and households within the 48 dBA contour have fallen by 2% and 3% respectively. These changes can be attributed to the 9% area reduction and changes to the contour shapes following the completion of the northern runway resurfacing works in 2014 and the subsequent shift in traffic from the southern runway back onto the northern runway in 2015.

3.26 The 2015  $L_{eq,6.5hr}$  night 48 dBA contour is compared against the 2014 contour in **Figure 7**. The effects of the shift in traffic back onto the northern runway in 2015, following the completion of the northern runway resurfacing programme in 2014, are evident in the longer contours on the northern runway and the shorter contours on the southern runway.



## Long-term contour trends

- 3.27 Long-term area, population and household trends for the outermost contour band are shown graphically in **Figures 8-12** for  $L_{\text{day}}$ ,  $L_{\text{evening}}$ ,  $L_{\text{night}}$ ,  $L_{\text{den}}$  and  $L_{\text{eq,6.5hr night}}$  respectively, for the base year 2006 and years 2009 through to 2015 (note: the population and household trends are all based on updated CACI data). The percentage of westerly and easterly movements (i.e. the runway modal split) has also been indicated by the dashed lines on the charts.
- 3.28 Some factors that had an effect on the contours between 2006 and 2015 include the following:
- 2006:
    - ICAO Chapter 4 compliance estimated at 94% of the total fleet. (In the following years, the replacement of older, noisier types by quieter types will increase the Chapter 4 compliance percentage, leading to smaller contours).
  - 2009:
    - Boeing 747-400 movements were 21% lower than in 2006, causing reductions in contour size.
  - 2010:
    - Disruption from volcanic ash crisis, air traffic control strikes and adverse winter weather led to higher numbers of late running departures at night, thus increasing the size of the night-time contours;
    - Total movements were 5% lower than in 2006, helping to reduce contour areas relative to 2006;
    - A low in the percentage of westerly movements, tending to reduce contour areas.
  - 2011:
    - Total movements were 6% higher than in 2010, tending to increase contour areas;
  - 2013:
    - Southern runway closed at night due to resurfacing programme, shifting the noise at night from the southern runway to the northern runway;
    - A low in the percentage of westerly movements, helping to reduce contour areas;

- 2014:
  - Northern runway closed at night due to resurfacing programme, shifting the noise at night from the northern runway to the southern runway;
  - ICAO Chapter 4 compliance reached an estimated 99% of the total fleet (5% more than in 2006), reflecting higher numbers of newer, quieter aircraft and reducing contour areas compared to 2006;
  - Westerly departure trials between August and November, and easterly departure trials between July and November, shifting the distribution of departure noise to different areas;
- 2015:
  - Return to a 'normal' north-south runway split at night following the runway resurfacing works in 2013 and 2014, shifting some noise back to the northern runway;
  - Return to standard departure routes following the departure trials of 2014, and returning to the distributions of departure noise experienced prior to 2014;
  - ICAO Chapter 4 compliance estimated at 99% of the total fleet, reflecting higher numbers of newer, quieter aircraft and reducing contour areas compared to 2006.

3.29 There was a downward trend for the  $L_{\text{day}}$  55-60 dBA area, population and households from 2006 through to 2010 (see **Figure 8**), when movements also fell to a low and the percentage of easterly operations was unusually high. However, an increase in area in 2011 was accompanied by an increase in populations and households, which to a large extent was due to the update to the population database in 2011, and also to the 5% higher proportion of westerly movements. From 2011 to 2014, the  $L_{\text{day}}$  area, population and households were relatively steady, before falling in 2015 as noise levels reduced for certain ANCON aircraft types as identified by noise measurements in 2015, and as the fleet continued to switch to more modern, quieter aircraft types. The proportion of westerly movements was at its lowest in 2010 and 2013. Apart from year 2010, total movements have been relatively steady, in the range of approximately 940-960 per 12-hour day.

3.30 The  $L_{\text{evening}}$  55-60 dBA area showed a downward trend from 2006 through to 2010 before rising in 2011, but since then, it has been falling steadily (**Figure 9**). Movement numbers in the evening period declined from 2011 to 2014, but rose in 2015. Populations and households fell in 2009 from the 2006 levels, but increased in 2010 and 2011, and since then have fallen in tandem with the area

reductions. The 2013 population did not drop as much as expected following the area decrease, because of the major update to the 2013 population database. The percentage of westerly operations was at its lowest in 2010 and 2013.

- 3.31 The  $L_{\text{night}}$  50-55 dBA area was at a similar level to 2006 in 2009 and 2010, before dropping back in 2011, and since then has remained at a steady level (**Figure 10**). From 2011 onwards,  $L_{\text{night}}$  movements have been in the range of 75-78 per night. There was a downward trend in the population and households from 2009 to 2012 after the 2009 high. However, the population count rose in 2013 following the major update to the 2013 population database and the southern runway resurfacing programme, which increased arrival noise over Windsor. Around 60% of this population increase was due solely to the population database update. The population also increased in 2014 and 2015 as the contour shape changed following the northern runway resurfacing works in 2014 and the subsequent reversion to a 'normal' north/south runway usage split in 2015, coupled with a higher percentage of westerly operations.
- 3.32 The  $L_{\text{den}}$  55-60 dBA area fell between 2006 and 2009 as movements of the noise dominant Boeing 747-400 aircraft dropped by 21% (**Figure 11**). From 2009 to 2013 the area stayed at a similar level, but since then has fallen for two years running as the fleet continued its switch to more modern, quieter aircraft such as the Airbus A380 and Boeing 787-8/9. The  $L_{\text{den}}$  population and households declined from 2006 through to 2010, but increased in 2011 despite the area staying almost constant, mainly due to the effects of the update to the 2011 population database, and also to a higher proportion of westerly movements. Since 2011, the population and household counts have generally followed a downward trend. The frequency of movements has been fairly steady since the 2006 base year, apart from a dip in 2010, when disruptions from volcanic ash, air traffic control strikes and adverse winter weather meant the total was 5% below 2006 levels. There were lows in the proportions of westerly operations in 2010 and 2013.
- 3.33 The  $L_{\text{eq},6.5\text{hr night}}$  48 dBA area was at a high in the 2006 base year, dropped by 16% in 2009, and increased in 2010 when movements also rose (**Figure 12**). The area then dropped by 23% in 2011. From 2011 to 2013 the area was reasonably steady, but since then has reduced by over 10%. Movement numbers have changed little since 2011. Population and household counts moved broadly in line with the contour area from 2006 to 2011. However, in 2012 the population count fell despite an area increase as parts of the contour retracted from densely populated areas of west London, after the percentage of westerly movements reduced. The area dropped by 4% in 2013, but the population count increased by 25% as the contour extended over west London, in line with the northern runway. This population rise was caused by a combination of: (a) the southern runway resurfacing programme, which shifted movements to the northern runway, (b) a higher percentage of westerly

operations, and (c) the major 2013 population database update based on the 2011 Census. Around 50% of the total population increase in 2013 was due solely to the population database update. The area and population/household counts declined in 2014 following a reduction in B744R movements and a shift in traffic to the southern runway whilst the northern runway underwent resurfacing works. In 2015 the area and population and household counts fell again as more B744R movements were replaced by quieter aircraft.

## Cumulative noise contours

- 3.34 The cumulative results in **Tables C11-C15** of Appendix C show that year 2015 contour areas were all below the 2006 base year levels across all the noise metrics. For example, the  $L_{den}$  55 dBA contour area in 2015 was 200.0 km<sup>2</sup>, 18% smaller than the 2006  $L_{den}$  55 dBA area of 244.7 km<sup>2</sup>.
- 3.35 For the most part, population and household counts were lower in 2015 compared to 2006, in line with the area decreases; however, in some cases the 2015 populations were actually *higher* than in 2006. For instance, the 2015  $L_{day}$  60 dBA population count was 10% higher than in 2006. The rises in population can be attributed to the effects of population encroachment between 2006 and 2015 in the areas around Heathrow. To illustrate the impact of encroachment, population and household counts for the 2015 contours have also been made using the 2006 population database. These counts, which are highlighted in blue in **Tables C11-C15**, confirm that the population and household counts would have dropped across all the noise metrics had there not been any population encroachment between 2006 and 2015. In the above example of the 2015  $L_{day}$  60 dBA contour, the population count would have fallen by 14% without encroachment, instead of the actual 10% rise.
- 3.36 To eliminate the effects of modal split changes between 2006 and 2015, year 2015 contours have also been produced using the 2006 base year modal splits. The areas and populations (for both the 2015 and 2006 population databases) within the outermost cumulative contour level are summarised in **Table C16** for each noise metric<sup>9</sup>. The differences between the 2006 and 2015 modal splits were generally small, i.e. 2% or less. The results show that the differences in modal split had little effect on the contour areas across all metrics, and only caused at most a 1% decrease in the population count.
- 3.37 The Heathrow contour area is largely controlled by movements of the noise dominant Boeing 747-400 aircraft. Their numbers have decreased from an average of 135 movements per day in 2006 (Ref 3) to 70 movements in 2015,

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<sup>9</sup> For  $L_{night}$ , whilst the overall modal split was identical in 2006 and 2015, i.e. 72% west / 28% east, differences in the separate modal splits for departures and arrivals between the two years meant that the contour areas and population counts were not exactly the same.

which amounts to a 48% reduction. Newer and quieter aircraft types such as the Airbus A380 and Boeing 787-8/9 were not in service in 2006, but by 2015 there was an average of 40 movements of the Airbus A380 and 43 movements of the Boeing 787-8/9 per day. These fleet changes helped to reduce the Heathrow contour area between 2006 and 2015.

- 3.38 A diagram comparing the 2006 and 2015  $L_{den}$  contours can be found in **Figure 13**. The contour lobes associated with departures turning to the north have shortened considerably, following the replacement of the noise dominant Boeing 747-400 aircraft over this period of time. A similar effect is seen on the contour lobe formed by westerly departures turning to the south (on the DVR/DET<sup>10</sup> route). Westerly arrival movements were more prevalent on the northern runway in 2006, thus the contour lobes to the east of the airport in 2006 were more expansive along the Runway 27R extended centreline compared to 2015.

### Noise change diagrams for $L_{den}$ and $L_{night}$

- 3.39 In order to identify the areas where  $L_{den}$  noise levels have increased or decreased, whilst excluding the effect of weather patterns on runway usage, a 'noise change' map has been produced to compare the noise exposure between the year 2006 and 2015  $L_{den}$  noise contours, *assuming the 2006 runway modal splits in both cases*<sup>11</sup> (see **Figure 14**). The 2006  $L_{den}$  modal split was 70% west / 30% east. The year 2015  $L_{den}$  55 dBA contour (assuming the 2006 modal split) has been used as the outer boundary of the areas of noise change being considered.
- 3.40 As expected, most areas have experienced noise reductions of up to 3 dB, which reflects the phase-out of the older, noisier aircraft types between 2006 and 2015. However, a few areas have seen noise increases of less than 1 dB. The noise increase in the region immediately to the south of Windsor can be attributed to the CPT/SAM/GOG departure routes being used by over 30% more traffic in 2015 compared to 2006. The noise increase over Egham can be explained by the positioning of the westerly mean tracks for the DET (previously DVR) departure routes, which were further to the west in 2015. It is estimated that 9% of the total area within the  $L_{den}$  noise change boundary experienced increases in noise.
- 3.41 A similar noise change diagram has also been produced for  $L_{night}$  (**Figure 15**), assuming the 2006  $L_{night}$  runway modal split (72% west / 28% east). The year 2015  $L_{night}$  50 dBA contour with the 2006  $L_{night}$  modal split has been taken as the

<sup>10</sup> See Figure 1 for the route diagram.

<sup>11</sup> That is, the 2015  $L_{day}$ ,  $L_{evening}$  and  $L_{night}$  contours (the constituent parts of 2015  $L_{den}$ ) have been modelled with the 2006  $L_{day}$ ,  $L_{evening}$  and  $L_{night}$  runway modal splits respectively.

outer boundary of the noise changes. It can be seen that the majority of areas experienced reductions in noise levels of up to 3 dB, which reflects the replacement of the older, noisier types (especially the B744R) between 2006 and 2015. It is estimated that 3% of the total area within the L<sub>night</sub> noise change boundary experienced increases in noise.

### N65 annual 16-hour day contours

- 3.42 N65 contours (i.e. contours showing the number of aircraft noise events above 65 dBA L<sub>max</sub>) have been produced for the 2015 annual average 16-hour day period (0700-2300 local time), for which the runway modal split was 72% west / 28% east.
- 3.43 The N65 contours for both 2006 (modal split 70% west / 30% east) and 2015 are overlaid in **Figure 16** (note: only the 50, 200 and 500 noise event levels are shown in the diagram for clarity). At the 50 events level, it can be seen that the contours are generally smaller in 2015; however, there was an obvious extension to the contour lobe to the west of Windsor Forest. This was a consequence of a much higher movement rate (of over 30%) on the westerly CPT/SAM/GOG departure routes in 2015 compared to 2006.
- 3.44 The estimated cumulative areas, populations and households are summarised in **Table 9** for N65 values of 50,100, 200 and 500 events.

**Table 9 Heathrow 2006 and 2015 annual average 16-hour day N65 cumulative contour area, population and household estimates**

N65	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 50	223.6	195.8	-12%	589.6	506.3 (437.8)	-14% (-26%)	259.9	202.4 (188.7)	-22% (-27%)
> 100	120.3	111.3	-7%	304.6	321.9 (274.8)	+6% (-10%)	130.9	128.2 (118.1)	-2% (-10%)
> 200	64.6	62.7	-3%	128.8	166.5 (130.8)	+29% (+2%)	53.8	64.2 (54.4)	+19% (+1%)
> 500	10.8	8.0	-26%	0.7	0.6 (0.7)	-14% (0%)	0.3	0.3 (0.3)	0% (0%)

Note: Areas are given in km<sup>2</sup> and populations/households in thousands. The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census. The 2015 population/household counts are based on a 2015 CACI update of the 2011 Census. The population and household counts for 2015 assuming the 2006 population database are shown in blue.

- 3.45 The results show that the N65 contour areas have all reduced between 2006 and 2015, reflecting the ongoing switch from the noisiest aircraft types such as the Boeing 747-400 to quieter types such as the Airbus A380 and Boeing 787. For

example, the 50 events contour area for 2015 was 12% smaller than in 2006. However, population counts have not fallen in all cases – this was largely due to the effects of population encroachment around Heathrow, and also to changes in the contour shape. (The population and household counts for 2015 assuming the 2006 population database are shown in blue in **Table 9**).

- 3.46 An N65 ‘change’ map has also been produced comparing the N65 results for 2015 with those for 2006, assuming the 2006 runway modal split, i.e. 70% west / 30% east (**Figure 17**). The outer boundary for the changes is the 2015 N65 50 events contour (assuming the 2006 runway modal split). It can be seen that many areas have experienced reductions of up to 150 noise events (per annual 16-hour day) that exceed 65 dBA  $L_{max}$ . However, there were increases of up to 50 events around Windsor Forest, which was due to the higher movement rates on the westerly CPT/SAM/GOG departure routes as already mentioned. An area in the vicinity of Egham also experienced increases of up to 50 events, which was caused by the DET mean departure track being positioned more to the west in 2015. A region to the east of the southern runway showed increases in N65 events of mostly up to 50, with a much smaller area experiencing up to 100 N65 events. This was caused by higher numbers of westerly arrivals in 2006 on the northern runway over the 16-hour day period, whereas the split between the two runways in 2015 was more even. Around 24% of the total area within the outer boundary of noise changes experienced increases of more than 10 N65 events.

### N70 annual 16-hour day contours

- 3.47 N70 contours (i.e. contours showing the number of aircraft noise events above 70 dBA  $L_{max}$ ) have also been produced for the 2015 annual average 16-hour day period (0700-2300 local time), for which the runway modal split was 72% west / 28% east.
- 3.48 The N70 contours for 2006 (modal split 70% west / 30% east) and 2015 are overlaid in **Figure 18** (note: only the 50, 200 and 500 noise event levels are shown in the diagram for clarity). At the 50 events level, there were obvious contractions in the departure contour lobes near Slough and Egham. However, there was an extension to the contour lobe over Windsor Great Park. This was the result of a much higher movement rate (of over 30%) on the westerly CPT/SAM/GOG departure routes in 2015 compared to 2006, as previously mentioned.
- 3.49 The estimated cumulative areas, populations and households are summarised in **Table 10** for N70 values of 50, 100, 200 and 500 events.



**Table 10 Heathrow 2006 and 2015 annual average 16-hour day N70 cumulative contour area, population and household estimates**

N70	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 50	96.6	88.8	-8%	202.6	219.3 (179.6)	+8% (-11%)	84.4	85.9 (75.4)	+2% (-11%)
> 100	58.0	52.3	-10%	109.4	116.2 (89.6)	+6% (-18%)	44.8	44.0 (35.7)	-2% (-20%)
> 200	35.0	33.5	-4%	45.7	61.5 (48.1)	+35% (+5%)	17.6	23.2 (18.8)	+32% (+7%)
> 500	1.2	0.9	-25%	0.0	0.0 (0.0)	(-) (-)	0.0	0.0 (0.0)	(-) (-)

Note: Areas are given in km<sup>2</sup> and populations/households in thousands. The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census. The 2015 population/household counts are based on a 2015 CACI update of the 2011 Census. The population and household counts for 2015 assuming the 2006 population database are shown in blue.

3.50 The results show that the N70 contour areas have reduced between 2006 and 2015 at all levels, reflecting the replacement of the noisiest aircraft such as the B747-400 and the introduction of quieter types such as the Airbus A380 and the Boeing 787. For example, the 50 events N70 contour area for 2015 was 8% smaller than in 2006. However, despite the area reductions, population counts have mostly risen. This was largely due to the effects of population encroachment around Heathrow, and also to changes in contour shape. (The population and household counts for 2015 assuming the 2006 population database are shown in blue in **Table 10**).

3.51 An N70 ‘change’ map has also been produced comparing the N70 results for 2015 with those for 2006, assuming the 2006 modal split, i.e. 70% west / 30% east (**Figure 19**). The outer boundary for the changes is the 2015 N70 50 events contour (assuming the 2006 runway modal split). It can be seen that many areas have experienced reductions of up to 150 N70 events. However, there were increases of between 10 and 50 events over Windsor Great Park, which were due to the higher movement rates on the westerly CPT/SAM/GOG departure routes as previously mentioned. An area immediately to the west of the northern runway also experienced increases of between 10 and 50 events. This can be attributed to the westerly departures in 2006 being more biased to the southern runway, whereas in 2015, the split between the two runways was relatively even. An area to the east of the southern runway also showed increases up to 50-100 N70 events. This was caused by westerly arrivals in 2006 favouring the northern runway over the 16-hour day period, whereas the westerly arrival split between the two runways in 2015 was almost exactly 50:50. Around 23% of the total area



within the outer boundary of noise changes experienced increases of more than 10 N70 events.

