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Environmental Research and Consultancy Department
Directorate of Airspace Policy
Civil Aviation Authority

ERCD Report 0801

Noise Exposure Contours for Heathrow Airport 2007

D J Monkman
J Deeley
D Beaton
J McMahon
L E Edmonds

Prepared by the Civil Aviation Authority on behalf of the Department for Transport, London, July 2008

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ERCD REPORT 0801

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SUMMARY

This report describes the calculations of the aircraft noise exposure around London Heathrow Airport for the year 2007 and compares both the input data and the resulting contours, together with the areas and populations within the contours, with those for 2006.

Prepared by the CAA on behalf of the Department for Transport, July 2008

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EXECUTIVE SUMMARY

For every year, the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority estimates the noise exposures around the London Airports (Heathrow, Gatwick and Stansted) on behalf of the Department for Transport (DfT). The magnitude and extent of the aircraft noise around these airports are depicted on maps by *contours* of constant aircraft noise index (Leq) values. The contours are generated by a computer model validated with noise measurements, which calculates the emissions and propagation of noise from arriving and departing air traffic.

This report presents the results for London Heathrow Airport for the year 2007 and compares both the air traffic information and the noise contours with those for 2006. As for 2006, the 2007 contours shown in this report take into account the topography around Heathrow by accounting for terrain height in the modelling process.

Estimates of the populations within the 2006 contours are based on the 2001 census (updated by CACI in 2005), populations within the 2007 contours are also based on the 2001 census but updated by CACI in 2006.

The average daily aircraft movement rate during the Leq period was 0.8% higher in 2007 than in 2006. The actual modal split of runway direction in 2007 was 87% west - 13% east compared with 70% west – 30% east in 2006. The standard modal split (20 year average) in 2007 was 76% west – 24% east which remained unchanged from 2006.

Relative to 2006, the total area within the **actual** 2007 terrain adjusted 57 dBA Leq (16-hour) contour increased from 117.4 square kilometres to 119.6 square kilometres, an increase of 1.9% and the population within this contour decreased from 258,000 to 251,900, a decrease of 2.4%. However, the area within the **standard** 2007 terrain adjusted 57 dBA Leq (16-hour) contour decreased from 118.7 square kilometres to 116.3 square kilometres, a decrease of 2.0% and the population within this contour decreased from 259,000 to 251,600, a decrease of 2.9%.

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CONTENTS **Page No**

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1 INTRODUCTION

1.1 The amount of aircraft noise experienced by people living around London (Heathrow) Airport during the summer (mid June – mid September) of each year is estimated by the Environmental Research and Consultancy Department of the Civil Aviation Authority on behalf of the Department for Transport (DfT). The noise exposure measure is the Equivalent Continuous Sound Level, Leq (16-hour) in dBA. The background to the use of this index is explained in DORA Report 9023 (Ref 1). The method by which noise maps, or contours of Leq, are prepared using the ANCON Noise Model is described in DORA Report 9120, R&D Report 9842 and ERCD Report 0606[1] (Refs 2, 3 and 4).

1.2 This report contains small scale (1:200,000) diagrams of the 2007 Heathrow Leq contours. Contours overlaid on Ordnance Survey (OS) digital maps, or in AutoCAD DXF format, are available for download from the Department for Transport website at www.dft.gov.uk. Additionally, printed contours overlaid on OS maps to scale 1:50,000 are available for purchase from the Department for Transport, Aviation Environmental Division, Zone 1/22, Great Minster House, 76 Marsham Street, London, SW1P 4DR, telephone 020 7944 4856, e-mail address aed@dft.gsi.gov.uk.

1.3 This report provides supporting information and compares both the aircraft operations and the resulting noise contours with those for 2006 (Ref 5).

1.4 New analyses of radar and noise data were undertaken in 2007, and the calculations incorporate revised mean tracks and associated dispersions for departing aircraft, together with revised 'spurs' to model the arrival flight track dispersion. Height/speed departure and arrival profiles have also been updated for each aircraft type where the data have shown this to be necessary.

1.5 To remove the effect of year-on-year weather fluctuations on aircraft operations in order to clarify underlying trends, two sets of contours for 2007 have been generated; (i) the '*actual*' modal split and (ii) the '*standard*' modal split. In 2007 the actual modal split (for the summer period 16 June to 15 September inclusive) was 87% west - 13% east compared to 70% west - 30% east in 2006. For 2006 the standard modal split was 76% west - 24% east (based on the 20 year Leq period average 1987 to 2006 inclusive); for 2007 the standard modal split was also 76% west - 24% east (based on the 20 year Leq period average 1988 to 2007 inclusive). This report compares actual and standard contours for 2006 and 2007.

1.6 As in 2006, the 2007 contours shown in this report take into account the topography around Heathrow by accounting for terrain height in the modelling process. This was achieved by geometrical corrections for source-receiver distance and elevation angles, other more complex effects such as lateral attenuation from uneven ground surfaces and noise screening/reflection effects due to topographical features were not taken into account. ERCD holds terrain height data[2] obtained from Ordnance Survey on a 200m by 200m grid for England and Wales. Interpolation was performed to generate height data at each of the calculation points on the 100m by 100m receiver grid for use by the ANCON noise model.

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[1] ERCD Report 0606 will be published shortly.

[2] Meridian® 2 data revised 2007.

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2 AIRCRAFT OPERATIONS

2.1 Flight Tracks

2.1.1 The 2007 calculations were based on updated mean tracks and track dispersions for all outbound routes from Runways 27L, 27R and 09R (see Figure 1 for route designations). These were determined from radar data extracted from the airport's Noise and Track Keeping (NTK) monitoring system for the summer of 2007. There were insufficient departures from Runway 09L in 2007 to define statistically adequate tracks and dispersions (0.04% of the total easterly departures), so the 09L mean departure tracks/dispersions from 2005 were used for the 2006 and 2007 modelling.

2.1.2 Radar measurements of arrival tracks between the stacks and Runways 27L, 27R, 09L and 09R confirmed that the continued use of evenly spaced 'spurs' remained a realistic method for modelling the dispersion of arrival tracks about the extended runway centre lines. The majority of aircraft joined the centre lines at distances greater than 10 kilometres from threshold – only a very small number joined at shorter distances.

2.2 Flight Profiles and Noise Emissions

2.2.1 For 2007, the average flight profiles of height and speed versus