### N60 annual 8-hour night contours

3.52 N60 contours (i.e. contours showing the number of aircraft noise events above 60 dBA  $L_{max}$ ) have been produced for the 2015 annual average 8-hour night period (2300-0700 local time), for which the runway modal split was 72% west / 28% east. The N60 contours for years 2006 and 2015 are overlaid in **Figure 20** for the noise event levels 10, 20 and 50. The  $L_{night}$  modal split in 2006 was also 72% west / 28% east.

3.53 The estimated cumulative areas, populations and households are summarised in **Table 11** for the N60 values of 10, 20 and 50 events.

**Table 11 Heathrow 2006 and 2015 annual average 8-hour night N60 cumulative contour area, population and household estimates**

N60	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 10	190.2	167.8	-12%	858.1	873.0 (768.2)	+2% (-10%)	397.2	367.9 (354.0)	-7% (-11%)
> 20	92.3	88.5	-4%	405.6	486.9 (422.6)	+20% (+4%)	183.3	202.0 (191.7)	+10% (+5%)
> 50	3.7	0.1	-97%	< 0.1	0.0 (< 0.1)	(n/a) (n/a)	< 0.1	0.0 (< 0.1)	(n/a) (n/a)

Note: Areas are given in km<sup>2</sup> and populations/households in thousands. The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census. The 2015 population/household counts are based on a 2015 CACI update of the 2011 Census. The population and household counts for 2015 assuming the 2006 population database are shown in blue.

3.54 The results show that the N60 contour areas have all reduced between 2006 and 2015, reflecting the replacement of the noisiest aircraft types, especially the Boeing 747-400. For example, the 10 events N60 contour area for 2015 was 12% smaller than in 2006. However, population counts have increased at the 10 and 20 event levels; this was due to the effects of population encroachment around Heathrow and to changes in the contour shape, e.g. the widening of the 20 events contour over parts of west London. (The population and household counts for 2015 assuming the 2006 population database are shown in blue in **Table 11**).

## Chapter 4

## Conclusions

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- 4.1 Numbers of aircraft movements at Heathrow in 2015 were similar to those in the previous year. Movements were up by 0.1% in the  $L_{\text{day}}$  period and up by 2% for  $L_{\text{evening}}$ , but down by 1% for  $L_{\text{night}}$ . Overall movements in 2015 were higher by 0.4% compared to 2014. Movements over the 6.5-hour night were 0.3% lower than the previous year.
- 4.2 The area of the outermost  $L_{\text{day}}$  contour band (55-60 dBA) in 2015 was 6% smaller than in 2014. There were also area decreases of up to 4% at the other  $L_{\text{day}}$  contour bands. Similarly, the outermost band for  $L_{\text{evening}}$  (55-60 dBA) reduced by 7% in 2015 and there were reductions at the higher contour bands as well. The area of the outermost 2015  $L_{\text{night}}$  contour band (50-55 dBA) was smaller compared to 2014, and decreases occurred at most of the higher contour bands. The 2015  $L_{\text{den}}$  area was 7% lower than in 2014 for the outermost contour band (55-60 dBA), and there were decreases of up to 5% at all the higher contour bands. The area reductions in 2015 for  $L_{\text{day}}$  and  $L_{\text{evening}}$  can be attributed to the ongoing switch at Heathrow to more modern and quieter aircraft types, such as the Airbus A380 and Boeing 787, and especially to reductions in noise levels of certain ANCON aircraft types, such as the EA38 on departure, and the EA320V and EA319V on arrival, as identified by noise measurements undertaken in 2015. The  $L_{\text{night}}$  area reductions resulted from a drop in movements and a switch to quieter aircraft such as the Boeing 787 and Airbus A380.
- 4.3 The *cumulative* contour areas were smaller in 2015 compared to 2014 for all the noise metrics. For example, the 2015  $L_{\text{den}}$  55 dBA contour area of 200.0 km<sup>2</sup> was 5% smaller than in 2014. The 2015  $L_{\text{eq},6.5\text{hr night}}$  48 dBA contour area fell by 9% in 2015 to 33.0 km<sup>2</sup>, largely due to a reduction in movements by the ANCON aircraft type B744R. This area was the smallest ever calculated for Heathrow.
- 4.4 The 2015  $L_{\text{day}}$  and  $L_{\text{evening}}$  contour bands showed population and household changes from 2014 that were, for the most part, in line with the area changes. For  $L_{\text{evening}}$ , there was a 3% population increase at the 65-70 dBA contour band despite a 2% area reduction; this was due to changes in the contour shape over populated areas. Although contour band areas generally decreased for  $L_{\text{night}}$ , the population and household counts increased – this was caused by contour shape changes that resulted from a higher percentage of westerly movements and a shift in traffic back onto the northern runway (following the northern runway resurfacing work carried out in 2014). Although population and household counts reduced by 2% for the outermost  $L_{\text{den}}$  contour band in 2015 following a 7% area

reduction, there were some population increases at the higher bands even though areas were smaller. Again, this can be attributed to the effects of runway modal split changes on contour shapes and a return to more even north-south runway splits in the 2015 night period. The population and households within the 2015  $L_{eq,6.5hr\ night}$  48 dBA contour decreased by 2% and 3% respectively, after the area reduced by 9%.

- 4.5 With respect to long-term trends, the  $L_{day}$  55-60 dBA contour band area has been reasonably steady since 2009 after the initial high in 2006. A dip in the  $L_{day}$  area in 2010 coincided with a low in aircraft movements and a relatively high percentage of easterly movements. The  $L_{day}$  area also dipped in 2015 as noise levels reduced for certain ANCON aircraft types as identified by 2015 noise measurement data, and as the fleet mix continued to switch to more modern, quieter aircraft. Populations and households reached a bottom in 2010 after falling from the 2006 peak, but after rising in 2011 they remained relatively steady until 2014, but dipped again in 2015 for the aforementioned reasons.
- 4.6 The area, population and households within the  $L_{evening}$  55-60 dBA contour band decreased in 2009 from the 2006 peak as movements declined, but rose again to a high in 2011 as movements recovered. Since 2011 the area, population and households have followed a downward trend. Movements declined between 2011 and 2014, but rose in 2015.
- 4.7 In terms of trends for the  $L_{night}$  50-55 dBA contour band, aircraft movements and contour areas have been relatively stable since 2011. Prior to 2011 the area was higher but also at a steady level. The population and household counts followed a downward trend from 2009 to 2012, but increased from 2013 to 2015 after the population database update of 2013, which was based on the latest 2011 Census, and because of contour shape changes caused by the southern and northern runway resurfacing programmes in 2013 and 2014 respectively. A higher percentage of westerly operations and a more even split between the northern and southern runways influenced the contour shape in 2015.
- 4.8 After the 2006 high,  $L_{den}$  55-60 dBA contour areas were fairly flat between 2009 and 2013, but since then areas have fallen as the Heathrow fleet switched to more modern and quieter types such as the Airbus A380 and Boeing 787. Populations and households have trended downwards since 2011. Aircraft movements in the  $L_{den}$  period have been at a similar level since 2006, apart from a dip in 2010.
- 4.9 The  $L_{eq,6.5hr\ night}$  48 dBA area has followed a downward trend since 2011, whilst movements over this period have been steady. Following two years of population decreases in 2011 and 2012, the population rose in 2013 due to an extension of the contour over west London in line with the northern runway. This was caused by resurfacing works on the southern runway coupled with a higher percentage of westerly operations. In addition, there was a major update to the population

database in 2013 based on the 2011 Census. However, in 2014, the population count returned to near 2012 levels as the contour area reduced, and fell again in 2015 as more B744R movements were phased out.

- 4.10 The 2015 *cumulative* contour areas were below 2006 levels for all the noise metrics considered. In most cases, populations and households within the 2015 contours were also lower than in 2006. However, at some contour levels, populations and households were higher in 2015 and this was due to the population encroachment around Heathrow between 2006 and 2015. Population and household counts for the 2015 contours, using the 2006 population database instead of the 2015 database, showed that the counts would have all been lower compared to 2006 had there not been any population encroachment.
- 4.11 An analysis of  $L_{den}$  noise changes between 2006 and 2015, assuming the 2006 base year modal split in both cases, indicated that most areas have experienced noise reductions of up to 3 dB. A few areas experienced a noise increase of less than 1 dB. These included a region south of Windsor, overflowed by the CPT/SAM/GOG westerly departure routes, which in 2015 had about 30% more movements than in 2006.
- 4.12 An analysis of  $L_{night}$  noise changes between 2006 and 2015, also assuming the 2006 base year runway modal split, showed that the vast majority of areas have experienced reductions in noise of up to 3 dB. This reflects the replacement of the older, noisier aircraft types operating at night, especially the B744R.
- 4.13 N65 and N70 annual average 16-hour day contours, and N60 annual average 8-hour night contours, produced for years 2006 and 2015, showed that contour areas have decreased between 2006 and 2015 in all cases. This is indicative of the progressive replacement of the noisiest aircraft types, such as the Boeing 747-400, by quieter types such as the Airbus A380 and Boeing 787.
- 4.14 There were some isolated areas that experienced increases in numbers of N65 and N70 events. For example, near Windsor Forest and Windsor Great Park, increases in N65 and N70 events were caused by much higher movement rates on the westerly CPT/SAM/GOG departure routes in 2015 compared to 2006. Another area exposed to higher numbers of N65 and N70 events was to the east of the southern runway. This resulted from a more even distribution of westerly arrivals in 2015 across the two runways compared to 2006, when the northern runway was used more frequently by westerly arrivals. Around a quarter of the area considered for the N65 and N70 noise changes was found to be exposed to increases of more than 10 N65/N70 events.
- 4.15 In some cases for the aforementioned N-contours there were population and household increases in spite of reductions in contour area. These can be attributed to the effects of population encroachment around Heathrow and also to changes in contour shape.

**APPENDIX A****References**

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1. ERCD Report 1504, Noise Action Plan Contours for Heathrow Airport 2014, Civil Aviation Authority, September 2015.
2. R&D Report 9842, The UK Civil Aircraft Noise Contour Model ANCON: Improvements in Version 2, Civil Aviation Authority, June 1999.
3. ERCD Report 0706, London Heathrow Airport Strategic Noise Maps 2006, Civil Aviation Authority, December 2007.

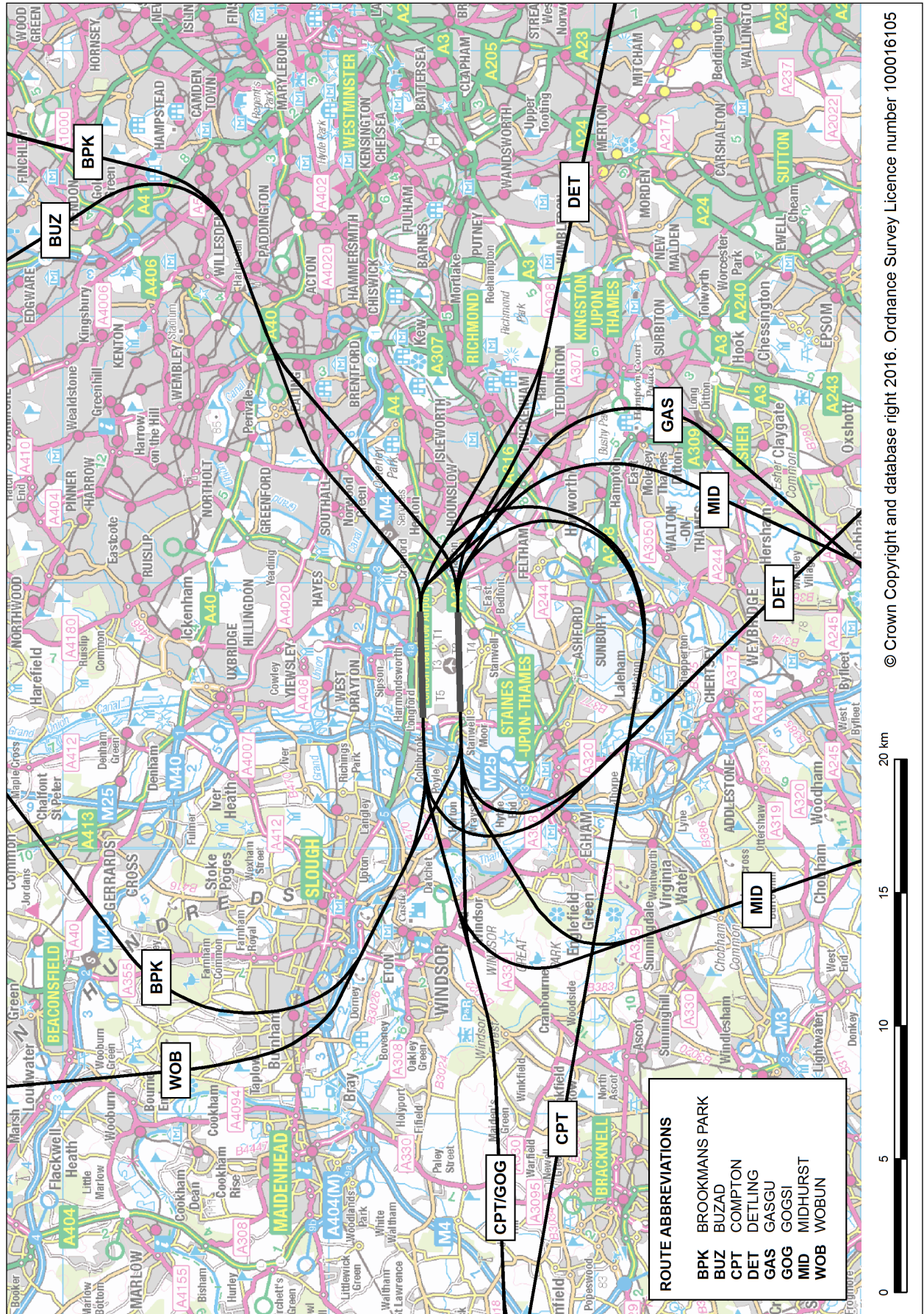
## APPENDIX B

# Figures

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Figure 1 Heathrow NPR/SID routes



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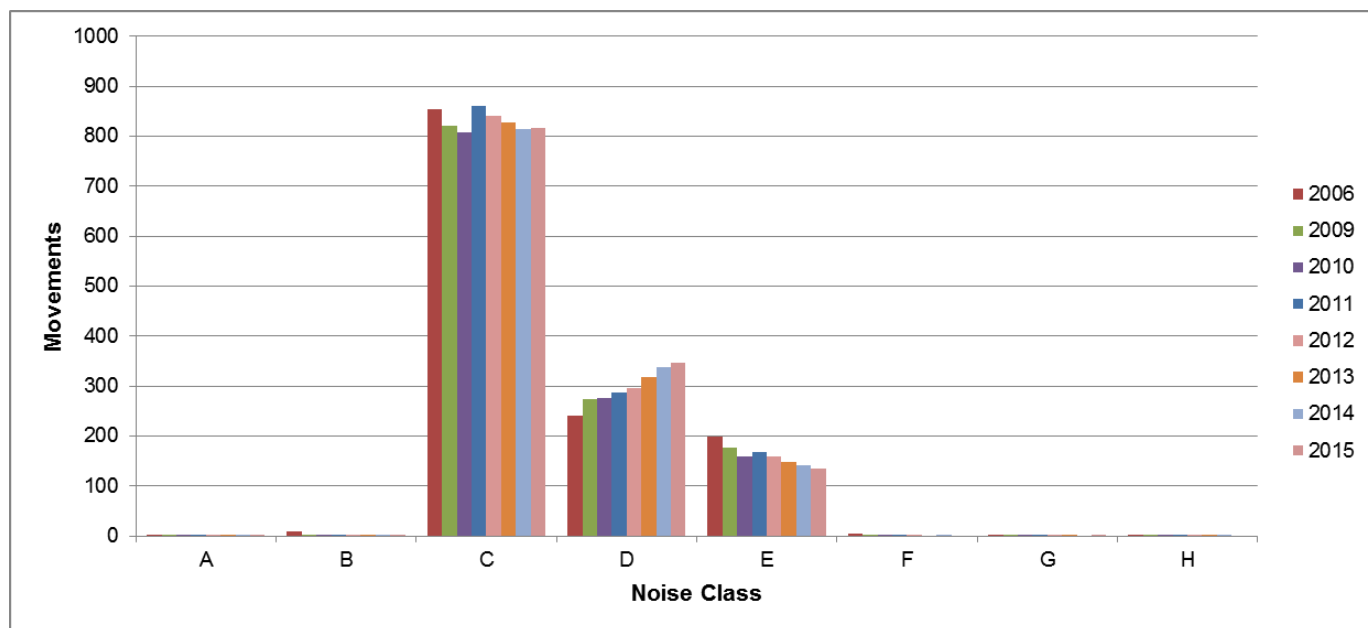
Note: Route usage figures are provided on the following page.

<b>Westerly NPR/SID</b>	<b>Route usage percentage (on average westerly day)</b>
BPK	21.8%
CPT/GOG (including SAM)	20.4%
DET	26.9%
MID	15.6%
WOB	15.3%
Total	100.0%

<b>Easterly NPR/SID</b>	<b>Route usage percentage (on average easterly day)</b>
BPK	21.3%
BUZ	13.4%
CPT	17.4%
DET	27.6%
GAS (including SAM)	5.4%
MID	14.9%
Total	100.0%



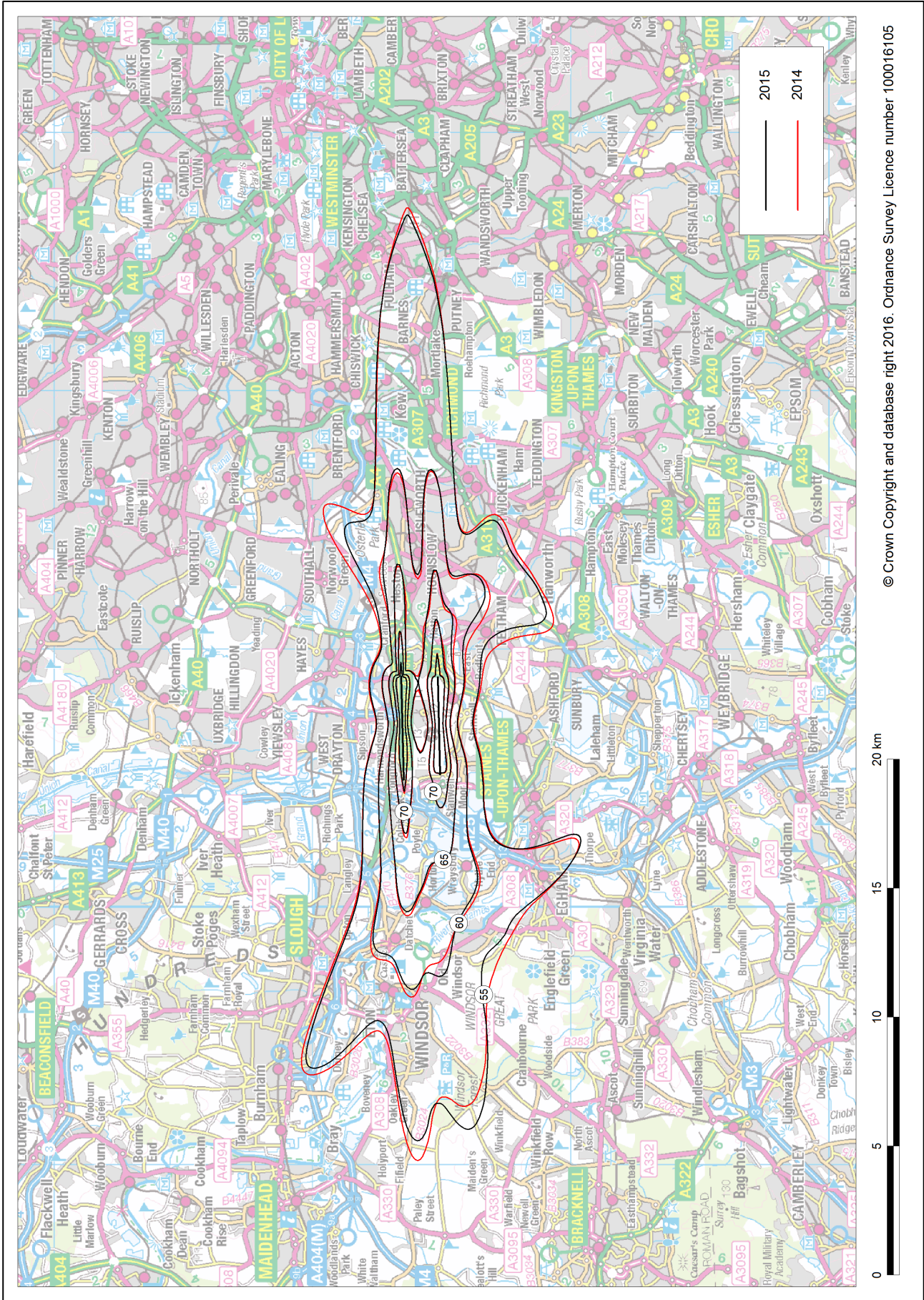
**Figure 2 Heathrow annual average 24-hour movements by Noise Class**



Note: Noise Class descriptions are given below:

Noise Class	Description
A	Small propeller
B	Large propeller
C	Narrow-body jets (e.g. Airbus A319, Airbus A320, Boeing 737-800)
D	Wide-body twins (e.g. Boeing 777, Boeing 787, Airbus A330)
E	Wide-body 3,4 engine (e.g. Boeing 747-400, Airbus A380)
F	1 <sup>st</sup> generation wide-body 3,4 engine (e.g. Boeing 747-100)
G	2 <sup>nd</sup> generation narrow-body twin (e.g. Boeing 737-200)
H	1 <sup>st</sup> generation narrow-body 3,4 engine (e.g. Boeing 727)

Figure 3 Heathrow 2015 and 2014 L<sub>day</sub> noise contours



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Figure 4 Heathrow 2015 and 2014 Leveing noise contours

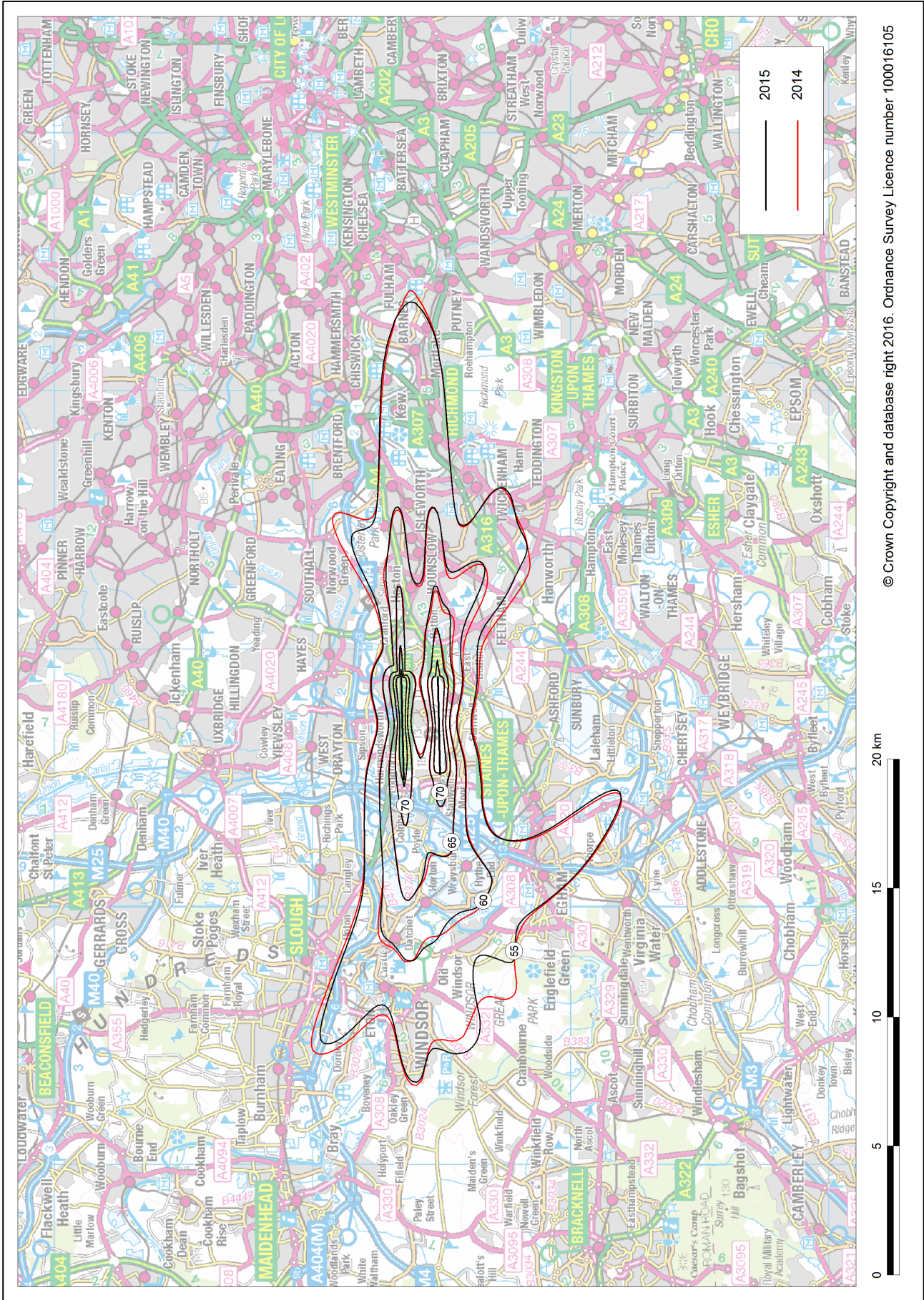
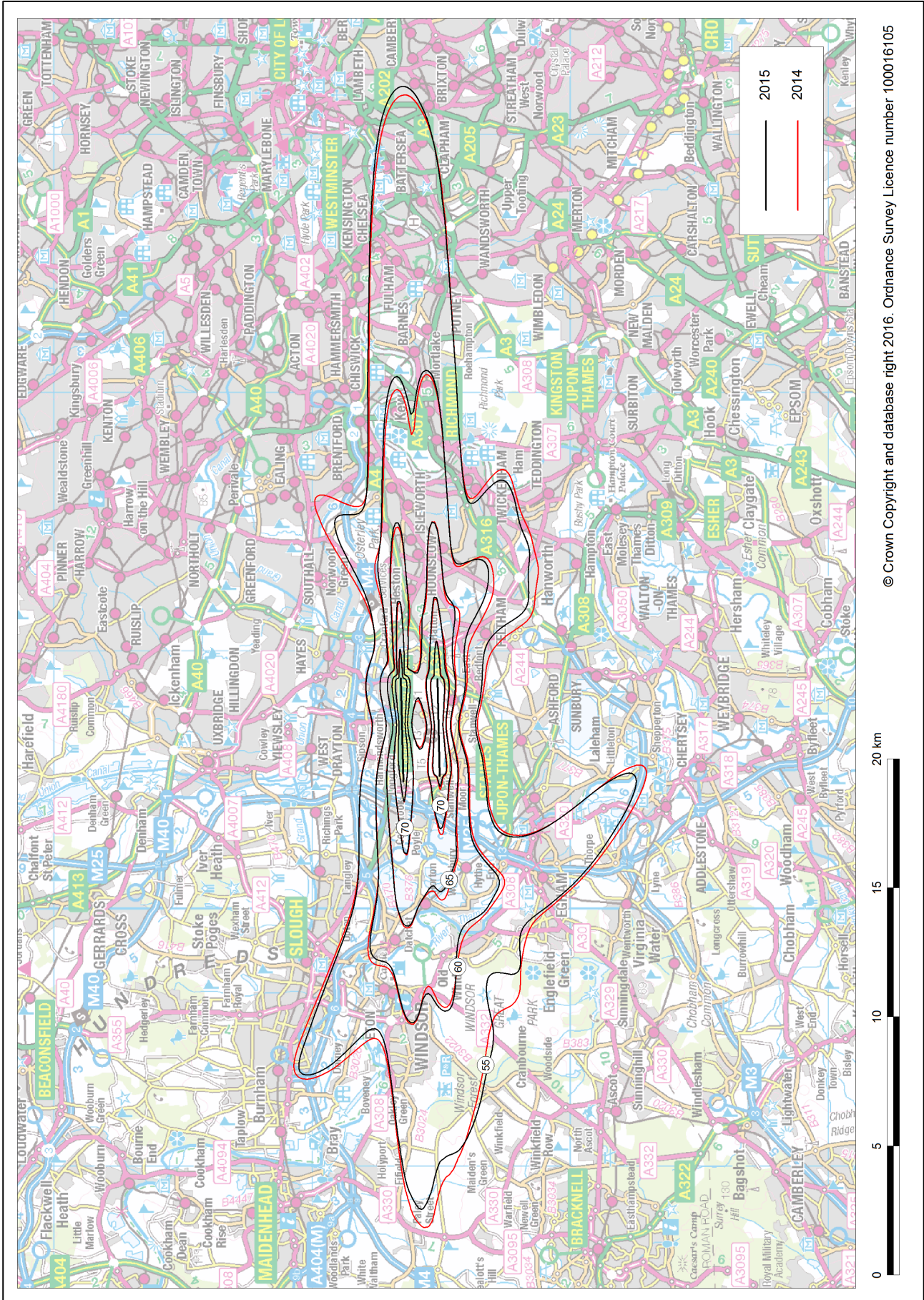








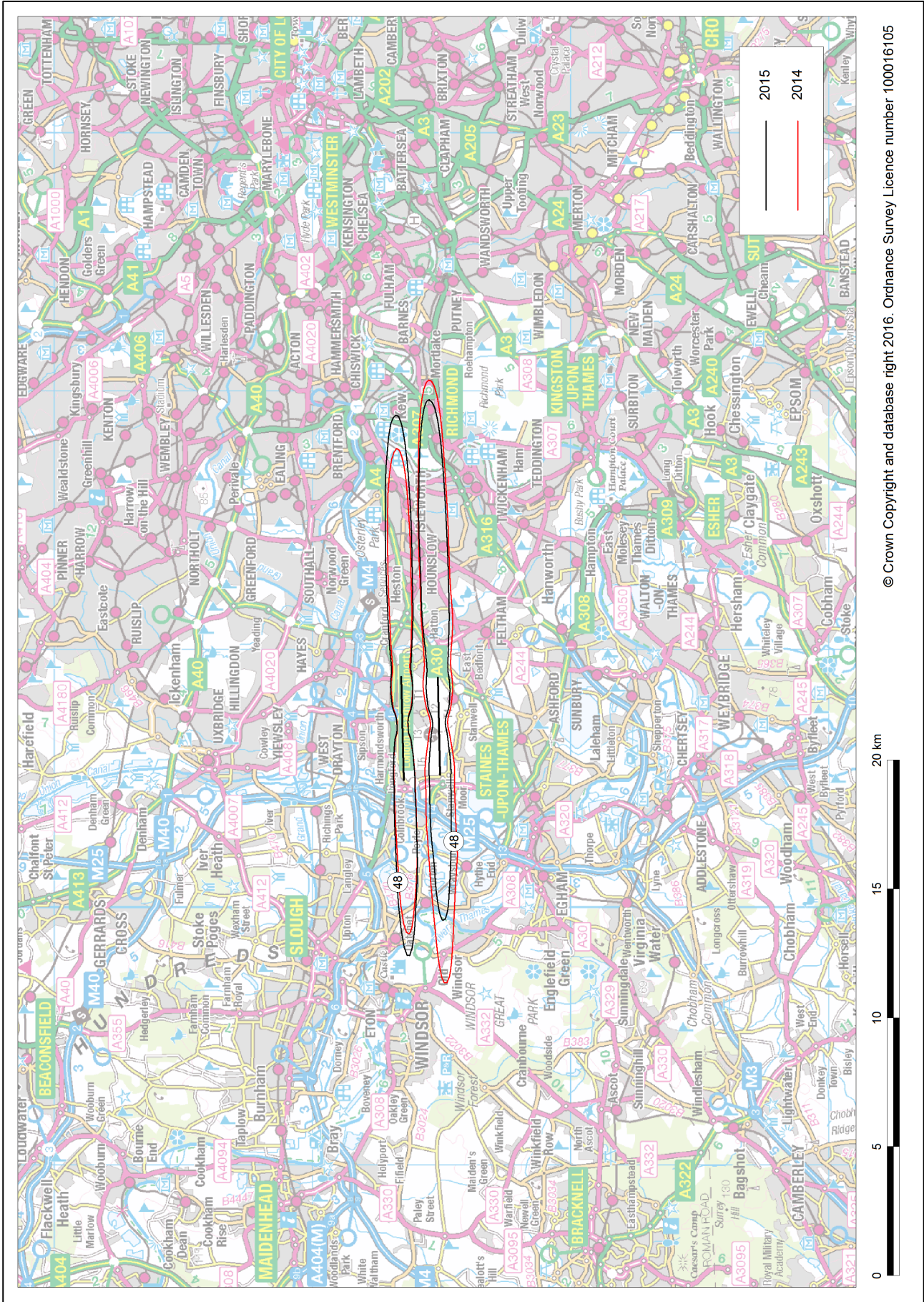
Figure 6 Heathrow 2015 and 2014  $L_{den}$  noise contours



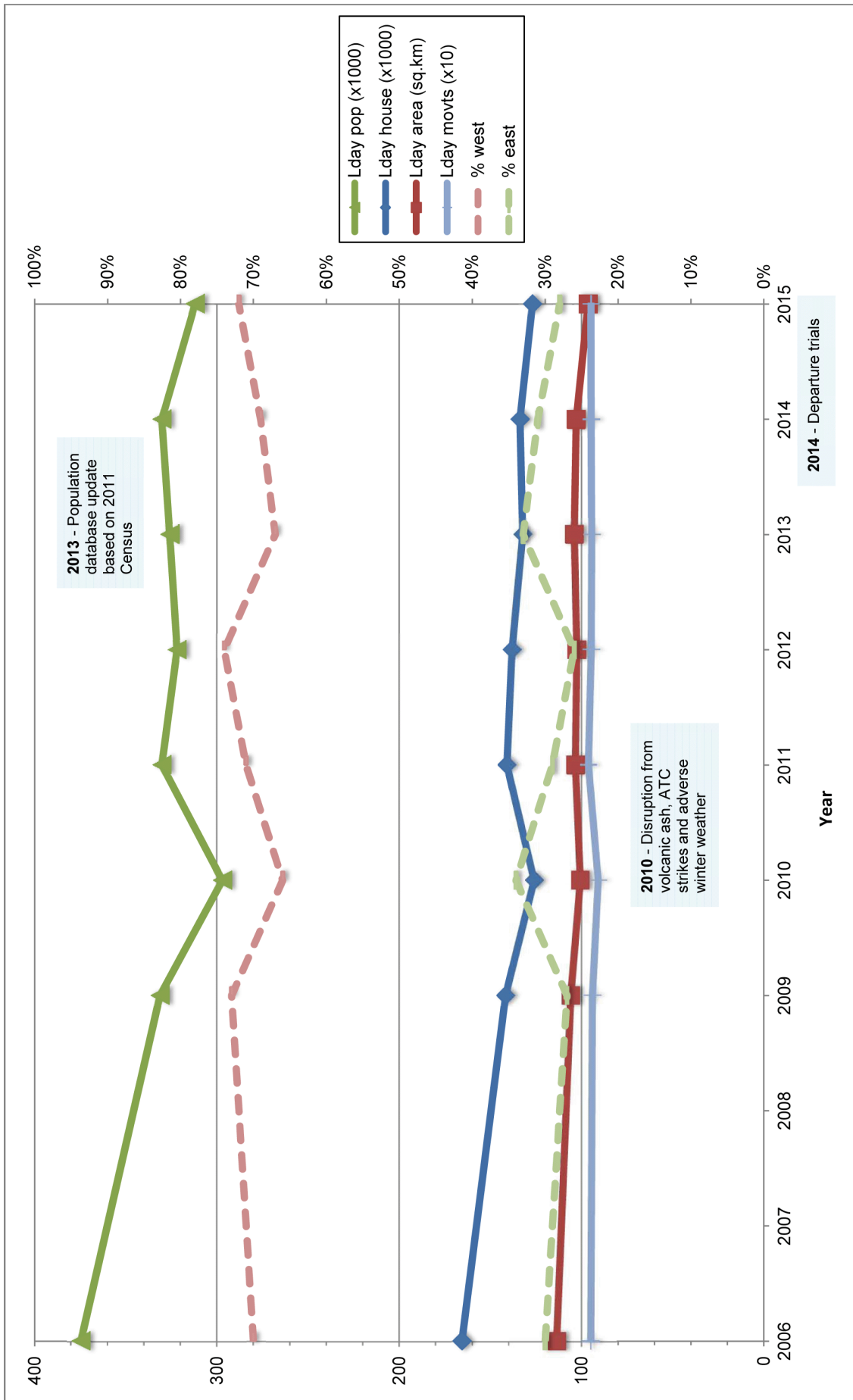
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Figure 7 Heathrow 2015 and 2014  $L_{eq,6.5hr}$  night noise contours

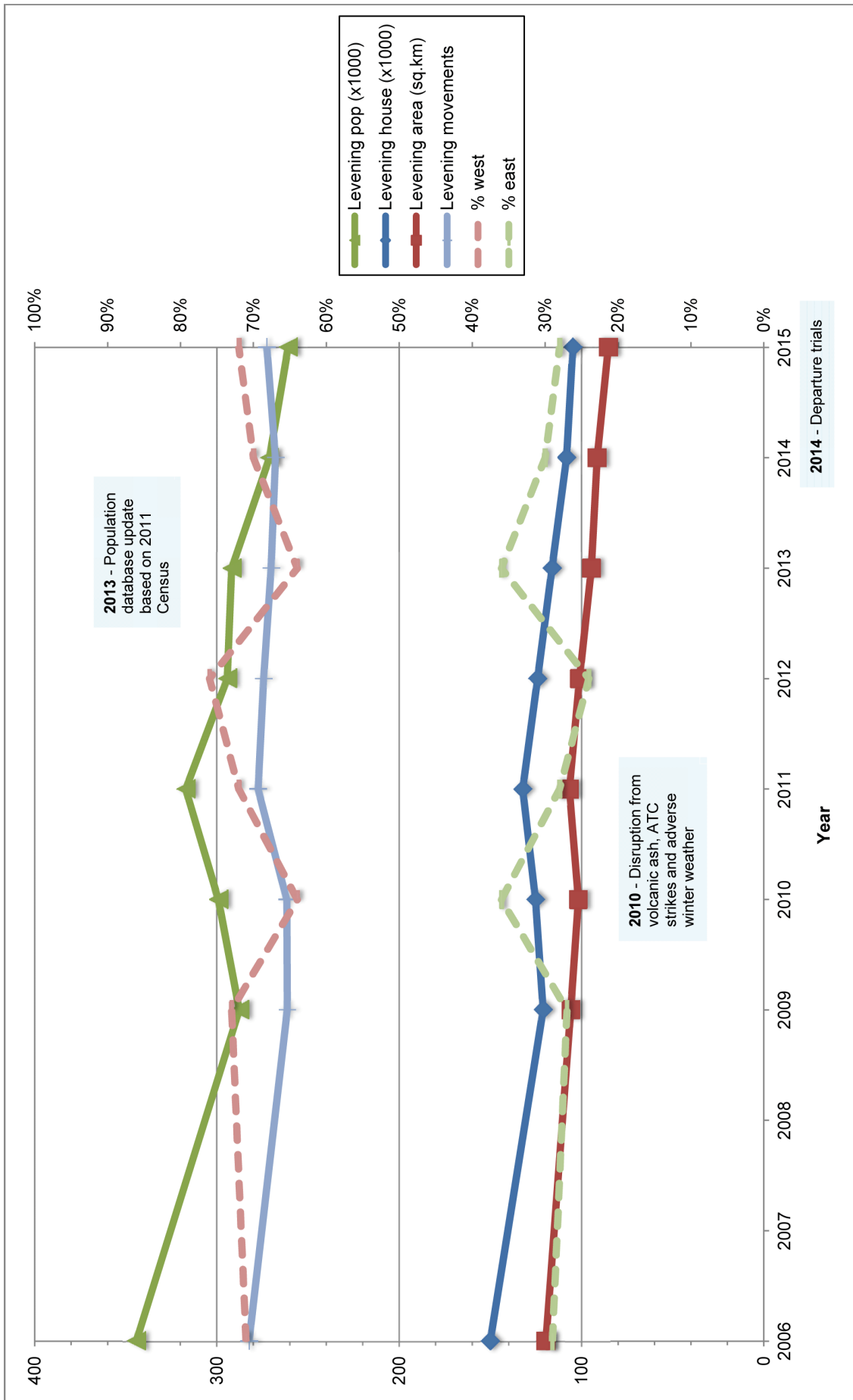


**Figure 8 Heathrow 2006 to 2015 L<sub>day</sub> 55-60 dBA area, population and household trends**



Note: There are no contour data for 2007 and 2008, and the lines joining the 2006 and 2009 data points are not meant to imply that the levels for 2007 and 2008 can be interpolated.

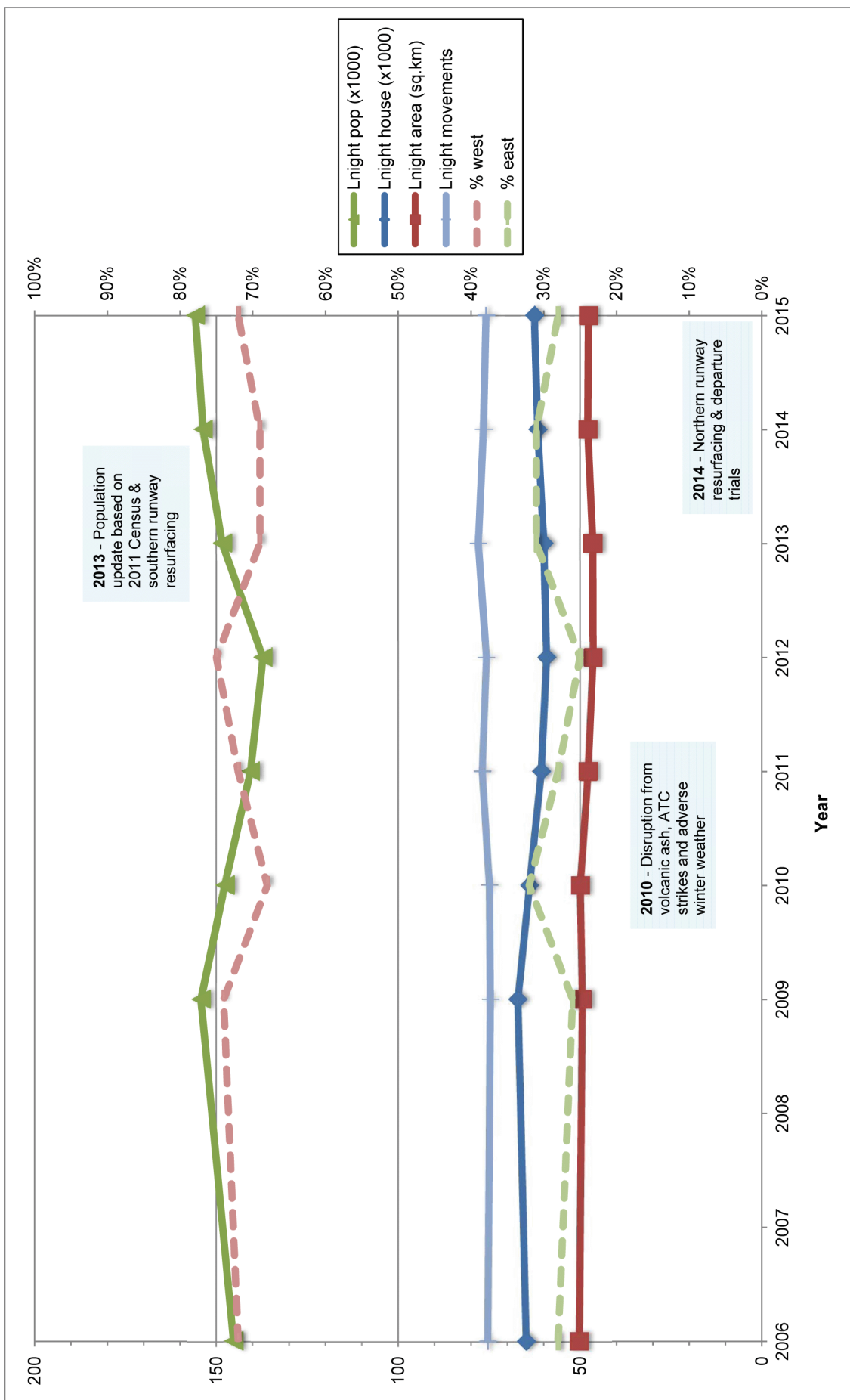
**Figure 9 Heathrow 2006 to 2015  $L_{\text{evening}}$  55-60 dBA area, population and household trends**



Note: There are no contour data for 2007 and 2008, and the lines joining the 2006 and 2009 data points are not meant to imply that the levels for 2007 and 2008 can be interpolated.

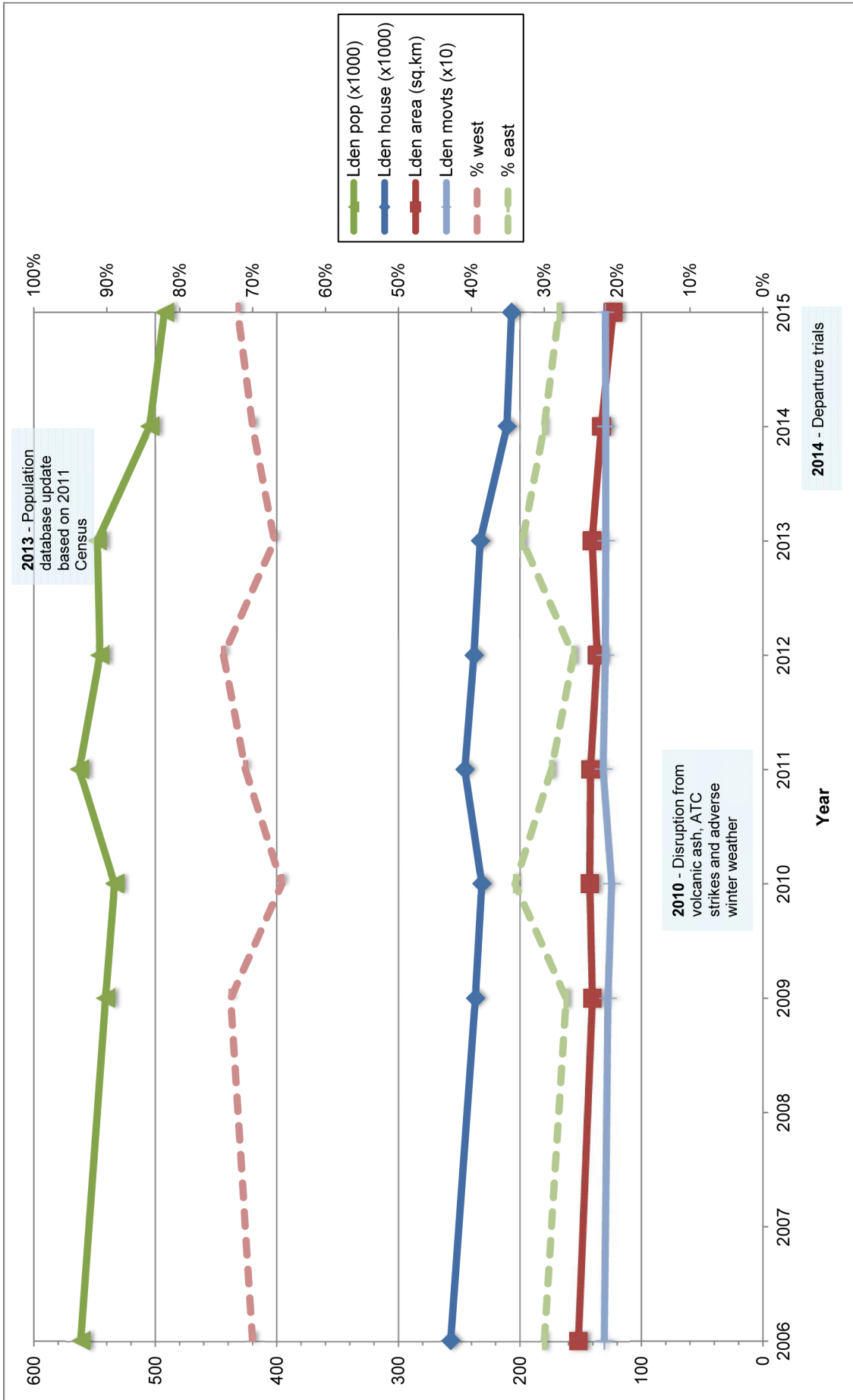


Figure 10 Heathrow 2006 to 2015 L<sub>night</sub> 50-55 dBA area, population and household trends



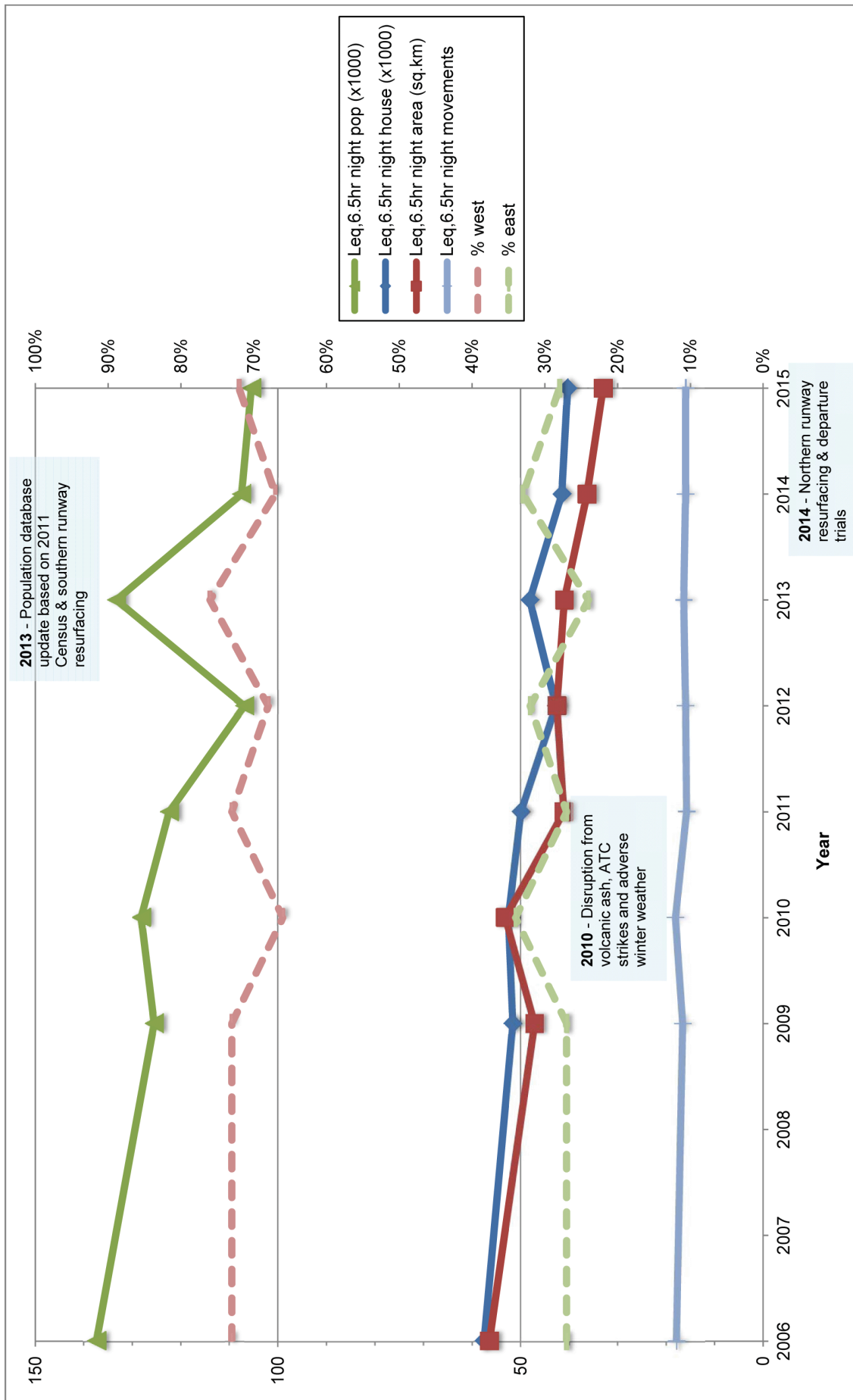
Note: There are no contour data for 2007 and 2008, and the lines joining the 2006 and 2009 data points are not meant to imply that the levels for 2007 and 2008 can be interpolated.

**Figure 11 Heathrow 2006 to 2015 L<sub>den</sub> 55-60 dBA area, population and household trends**



Note: There are no contour data for 2007 and 2008, and the lines joining the 2006 and 2009 data points are not meant to imply that the levels for 2007 and 2008 can be interpolated.

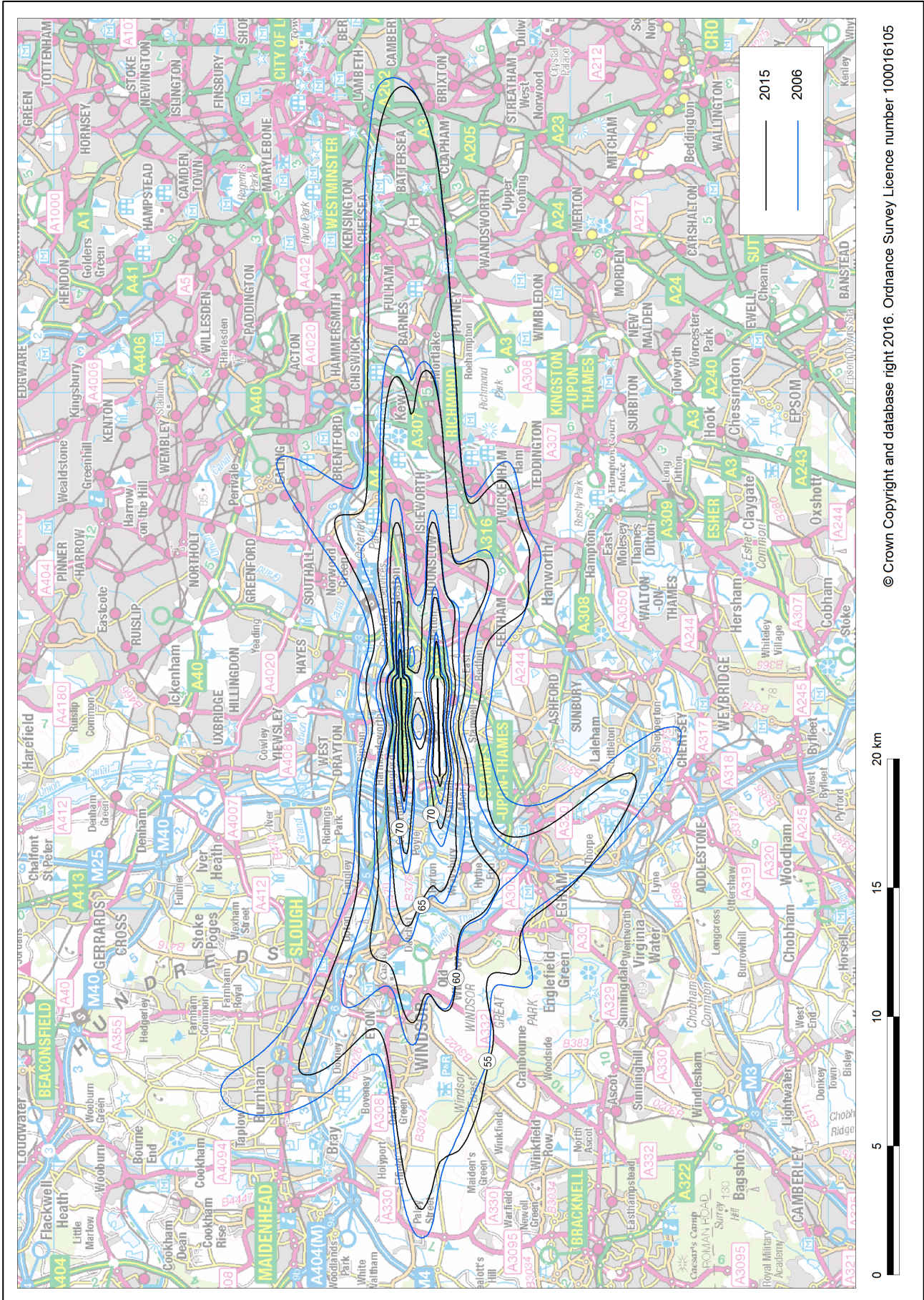
**Figure 12 Heathrow 2006 to 2015  $L_{eq,6.5hr}$  night 48 dBA area, population and household trends**



Note: There are no contour data for 2007 and 2008, and the lines joining the 2006 and 2009 data points are not meant to imply that the levels for 2007 and 2008 can be interpolated.



Figure 13 Heathrow 2015 and 2006  $L_{den}$  noise contours



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Figure 14 Heathrow noise change map for 2015 vs 2006  $L_{den}$  modal split 70% west / 30% east

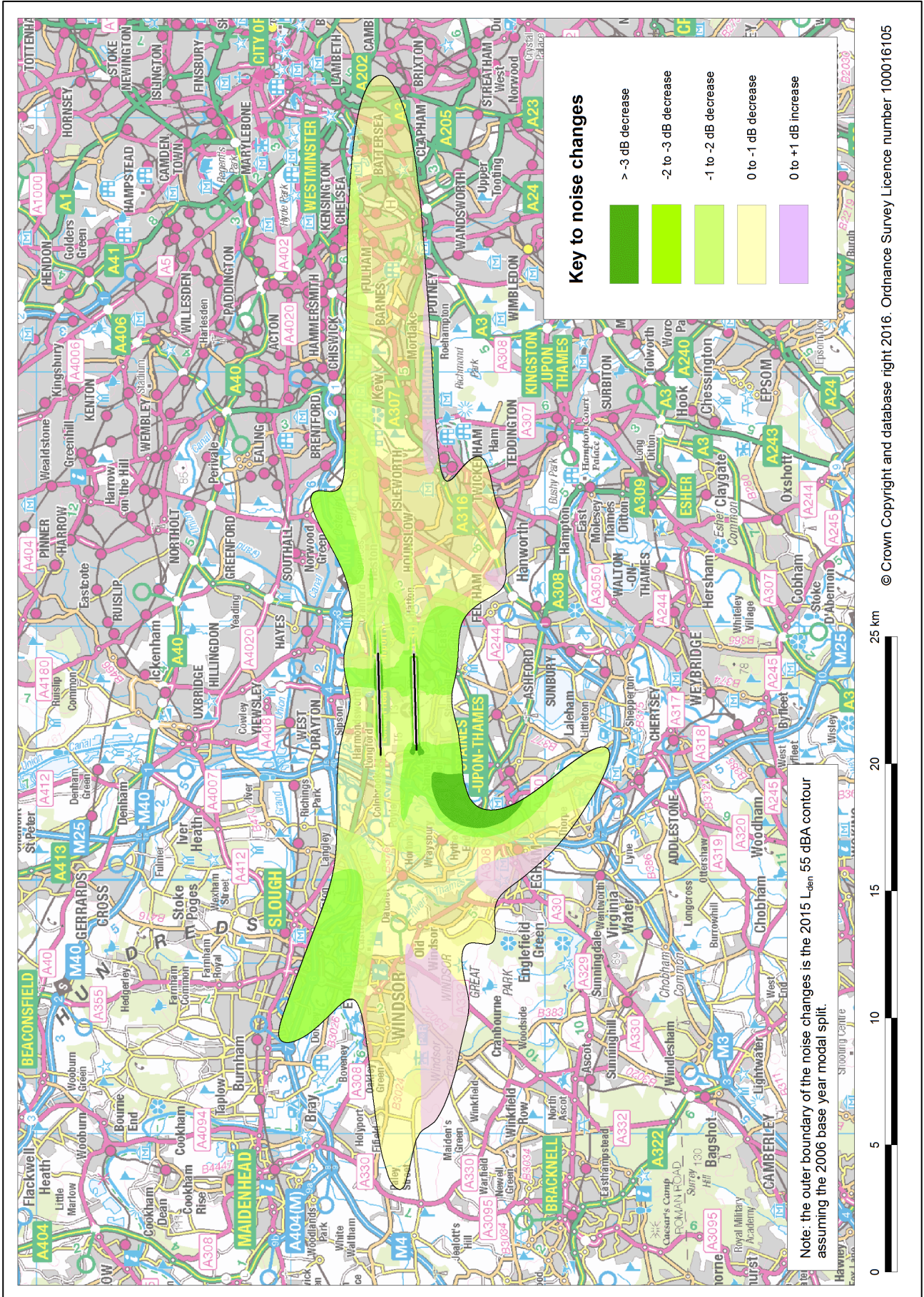




Figure 15 Heathrow noise change map for 2015 vs 2006 L<sub>night</sub> (assuming 2006 L<sub>night</sub> modal split 72% west / 28% east)

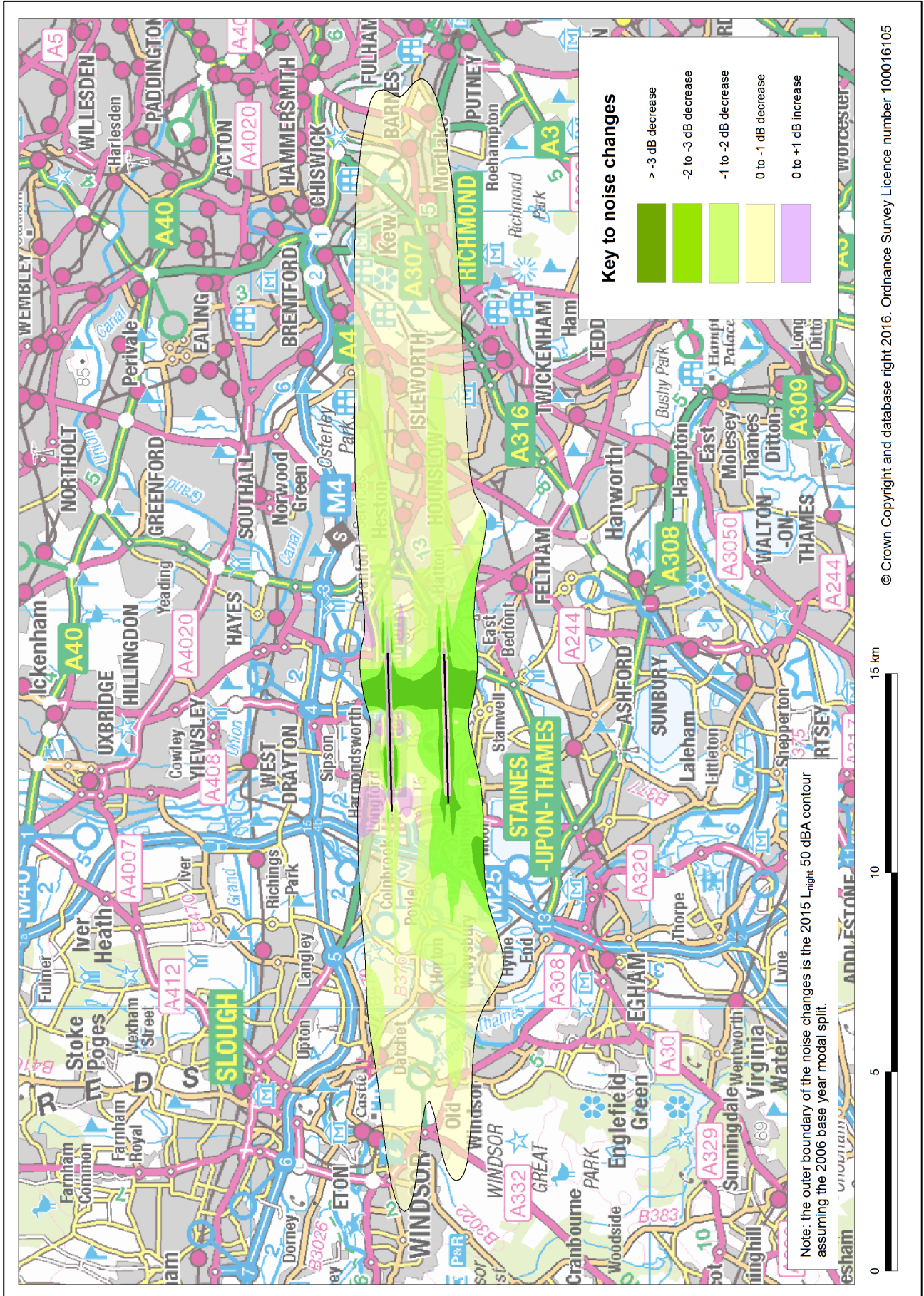
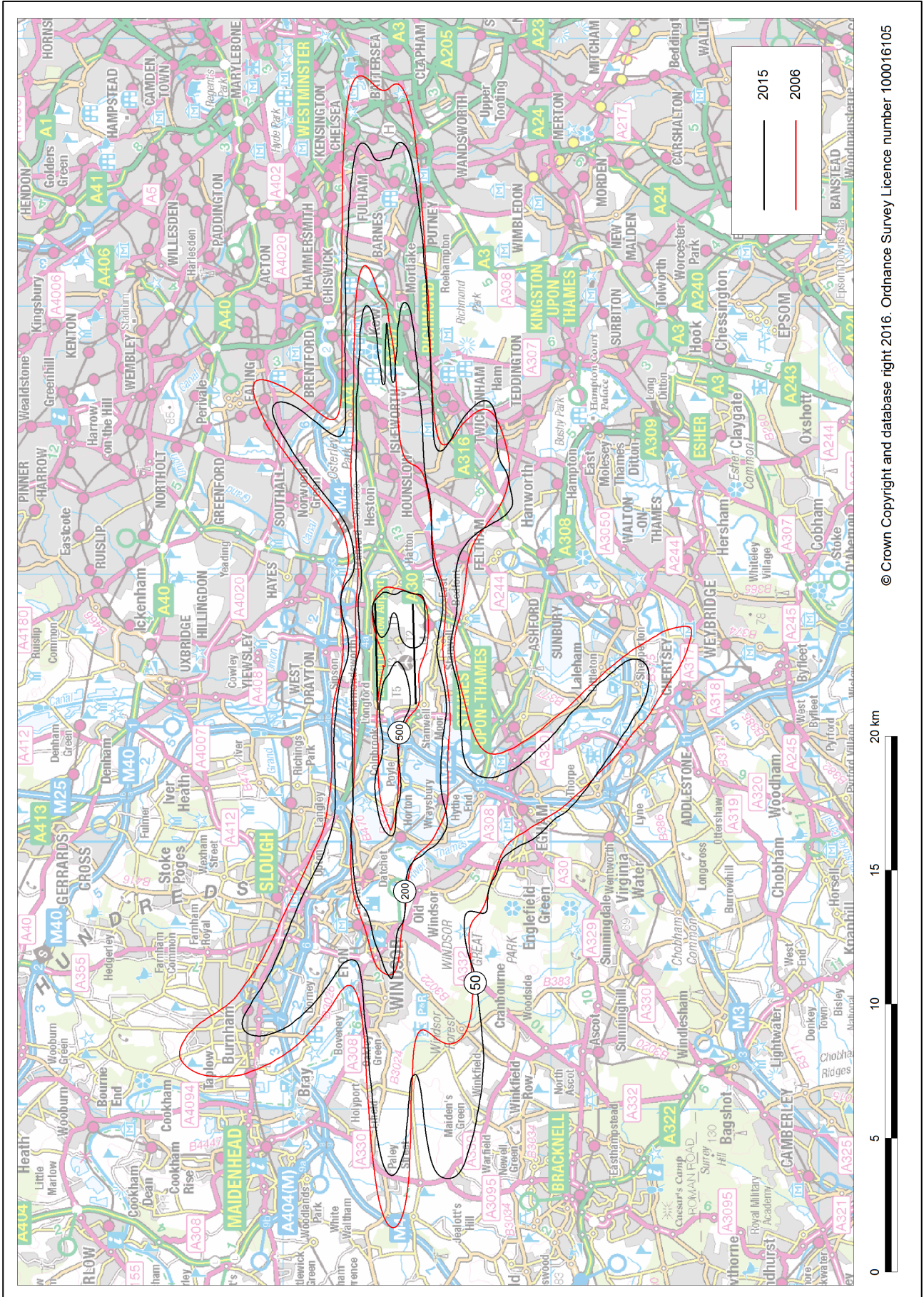




Figure 16 Heathrow 2015 and 2006 annual 16-hour day N65 contours



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Figure 17 Heathrow noise change map for 2015 vs 2006 annual 16-hour day N65 (assuming 2006 modal split 70% west / 30% east)

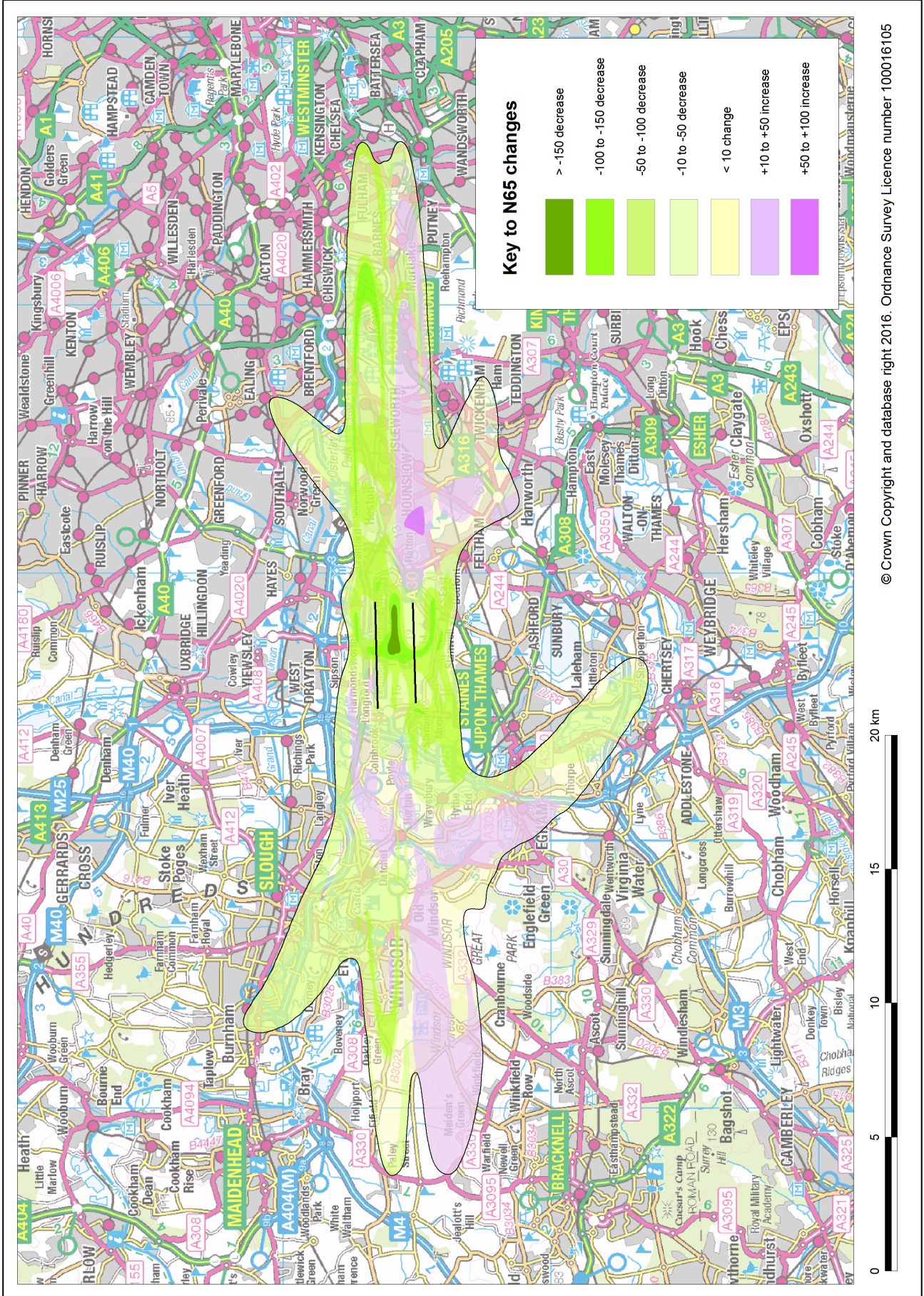
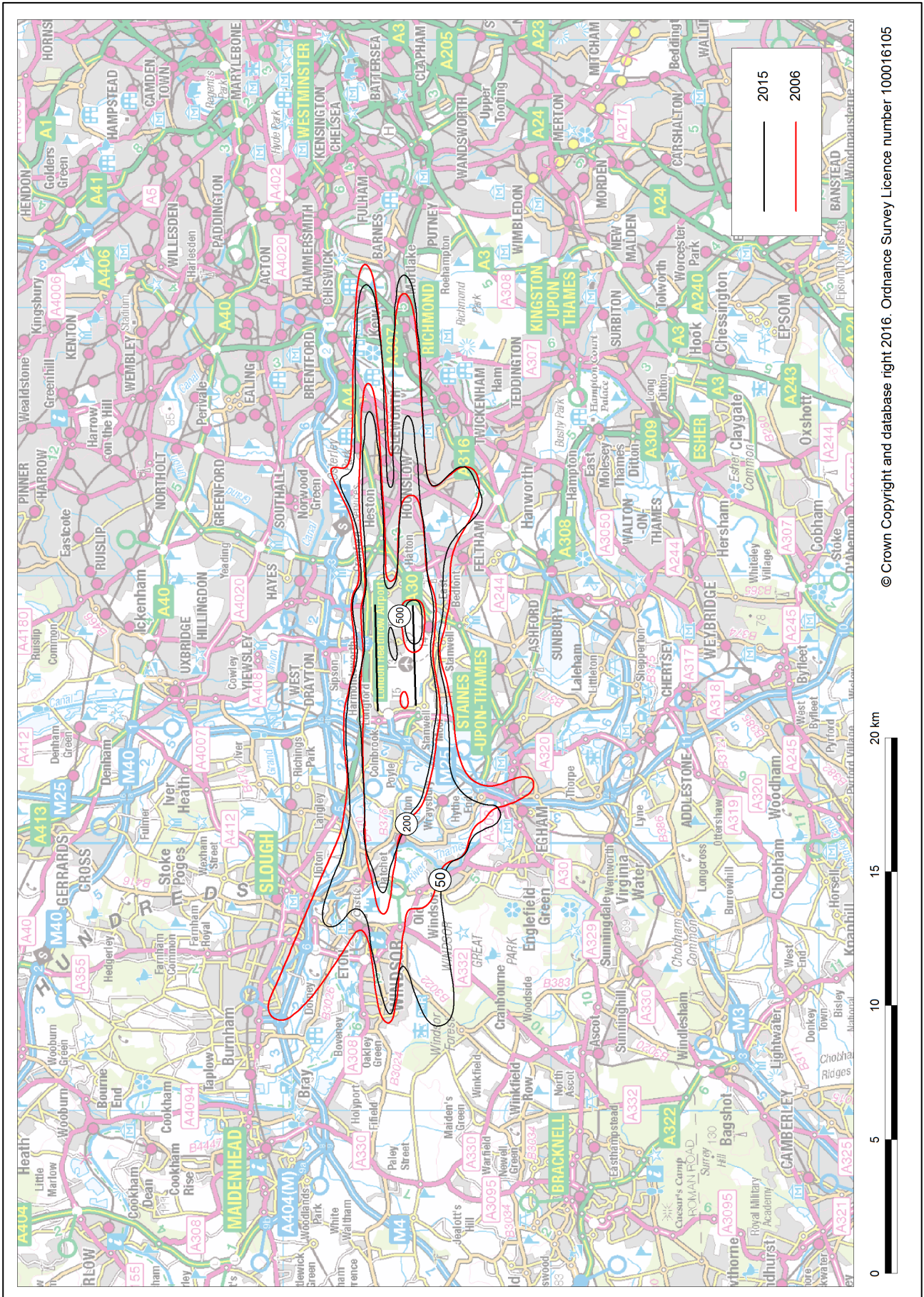




Figure 18 Heathrow 2015 and 2006 annual 16-hour day N70 contours



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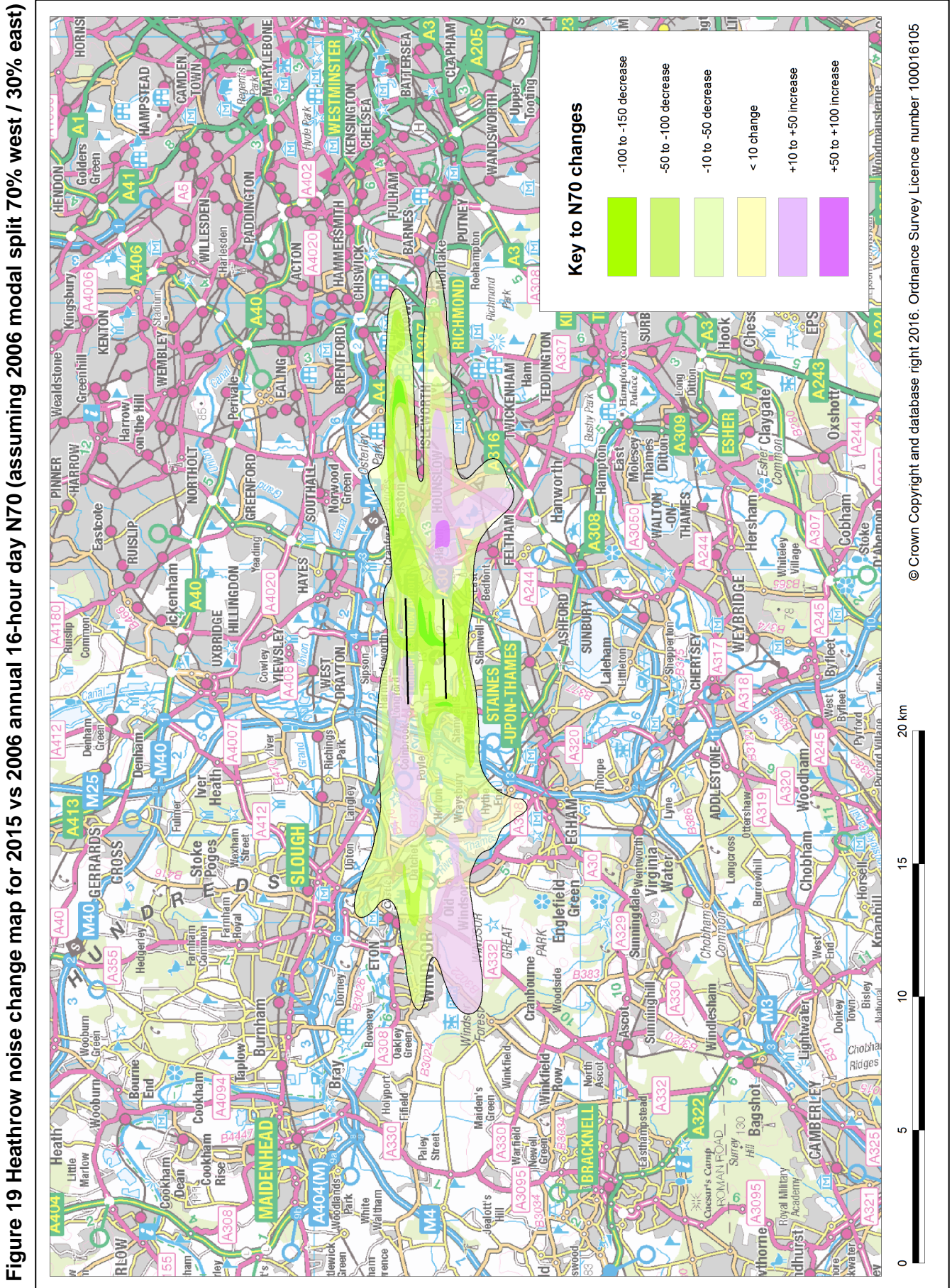
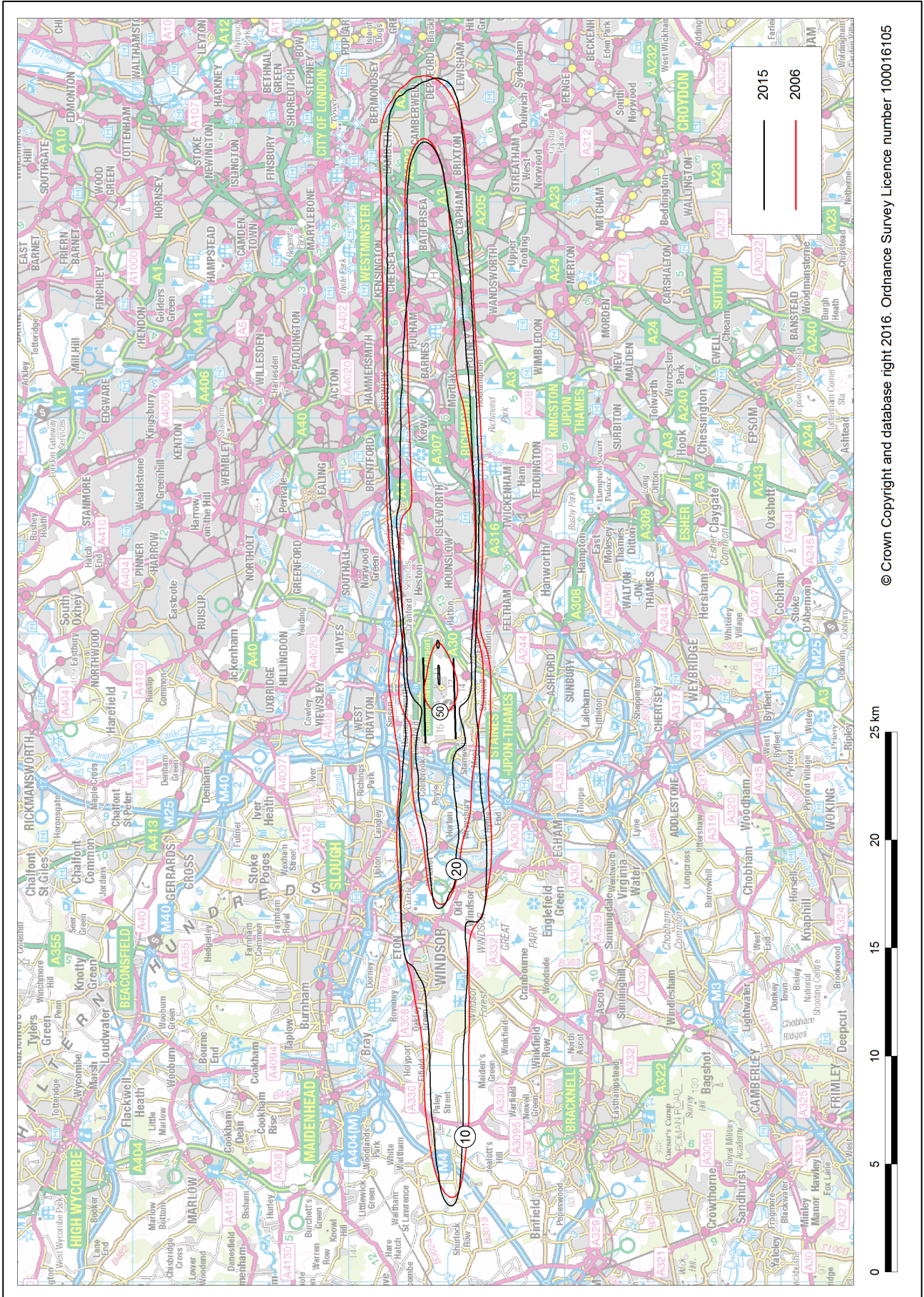




Figure 20 Heathrow 2015 and 2006 annual 8-hour night N60 contours



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## APPENDIX C

# Tables

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**Table C1 Heathrow 2014 & 2015 annual 12-hour day traffic movements by ANCON type**

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
B717	0.038	0.049	+0.011	0.047	0.052	+0.005	0.085	0.101	+0.016
B727	0.003	0.000	-0.003	0.003	0.000	-0.003	0.005	0.000	-0.005
B732	0.000	0.027	+0.027	0.000	0.030	+0.030	0.000	0.058	+0.058
B733	2.359	1.997	-0.362	2.370	2.142	-0.227	4.729	4.140	-0.589
B736	7.671	6.797	-0.874	9.545	8.274	-1.271	17.216	15.071	-2.145
B738	8.466	9.178	+0.712	9.030	9.603	+0.573	17.496	18.781	+1.285
B744G	5.260	3.893	-1.367	4.805	3.945	-0.860	10.066	7.838	-2.227
B744P	0.364	0.660	+0.296	0.567	0.660	+0.093	0.932	1.321	+0.389
B744R	26.622	22.353	-4.268	21.279	17.984	-3.296	47.901	40.337	-7.564
B747	0.008	0.003	-0.005	0.003	0.003	0.000	0.011	0.005	-0.005
B747SP	0.011	0.011	0.000	0.008	0.008	0.000	0.019	0.019	0.000
B748	0.000	0.025	+0.025	0.047	0.055	+0.008	0.047	0.079	+0.033
B753	0.052	0.227	+0.175	0.052	0.230	+0.178	0.104	0.458	+0.353
B757C	0.011	0.005	-0.005	0.203	0.142	-0.060	0.214	0.148	-0.066
B757E	3.764	4.063	+0.299	2.288	2.132	-0.156	6.052	6.195	+0.142
B757P	0.008	0.603	+0.595	0.005	0.189	+0.184	0.014	0.792	+0.778
B762	0.014	0.044	+0.030	0.121	0.049	-0.071	0.134	0.093	-0.041
B763G	8.912	9.444	+0.532	5.970	6.644	+0.674	14.882	16.088	+1.205
B763P	9.523	8.992	-0.532	6.455	5.526	-0.929	15.978	14.518	-1.460
B763R	14.989	13.310	-1.679	12.482	10.167	-2.315	27.471	23.477	-3.995
B764	4.937	3.970	-0.967	3.715	3.797	+0.082	8.652	7.767	-0.885
B772G	14.134	14.093	-0.041	12.019	12.312	+0.293	26.153	26.405	+0.252
B772P	4.321	4.211	-0.110	4.167	4.137	-0.030	8.488	8.348	-0.140
B772R	14.890	13.542	-1.348	15.682	14.156	-1.526	30.573	27.699	-2.874
B773G	26.584	26.485	-0.099	31.603	30.819	-0.784	58.186	57.304	-0.882
B773R	0.000	0.000	0.000	0.000	0.003	+0.003	0.000	0.003	+0.003
B788	8.534	11.677	+3.142	9.181	13.299	+4.118	17.715	24.975	+7.260
B789	0.129	3.162	+3.033	0.126	3.573	+3.447	0.255	6.734	+6.479
BA46	0.737	0.868	+0.132	0.745	0.923	+0.178	1.482	1.792	+0.310
CRJ	0.000	0.011	+0.011	0.000	0.014	+0.014	0.000	0.025	+0.025
CRJ900	0.638	0.951	+0.312	0.682	0.967	+0.285	1.321	1.918	+0.597
EA30	1.178	1.173	-0.005	1.159	1.101	-0.058	2.337	2.274	-0.063

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
EA31	0.145	0.173	+0.027	0.252	0.247	-0.005	0.397	0.419	+0.022
EA318	0.967	1.005	+0.038	0.978	1.005	+0.027	1.945	2.011	+0.066
EA319C	21.055	19.849	-1.205	21.458	20.644	-0.814	42.512	40.493	-2.019
EA319V	79.197	69.526	-9.671	72.145	63.784	-8.362	151.342	133.310	-18.033
EA320C	48.721	45.693	-3.027	49.995	47.655	-2.340	98.715	93.348	-5.367
EA320V	92.553	104.181	+11.627	83.063	92.877	+9.814	175.616	197.058	+21.441
EA321C	10.603	8.542	-2.060	12.630	10.129	-2.501	23.233	18.671	-4.562
EA321V	33.827	37.647	+3.819	29.479	31.416	+1.937	63.307	69.063	+5.756
EA33	13.937	15.521	+1.584	16.523	16.677	+0.153	30.460	32.197	+1.737
EA34	2.556	0.814	-1.742	3.019	1.071	-1.948	5.575	1.885	-3.690
EA346	4.948	5.167	+0.219	7.140	6.321	-0.819	12.088	11.488	-0.600
EA35	0.000	0.016	+0.016	0.000	0.079	+0.079	0.000	0.096	+0.096
EA38GP	3.214	5.381	+2.167	3.537	5.879	+2.342	6.751	11.260	+4.510
EA38R	4.545	7.279	+2.734	4.636	6.071	+1.436	9.181	13.351	+4.170
ERJ	0.016	0.030	+0.014	0.027	0.027	0.000	0.044	0.058	+0.014
ERJ170	0.011	0.430	+0.419	0.011	0.011	0.000	0.022	0.441	+0.419
ERJ190	1.633	2.118	+0.485	1.844	2.688	+0.844	3.477	4.805	+1.329
EXE2	0.000	0.003	+0.003	0.000	0.003	+0.003	0.000	0.005	+0.005
EXE3	0.334	0.310	-0.025	0.340	0.277	-0.063	0.674	0.586	-0.088
FK10	1.652	1.499	-0.153	2.814	2.436	-0.378	4.466	3.934	-0.532
L4P	0.005	0.003	-0.003	0.003	0.003	0.000	0.008	0.005	-0.003
LTT	0.005	0.063	+0.058	0.005	0.063	+0.058	0.011	0.126	+0.115
MD80	0.000	0.003	+0.003	0.000	0.003	+0.003	0.000	0.005	+0.005
STT	0.005	0.005	0.000	0.003	0.003	0.000	0.008	0.008	0.000
	484.090	<b>487.082</b>	<b>+2.992</b>	464.260	<b>462.304</b>	<b>-1.956</b>	948.351	<b>949.386</b>	<b>+1.036</b>
									<b>(+0.11%)</b>

Note: Changes and totals have been calculated *before* rounding.



**Table C2 Heathrow 2014 & 2015 annual 4-hour evening traffic movements by ANCON type**

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
B717	0.011	0.000	-0.011	0.003	0.000	-0.003	0.014	0.000	-0.014
B732	0.000	0.003	+0.003	0.000	0.000	0.000	0.000	0.003	+0.003
B733	0.255	0.279	+0.025	0.732	0.573	-0.159	0.986	0.852	-0.134
B736	3.690	3.175	-0.515	1.899	1.808	-0.090	5.589	4.984	-0.605
B738	2.093	2.427	+0.334	2.301	2.756	+0.455	4.395	5.184	+0.789
B744G	0.307	0.715	+0.408	0.096	0.290	+0.195	0.403	1.005	+0.603
B744P	0.386	0.378	-0.008	0.258	0.249	-0.008	0.644	0.627	-0.016
B744R	6.205	6.011	-0.195	1.099	1.230	+0.132	7.304	7.241	-0.063
B747	0.008	0.000	-0.008	0.008	0.000	-0.008	0.016	0.000	-0.016
B747SP	0.000	0.000	0.000	0.003	0.005	+0.003	0.003	0.005	+0.003
B748	0.063	0.038	-0.025	0.041	0.011	-0.030	0.104	0.049	-0.055
B753	0.047	0.025	-0.022	0.047	0.027	-0.019	0.093	0.052	-0.041
B757C	0.310	0.219	-0.090	0.425	0.356	-0.068	0.734	0.575	-0.159
B757E	1.195	1.112	-0.082	2.079	2.668	+0.589	3.274	3.781	+0.507
B757P	0.178	0.121	-0.058	0.192	0.126	-0.066	0.370	0.247	-0.123
B762	0.107	0.005	-0.101	0.033	0.000	-0.033	0.140	0.005	-0.134
B763G	0.589	0.137	-0.452	1.995	1.647	-0.348	2.584	1.784	-0.800
B763P	0.216	0.181	-0.036	1.011	1.052	+0.041	1.227	1.233	+0.005
B763R	2.841	1.600	-1.241	5.573	5.142	-0.430	8.414	6.742	-1.671
B764	0.027	0.016	-0.011	0.036	0.022	-0.014	0.063	0.038	-0.025
B772G	4.562	4.868	+0.307	1.666	1.038	-0.627	6.227	5.907	-0.321
B772P	1.047	1.047	0.000	0.104	0.134	+0.030	1.151	1.181	+0.030
B772R	3.805	3.685	-0.121	0.836	0.811	-0.025	4.641	4.496	-0.145
B773G	15.230	15.658	+0.427	2.767	3.178	+0.411	17.997	18.836	+0.838
B773R	0.000	0.003	+0.003	0.000	0.000	0.000	0.000	0.003	+0.003
B788	2.044	4.512	+2.468	0.074	0.882	+0.808	2.118	5.395	+3.277
B789	0.003	1.553	+1.551	0.003	0.164	+0.162	0.005	1.718	+1.712
BA46	0.066	0.099	+0.033	0.060	0.055	-0.005	0.126	0.153	+0.027
CRJ900	0.063	0.022	-0.041	0.019	0.003	-0.016	0.082	0.025	-0.058
EA30	0.321	0.334	+0.014	0.978	1.063	+0.085	1.299	1.397	+0.099
EA31	0.110	0.088	-0.022	0.008	0.016	+0.008	0.118	0.104	-0.014
EA318	0.014	0.014	0.000	0.011	0.022	+0.011	0.025	0.036	+0.011

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
EA319C	6.408	6.244	-0.164	7.310	6.373	-0.937	13.718	12.616	-1.101
EA319V	17.438	16.523	-0.915	24.222	21.989	-2.233	41.660	38.512	-3.148
EA320C	15.975	15.526	-0.449	17.192	16.233	-0.959	33.167	31.759	-1.408
EA320V	19.696	22.458	+2.762	30.181	35.233	+5.052	49.877	57.690	+7.814
EA321C	3.499	3.099	-0.400	2.499	2.427	-0.071	5.997	5.526	-0.471
EA321V	7.241	7.411	+0.170	12.485	13.444	+0.959	19.726	20.855	+1.129
EA33	9.507	8.466	-1.041	3.773	3.616	-0.156	13.279	12.082	-1.197
EA34	1.370	1.137	-0.233	0.249	0.236	-0.014	1.619	1.373	-0.247
EA346	6.129	4.395	-1.734	1.408	1.430	+0.022	7.537	5.825	-1.712
EA35	0.000	0.063	+0.063	0.000	0.000	0.000	0.000	0.063	+0.063
EA38GP	1.833	2.397	+0.564	1.148	1.192	+0.044	2.981	3.589	+0.608
EA38R	4.734	4.658	-0.077	0.162	0.055	-0.107	4.896	4.712	-0.184
ERJ	0.016	0.014	-0.003	0.011	0.016	+0.005	0.027	0.030	+0.003
ERJ170	0.000	0.005	+0.005	0.005	0.427	+0.422	0.005	0.433	+0.427
ERJ190	0.364	0.912	+0.548	0.332	0.532	+0.200	0.696	1.444	+0.748
EXE3	0.107	0.090	-0.016	0.090	0.096	+0.005	0.197	0.186	-0.011
FK10	1.712	1.564	-0.148	0.556	0.633	+0.077	2.268	2.197	-0.071
L4P	0.000	0.003	+0.003	0.000	0.000	0.000	0.000	0.003	+0.003
LTT	0.011	0.003	-0.008	0.008	0.003	-0.005	0.019	0.005	-0.014
MD80	0.016	0.000	-0.016	0.019	0.000	-0.019	0.036	0.000	-0.036
STP	0.000	0.000	0.000	0.000	0.003	+0.003	0.000	0.003	+0.003
STT	0.003	0.000	-0.003	0.014	0.003	-0.011	0.016	0.003	-0.014
<b>Total</b>	<b>141.852</b>	<b>143.293</b>	<b>+1.441</b>	<b>126.016</b>	<b>129.271</b>	<b>+3.255</b>	<b>267.868</b>	<b>272.564</b>	<b>+4.696</b>
									<b>(+1.75%)</b>

Note: Changes and totals have been calculated *before* rounding.



**Table C3 Heathrow 2014 & 2015 annual 8-hour night traffic movements by ANCON type**

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
B733	0.504	0.433	-0.071	0.022	0.003	-0.019	0.526	0.436	-0.090
B736	0.052	0.088	+0.036	0.000	0.000	0.000	0.052	0.088	+0.036
B738	0.740	0.742	+0.003	0.003	0.016	+0.014	0.742	0.759	+0.016
B744G	0.030	0.014	-0.016	0.740	0.384	-0.356	0.770	0.397	-0.373
B744P	0.129	0.123	-0.005	0.058	0.252	+0.195	0.186	0.375	+0.189
B744R	0.712	0.847	+0.134	11.408	10.090	-1.318	12.121	10.937	-1.184
B747	0.000	0.000	0.000	0.005	0.000	-0.005	0.005	0.000	-0.005
B748	0.025	0.005	-0.019	0.000	0.003	+0.003	0.025	0.008	-0.016
B753	0.000	0.005	+0.005	0.000	0.000	0.000	0.000	0.005	+0.005
B757C	0.307	0.274	-0.033	0.000	0.000	0.000	0.307	0.274	-0.033
B757E	0.044	0.044	0.000	0.636	0.422	-0.214	0.679	0.466	-0.214
B757P	0.008	0.000	-0.008	0.000	0.416	+0.416	0.008	0.416	+0.408
B762	0.033	0.000	-0.033	0.000	0.000	0.000	0.033	0.000	-0.033
B763G	0.063	0.008	-0.055	1.668	1.329	-0.340	1.732	1.337	-0.395
B763P	0.063	0.027	-0.036	2.408	2.625	+0.216	2.471	2.652	+0.181
B763R	1.230	0.874	-0.356	1.066	0.466	-0.600	2.296	1.340	-0.956
B764	0.000	0.000	0.000	1.290	0.200	-1.090	1.290	0.200	-1.090
B772G	1.115	0.704	-0.411	6.279	6.334	+0.055	7.395	7.038	-0.356
B772P	0.014	0.003	-0.011	1.134	0.992	-0.142	1.148	0.995	-0.153
B772R	0.707	0.770	+0.063	3.022	3.055	+0.033	3.729	3.825	+0.096
B773G	0.463	0.559	+0.096	8.085	8.816	+0.732	8.548	9.375	+0.827
B788	0.403	0.436	+0.033	1.748	2.460	+0.712	2.151	2.896	+0.745
B789	0.000	0.115	+0.115	0.003	1.151	+1.148	0.003	1.266	+1.263
BA46	0.005	0.003	-0.003	0.003	0.000	-0.003	0.008	0.003	-0.005
CRJ	0.000	0.003	+0.003	0.000	0.000	0.000	0.000	0.003	+0.003
CRJ900	0.000	0.000	0.000	0.000	0.003	+0.003	0.000	0.003	+0.003
EA30	0.625	0.660	+0.036	0.003	0.008	+0.005	0.627	0.668	+0.041
EA318	0.005	0.008	+0.003	0.000	0.000	0.000	0.005	0.008	+0.003
EA319C	1.784	1.430	-0.353	0.562	0.534	-0.027	2.345	1.964	-0.381
EA319V	1.693	0.825	-0.868	2.005	1.175	-0.830	3.699	2.000	-1.699
EA320C	2.830	3.027	+0.197	0.510	0.466	-0.044	3.340	3.493	+0.153
EA320V	1.666	2.359	+0.693	0.893	1.000	+0.107	2.559	3.359	+0.800

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
EA321C	1.063	1.008	-0.055	0.058	0.101	+0.044	1.121	1.110	-0.011
EA321V	1.321	0.800	-0.521	0.523	1.019	+0.496	1.844	1.819	-0.025
EA33	0.696	0.619	-0.077	3.923	4.364	+0.441	4.619	4.984	+0.364
EA34	0.041	0.049	+0.008	0.732	0.693	-0.038	0.773	0.742	-0.030
EA346	0.362	0.699	+0.337	2.942	2.537	-0.405	3.304	3.236	-0.068
EA38GP	0.162	0.142	-0.019	0.526	0.860	+0.334	0.688	1.003	+0.315
EA38R	0.296	0.145	-0.151	4.800	5.975	+1.175	5.096	6.121	+1.025
ERJ	0.005	0.008	+0.003	0.003	0.008	+0.005	0.008	0.016	+0.008
ERJ170	0.005	0.008	+0.003	0.000	0.000	0.000	0.005	0.008	+0.003
ERJ190	0.173	0.192	+0.019	0.000	0.008	+0.008	0.173	0.200	+0.027
EXE3	0.019	0.005	-0.014	0.027	0.041	+0.014	0.047	0.047	0.000
FK10	0.003	0.003	0.000	0.000	0.000	0.000	0.003	0.003	0.000
L4P	0.000	0.000	0.000	0.003	0.003	0.000	0.003	0.003	0.000
LTT	0.005	0.003	-0.003	0.008	0.003	-0.005	0.014	0.005	-0.008
MD80	0.003	0.000	-0.003	0.000	0.000	0.000	0.003	0.000	-0.003
STP	0.003	0.005	+0.003	0.003	0.005	+0.003	0.005	0.011	+0.005
STT	0.049	0.008	-0.041	0.044	0.005	-0.038	0.093	0.014	-0.079
<b>Total</b>	<b>19.455</b>	<b>18.082</b>	<b>-1.373</b>	<b>57.142</b>	<b>57.825</b>	<b>+0.682</b>	<b>76.597</b>	<b>75.907</b>	<b>-0.690</b>
									<b>(-0.90%)</b>

Note: Changes and totals have been calculated *before* rounding.

**Table C4 Heathrow 2014 & 2015 annual 24-hour day traffic movements by ANCON type**

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
B717	0.049	0.049	0.000	0.049	0.052	+0.003	0.099	0.101	+0.003
B727	0.003	0.000	-0.003	0.003	0.000	-0.003	0.005	0.000	-0.005
B732	0.000	0.030	+0.030	0.000	0.030	+0.030	0.000	0.060	+0.060
B733	3.118	2.710	-0.408	3.123	2.718	-0.405	6.241	5.427	-0.814
B736	11.414	10.060	-1.353	11.444	10.082	-1.362	22.858	20.142	-2.715
B738	11.299	12.348	+1.049	11.334	12.375	+1.041	22.633	24.723	+2.090
B744G	5.597	4.622	-0.975	5.641	4.619	-1.022	11.238	9.241	-1.997
B744P	0.879	1.162	+0.282	0.882	1.162	+0.279	1.762	2.323	+0.562
B744R	33.540	29.211	-4.329	33.786	29.304	-4.482	67.326	58.515	-8.811
B747	0.016	0.003	-0.014	0.016	0.003	-0.014	0.033	0.005	-0.027
B747SP	0.011	0.011	0.000	0.011	0.014	+0.003	0.022	0.025	+0.003
B748	0.088	0.068	-0.019	0.088	0.068	-0.019	0.175	0.137	-0.038
B753	0.099	0.258	+0.159	0.099	0.258	+0.159	0.197	0.515	+0.318
B757C	0.627	0.499	-0.129	0.627	0.499	-0.129	1.255	0.997	-0.258
B757E	5.003	5.219	+0.216	5.003	5.222	+0.219	10.005	10.441	+0.436
B757P	0.195	0.723	+0.529	0.197	0.732	+0.534	0.392	1.455	+1.063
B762	0.153	0.049	-0.104	0.153	0.049	-0.104	0.307	0.099	-0.208
B763G	9.564	9.589	+0.025	9.633	9.619	-0.014	19.197	19.208	+0.011
B763P	9.803	9.200	-0.603	9.874	9.203	-0.671	19.677	18.403	-1.274
B763R	19.060	15.784	-3.277	19.121	15.775	-3.345	38.181	31.559	-6.622
B764	4.964	3.986	-0.978	5.041	4.019	-1.022	10.005	8.005	-2.000
B772G	19.811	19.666	-0.145	19.964	19.685	-0.279	39.775	39.351	-0.425
B772P	5.381	5.260	-0.121	5.405	5.263	-0.142	10.786	10.523	-0.263
B772R	19.403	17.997	-1.405	19.540	18.022	-1.518	38.942	36.019	-2.923
B773G	42.277	42.701	+0.425	42.455	42.814	+0.359	84.732	85.515	+0.784
B773P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B773R	0.000	0.003	+0.003	0.000	0.003	+0.003	0.000	0.005	+0.005
B788	10.981	16.625	+5.644	11.003	16.641	+5.638	21.984	33.266	+11.282
B789	0.132	4.830	+4.699	0.132	4.888	+4.756	0.263	9.718	+9.455
BA46	0.808	0.970	+0.162	0.808	0.978	+0.170	1.616	1.948	+0.332
CRJ	0.000	0.014	+0.014	0.000	0.014	+0.014	0.000	0.027	+0.027
CRJ900	0.701	0.973	+0.271	0.701	0.973	+0.271	1.403	1.945	+0.542

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
EA30	2.123	2.167	+0.044	2.140	2.173	+0.033	4.263	4.340	+0.077
EA31	0.255	0.260	+0.005	0.260	0.263	+0.003	0.515	0.523	+0.008
EA318	0.986	1.027	+0.041	0.989	1.027	+0.038	1.975	2.055	+0.079
EA319C	29.247	27.523	-1.723	29.329	27.551	-1.778	58.575	55.074	-3.501
EA319V	98.329	86.874	-11.455	98.373	86.948	-11.425	196.701	173.822	-22.879
EA320C	67.526	64.247	-3.279	67.696	64.353	-3.342	135.222	128.600	-6.622
EA320V	113.915	128.997	+15.082	114.137	129.110	+14.973	228.052	258.107	+30.055
EA321C	15.164	12.649	-2.515	15.186	12.658	-2.529	30.351	25.307	-5.044
EA321V	42.389	45.858	+3.468	42.488	45.879	+3.392	84.877	91.737	+6.860
EA33	24.140	24.605	+0.466	24.219	24.658	+0.438	48.359	49.263	+0.904
EA34	3.967	2.000	-1.967	4.000	2.000	-2.000	7.967	4.000	-3.967
EA346	11.438	10.260	-1.178	11.490	10.288	-1.203	22.929	20.548	-2.381
EA35	0.000	0.079	+0.079	0.000	0.079	+0.079	0.000	0.159	+0.159
EA38GP	5.208	7.921	+2.712	5.211	7.932	+2.721	10.419	15.852	+5.433
EA38R	9.575	12.082	+2.507	9.597	12.101	+2.504	19.173	24.184	+5.011
ERJ	0.038	0.052	+0.014	0.041	0.052	+0.011	0.079	0.104	+0.025
ERJ170	0.016	0.444	+0.427	0.016	0.438	+0.422	0.033	0.882	+0.849
ERJ190	2.170	3.222	+1.052	2.175	3.227	+1.052	4.345	6.449	+2.104
EXE2	0.000	0.003	+0.003	0.000	0.003	+0.003	0.000	0.005	+0.005
EXE3	0.460	0.405	-0.055	0.458	0.414	-0.044	0.918	0.819	-0.099
FK10	3.367	3.066	-0.301	3.370	3.068	-0.301	6.737	6.134	-0.603
L4P	0.005	0.005	0.000	0.005	0.005	0.000	0.011	0.011	0.000
LTT	0.022	0.068	+0.047	0.022	0.068	+0.047	0.044	0.137	+0.093
MD11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD80	0.019	0.003	-0.016	0.019	0.003	-0.016	0.038	0.005	-0.033
STP	0.003	0.005	+0.003	0.003	0.008	+0.005	0.005	0.014	+0.008
STT	0.058	0.014	-0.044	0.060	0.011	-0.049	0.118	0.025	-0.093
	645.397	<b>648.458</b>	<b>+3.060</b>	647.419	<b>649.400</b>	<b>+1.981</b>	1292.816	<b>1297.858</b>	<b>+5.041</b>
									<b>(+0.39%)</b>

Note: Changes and totals have been calculated *before* rounding.

**Table C5 Heathrow 2014 & 2015 6.5-hour night traffic movements by ANCON type**

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
B733	0.005	0.000	-0.005	0.008	0.000	-0.008	0.014	0.000	-0.014
B736	0.000	0.003	+0.003	0.000	0.000	0.000	0.000	0.003	+0.003
B738	0.016	0.038	+0.022	0.000	0.005	+0.005	0.016	0.044	+0.027
B744G	0.008	0.003	-0.005	0.008	0.003	-0.005	0.016	0.005	-0.011
B744P	0.016	0.008	-0.008	0.000	0.003	+0.003	0.016	0.011	-0.005
B744R	0.162	0.126	-0.036	4.044	2.868	-1.176	4.206	2.995	-1.212
B748	0.000	0.003	+0.003	0.000	0.000	0.000	0.000	0.003	+0.003
B753	0.003	0.000	-0.003	0.000	0.000	0.000	0.003	0.000	-0.003
B757C	0.005	0.005	0.000	0.000	0.000	0.000	0.005	0.005	0.000
B757E	0.019	0.016	-0.003	0.113	0.047	-0.066	0.132	0.063	-0.069
B757P	0.003	0.000	-0.003	0.000	0.005	+0.005	0.003	0.005	+0.003
B763G	0.011	0.000	-0.011	0.063	0.030	-0.033	0.074	0.030	-0.044
B763P	0.003	0.005	+0.003	0.684	0.769	+0.085	0.687	0.775	+0.088
B763R	0.066	0.014	-0.052	0.071	0.069	-0.003	0.137	0.082	-0.055
B764	0.000	0.005	+0.005	0.016	0.003	-0.014	0.016	0.008	-0.008
B772G	0.159	0.077	-0.082	0.854	1.310	+0.456	1.014	1.387	+0.374
B772P	0.005	0.000	-0.005	0.077	0.071	-0.005	0.082	0.071	-0.011
B772R	0.118	0.080	-0.038	0.516	0.909	+0.393	0.635	0.989	+0.354
B773G	0.124	0.124	0.000	2.725	2.753	+0.027	2.849	2.876	+0.027
B788	0.047	0.055	+0.008	0.275	0.536	+0.261	0.321	0.591	+0.269
B789	0.000	0.019	+0.019	0.003	0.951	+0.948	0.003	0.970	+0.967
BA46	0.000	0.000	0.000	0.003	0.000	-0.003	0.003	0.000	-0.003
EA30	0.016	0.011	-0.005	0.000	0.000	0.000	0.016	0.011	-0.005
EA319C	0.011	0.000	-0.011	0.025	0.019	-0.005	0.036	0.019	-0.016
EA319V	0.044	0.038	-0.005	0.124	0.148	+0.025	0.168	0.187	+0.019
EA320C	0.066	0.047	-0.019	0.066	0.055	-0.011	0.132	0.102	-0.030
EA320V	0.049	0.082	+0.033	0.220	0.190	-0.030	0.269	0.272	+0.003
EA321C	0.016	0.014	-0.003	0.016	0.025	+0.008	0.033	0.038	+0.005
EA321V	0.154	0.044	-0.110	0.074	0.088	+0.014	0.228	0.132	-0.096
EA33	0.129	0.096	-0.033	0.071	0.132	+0.060	0.201	0.228	+0.027
EA34	0.022	0.014	-0.008	0.030	0.003	-0.027	0.052	0.016	-0.036
EA346	0.074	0.049	-0.025	0.953	0.283	-0.670	1.027	0.332	-0.695

ANCON type	2014 departs	2015 departs	Change departs	2014 arrivals	2015 arrivals	Change arrivals	2014 total	2015 total	Change total
EA38GP	0.019	0.025	+0.005	0.000	0.011	+0.011	0.019	0.036	+0.016
EA38R	0.060	0.052	-0.008	3.434	3.580	+0.146	3.495	3.632	+0.137
ERJ	0.011	0.000	-0.011	0.003	0.008	+0.005	0.014	0.008	-0.005
EXE3	0.008	0.000	-0.008	0.022	0.030	+0.008	0.030	0.030	0.000
FK10	0.003	0.000	-0.003	0.000	0.000	0.000	0.003	0.000	-0.003
LTT	0.005	0.003	-0.003	0.008	0.003	-0.005	0.014	0.005	-0.008
MD80	0.003	0.000	-0.003	0.000	0.000	0.000	0.003	0.000	-0.003
STP	0.005	0.000	-0.005	0.005	0.003	-0.003	0.011	0.003	-0.008
STT	0.016	0.003	-0.014	0.022	0.000	-0.022	0.038	0.003	-0.036
Total	1.486	<b>1.060</b>	<b>-0.426</b>	14.536	<b>14.909</b>	<b>+0.374</b>	16.022	<b>15.970</b>	<b>-0.052</b>
									<b>(-0.33%)</b>

Note: Changes and totals have been calculated *before* rounding.

**Table C6 Heathrow 2014 & 2015 L<sub>day</sub> cumulative contour area, population and household estimates**

L <sub>day</sub> (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
> 55	160.6	152.9	-5%	455.1	434.5	-5%	181.3	173.7	-4%
> 60	57.7	56.5	-2%	124.8	122.6	-2%	47.5	46.8	-1%
> 65	23.9	23.2	-3%	20.5	20.1	-2%	7.7	7.6	-1%
> 70	7.7	7.4	-4%	2.1	1.8	-14%	0.8	0.7	-13%
> 75	2.9	2.8	-3%	< 0.1	< 0.1	(n/a)	< 0.1	< 0.1	(n/a)

**Table C7 Heathrow 2014 & 2015 L<sub>evening</sub> cumulative contour area, population and household estimates**

L <sub>evening</sub> (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
> 55	142.3	135.0	-5%	367.5	356.1	-3%	145.0	141.0	-3%
> 60	50.8	49.7	-2%	96.3	95.2	-1%	36.6	36.2	-1%
> 65	21.1	20.6	-2%	12.4	12.8	+3%	4.7	4.9	+4%
> 70	6.9	6.7	-3%	0.8	0.8	0%	0.3	0.3	0%
> 75	2.7	2.6	-4%	0.0	0.0	(n/a)	0.0	0.0	(n/a)

**Table C8 Heathrow 2014 & 2015 L<sub>night</sub> cumulative contour area, population and household estimates**

L <sub>night</sub> (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
> 50	74.8	74.1	-1%	215.5	223.4	+4%	84.7	88.0	+4%
> 55	27.0	26.4	-2%	61.8	67.6	+9%	23.2	25.4	+9%
> 60	8.9	8.6	-3%	12.1	12.6	+4%	4.5	4.6	+2%
> 65	3.1	3.0	-3%	1.1	1.3	+18%	0.4	0.5	+25%
> 70	1.4	1.4	0%	0.0	0.0	(n/a)	0.0	0.0	(n/a)

Note: Areas are given in km<sup>2</sup>, and populations and households in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.

**Table C9 Heathrow 2014 & 2015  $L_{den}$  cumulative contour area, population and household estimates**

$L_{den}$ (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
> 55	210.7	200.0	-5%	704.3	695.4	-1%	288.3	285.9	-1%
> 60	77.7	76.5	-2%	199.5	202.7	+2%	77.6	79.0	+2%
> 65	30.6	29.8	-3%	47.4	47.7	+1%	17.9	18.1	+1%
> 70	10.2	9.8	-4%	5.2	5.3	+2%	2.0	2.0	0%
> 75	3.7	3.5	-5%	0.2	0.1	-50%	0.1	< 0.1	(n/a)

**Table C10 Heathrow 2014 & 2015  $L_{eq,6.5hr\ night}$  cumulative contour area, population and household estimates**

$L_{eq,6.5hr\ night}$ (dBA)	2014 area	2015 area	Change in area	2014 pop	2015 pop	Change in pop	2014 house	2015 house	Change in house
> 48	36.3	33.0	-9%	107.5	105.5	-2%	41.5	40.3	-3%

Note: Areas are given in km<sup>2</sup>, and populations and households in thousands. The 2014 and 2015 population/household counts are based on 2014 and 2015 CACI updates of the 2011 Census respectively.



**Table C11 Heathrow 2006 & 2015 L<sub>day</sub> cumulative contour area, population and household estimates**

L <sub>day</sub> (dBA)	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 55	177.7	152.9	-14%	485.6	434.5 (372.5)	-11% (-23%)	210.5	173.7 (159.8)	-17% (-24%)
> 60	64.0	56.5	-12%	111.0	122.6 (95.2)	+10% (-14%)	44.9	46.8 (38.2)	+4% (-15%)
> 65	27.2	23.2	-15%	24.1	20.1 (16.7)	-17% (-31%)	9.2	7.6 (6.4)	-17% (-30%)
> 70	9.3	7.4	-20%	2.8	1.8 (1.5)	-36% (-46%)	1.0	0.7 (0.6)	-30% (-40%)
> 75	3.5	2.8	-20%	< 0.1	< 0.1 (< 0.1)	(n/a) (n/a)	< 0.1	< 0.1 (< 0.1)	(n/a) (n/a)

**Table C12 Heathrow 2006 & 2015 L<sub>evening</sub> cumulative contour area, population and household estimates**

L <sub>evening</sub> (dBA)	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 55	185.6	135.0	-27%	450.5	356.1 (301.0)	-21% (-33%)	192.6	141.0 (126.9)	-27% (-34%)
> 60	66.1	49.7	-25%	106.3	95.2 (75.0)	-10% (-29%)	42.4	36.2 (29.7)	-15% (-30%)
> 65	28.1	20.6	-27%	20.5	12.8 (11.5)	-38% (-44%)	7.9	4.9 (4.4)	-38% (-44%)
> 70	10.0	6.7	-33%	2.4	0.8 (0.6)	-67% (-75%)	1.0	0.3 (0.3)	-70% (-70%)
> 75	3.8	2.6	-32%	< 0.1	0.0 (0.0)	(n/a) (n/a)	< 0.1	0.0 (0.0)	(n/a) (n/a)

Notes:

- Areas are given in km<sup>2</sup>, and populations and households in thousands.
- The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census.
- The 2015 population/household counts are based on a 2015 CACI update of the 2011 Census. Estimates for 2015 using the 2006 population database are shown in blue.

**Table C13 Heathrow 2006 & 2015  $L_{night}$  cumulative contour area, population and household estimates**

$L_{night}$ (dBA)	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 50	84.4	74.1	-12%	207.2	223.4 (184.1)	+8% (-11%)	88.9	88.0 (78.3)	-1% (-12%)
> 55	34.2	26.4	-23%	62.0	67.6 (52.2)	+9% (-16%)	24.1	25.4 (20.3)	+5% (-16%)
> 60	11.9	8.6	-28%	16.3	12.6 (10.6)	-23% (-35%)	6.0	4.6 (3.7)	-23% (-38%)
> 65	4.5	3.0	-33%	1.7	1.3 (1.1)	-24% (-35%)	0.6	0.5 (0.4)	-17% (-33%)
> 70	1.8	1.4	-22%	< 0.1	0.0 (0.0)	(n/a) (n/a)	< 0.1	0.0 (0.0)	(n/a) (n/a)

**Table C14 Heathrow 2006 & 2015  $L_{den}$  cumulative contour area, population and household estimates**

$L_{den}$ (dBA)	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 55	244.7	200.0	-18%	756.1	695.4 (611.1)	-8% (-19%)	338.5	285.9 (273.3)	-16% (-19%)
> 60	92.7	76.5	-17%	194.6	202.7 (163.7)	+4% (-16%)	81.6	79.0 (68.7)	-3% (-16%)
> 65	37.1	29.8	-20%	54.3	47.7 (36.8)	-12% (-32%)	21.4	18.1 (14.4)	-15% (-33%)
> 70	13.7	9.8	-28%	9.6	5.3 (4.4)	-45% (-54%)	3.5	2.0 (1.6)	-43% (-54%)
> 75	5.0	3.5	-30%	0.7	0.1 (0.1)	-86% (-86%)	0.3	< 0.1 (< 0.1)	(n/a) (n/a)

## Notes:

- Areas are given in km<sup>2</sup>, and populations and households in thousands.
- The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census.
- The 2015 population/household counts are based on a 2015 CACI update of the 2011 Census. Estimates for 2015 using the 2006 population database are shown in blue.

**Table C15 Heathrow 2006 & 2015  $L_{eq,6.5hr\ night}$  cumulative contour area, population and household estimates**

$L_{eq,6.5hr\ night}$ (dBA)	2006 area	2015 area	Change in area	2006 pop	2015 pop	Change in pop	2006 house	2015 house	Change in house
> 48	56.4	33.0	-41%	137.4	105.5 (81.2)	-23% (-41%)	57.5	40.3 (32.5)	-30% (-43%)

Notes:

- Areas are given in km<sup>2</sup>, and populations and households in thousands.
- The 2006 population/household counts are based on a 2006 CACI update of the 2001 Census.
- The 2015 population/household counts are based on a 2015 CACI update of the 2011 Census. Estimates for 2015 using the 2006 population database are shown in blue.
- The 2006 results were based on data recorded over the 2006 calendar year. The 2015 results were based on data recorded from 29 March 2015 to 27 March 2016.

**Table C16 Heathrow 2015 cumulative contour areas and populations assuming 2006 modal splits and 2006 population database**

Scenario	Modal split year (W/E % split)	Population database year	Area (km <sup>2</sup> )	Population (thousands)
<b>L<sub>day</sub></b>				
2015 L <sub>day</sub> 55 dBA	2015 (72/28)	2015	152.9	434.5
2015 L <sub>day</sub> 55 dBA	2006 (70/30)	2015	152.6 (0%)	430.9 (-1%)
2015 L <sub>day</sub> 55 dBA	2006 (70/30)	2006	152.6	367.6
2006 L <sub>day</sub> 55 dBA	2006 (70/30)	2006	177.7	485.6
<b>L<sub>evening</sub></b>				
2015 L <sub>evening</sub> 55 dBA	2015 (72/28)	2015	135.0	356.1
2015 L <sub>evening</sub> 55 dBA	2006 (71/29)	2015	134.8 (0%)	356.3 (0%)
2015 L <sub>evening</sub> 55 dBA	2006 (71/29)	2006	134.8	300.9
2006 L <sub>evening</sub> 55 dBA	2006 (71/29)	2006	185.6	450.5
<b>L<sub>night</sub></b>				
2015 L <sub>night</sub> 50 dBA	2015 (72/28)	2015	74.1	223.4
2015 L <sub>night</sub> 50 dBA	2006 (72/28)	2015	74.3 (0%)	220.4 (-1%)
2015 L <sub>night</sub> 50 dBA	2006 (72/28)	2006	74.3	182.6
2006 L <sub>night</sub> 50 dBA	2006 (72/28)	2006	84.4	207.2
<b>L<sub>den</sub></b>				
2015 L <sub>den</sub> 55 dBA	2015 (72/28)	2015	200.0	695.4
2015 L <sub>den</sub> 55 dBA	2006 (70/30)	2015	200.4 (0%)	685.2 (-1%)
2015 L <sub>den</sub> 55 dBA	2006 (70/30)	2006	200.4	603.0
2006 L <sub>den</sub> 55 dBA	2006 (70/30)	2006	244.7	756.1
<b>L<sub>eq,6.5hr night</sub></b>				
2015 L <sub>eq,6.5hr night</sub> 48 dBA	2015 (72/28)	2015	33.0	105.5
2015 L <sub>eq,6.5hr night</sub> 48 dBA	2006 (73/27)	2015	33.1 (0%)	105.5 (0%)
2015 L <sub>eq,6.5hr night</sub> 48 dBA	2006 (73/27)	2006	33.1	81.0
2006 L <sub>eq,6.5hr night</sub> 48 dBA	2006 (73/27)	2006	56.4	137.4

**Explanatory notes:**

The table above shows the following information for the outermost cumulative contour of each noise metric:  
 1<sup>st</sup> row - 2015 area and population for the actual 2015 modal split and using the 2015 population database;  
 2<sup>nd</sup> row - the effect on the above area and population if the 2006 modal split is assumed;  
 3<sup>rd</sup> row - the effect on the population if the 2006 population database is also now assumed;  
 4<sup>th</sup> row - 2006 area and population with the actual 2006 modal split and the 2006 population database, for reference.

Area and population percentage changes (shown in brackets) in the 2<sup>nd</sup> row are relative to the 1<sup>st</sup> row figures. Changes in the modelling parameter relative to the row above are shaded in blue.

**APPENDIX D**

**ANCON type descriptions**

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**Table D1 ANCON type descriptions**

ANCON type	Description
B717	Boeing 717
B727	Boeing 727 (Chapter 2&3)
B732	Boeing 737-200 (Chapter 2&3)
B733	Boeing 737-300/400/500
B736	Boeing 737-600/700
B738	Boeing 737-800/900
B747	Boeing 747-100 & 200/300 series (certificated to Chapter 3)
B744G	Boeing 747-400 with General Electric CF6-80F engines
B744P	Boeing 747-400 with Pratt & Whitney PW4000 engines
B744R	Boeing 747-400 with Rolls-Royce RB211 engines
B747SP	Boeing 747SP
B753	Boeing 757-300
B757C	Boeing 757-200 with Rolls-Royce RB211-535C engines
B757E	Boeing 757-200 with Rolls-Royce RB211-535E4/E4B engines
B757P	Boeing 757-200 with Pratt & Whitney PW2037/2040 engines
B762	Boeing 767-200
B763G	Boeing 767-300 with General Electric CF6-80 engines
B763P	Boeing 767-300 with Pratt & Whitney PW4000 engines
B763R	Boeing 767-300 with Rolls-Royce RB211 engines
B764	Boeing 767-400
B772G	Boeing 777-200 with General Electric GE90 engines
B772P	Boeing 777-200 with Pratt & Whitney PW4000 engines
B772R	Boeing 777-200 with Rolls-Royce Trent 800 engines
B773G	Boeing 777-200LR/300ER with General Electric GE90 engines
B773P	Boeing 777-300 with Pratt & Whitney PW4000 engines
B773R	Boeing 777-300 with Rolls-Royce Trent 800 engines
B788	Boeing 787-8
B789	Boeing 787-9
BA46	BAe 146/Avro RJ series
CRJ	Bombardier CRJ100/200 series
CRJ700	Bombardier CRJ700 series
CRJ900	Bombardier CRJ900 series
DC87	McDonnell Douglas DC-8-70 series

ANCON type	Description
DC10	McDonnell Douglas DC-10
EA30	Airbus A300
EA31	Airbus A310
EA318	Airbus A318
EA319C	Airbus A319 with CFM56 engines
EA319V	Airbus A319 with IAE V2500 engines
EA320C	Airbus A320 with CFM56 engines
EA320V	Airbus A320 with IAE V2500 engines
EA321C	Airbus A321 with CFM56 engines
EA321V	Airbus A321 with IAE V2500 engines
EA33	Airbus A330
EA34	Airbus A340-200/300
EA346	Airbus A340-500/600
EA359	Airbus A350-900
EA38GP	Airbus A380 with Engine Alliance GP7000 engines
EA38R	Airbus A380 with Rolls-Royce Trent 900 engines
ERJ	Embraer ERJ 135/145
ERJ170	Embraer E-170/175
ERJ190	Embraer E-190/195
EXE2	Chapter 2 executive jets
EXE3	Chapter 3 executive jets
FK10	Fokker 70/100
L101	Lockheed L-1011 TriStar
L4P	Large four-engine propeller
LTT	Large twin-turboprop
MD11	McDonnell Douglas MD-11
MD80	McDonnell Douglas MD-80 series
SP	Single piston
STP	Small twin-piston
STT	Small twin-turboprop
TU54	Tupolev Tu-154

# Glossary

Glossary	
ANCON	The UK civil aircraft noise contour model, developed and maintained by ERCD.
CAA	Civil Aviation Authority
dB	Decibel units describing sound level or changes of sound level.
dBA	Units of sound level on the A-weighted scale, which incorporates a frequency weighting approximating the characteristics of human hearing.
DfT	Department for Transport (UK Government)
END	Environmental Noise Directive
ERCD	Environmental Research and Consultancy Department
ICAO	International Civil Aviation Organization
$L_{day}$	Equivalent sound level of aircraft noise in dBA for the annual average 12-hour day period (0700-1900 local time).
$L_{den}$	Equivalent sound level of aircraft noise in dBA for the annual average 24-hour period with 5 dB weightings for $L_{evening}$ and 10 dB weightings for $L_{night}$ .
$L_{eq}$	Equivalent sound level of aircraft noise in dBA, often called 'equivalent continuous sound level'.
$L_{eq,6.5hr\ night}$	Equivalent sound level of aircraft noise in dBA for the average 6.5-hour night quota period (2330-0600 local time).
$L_{evening}$	Equivalent sound level of aircraft noise in dBA for the annual average 4-hour evening period (1900-2300 local time).
$L_{max}$	Maximum sound level of a noise event.
$L_{night}$	Equivalent sound level of aircraft noise in dBA for the annual average 8-hour night period (2300-0700 local time).
N60/N65/N70	Number of aircraft noise events exceeding a maximum sound level of 60/65/70 dBA.
NTK	Noise and Track Keeping monitoring system.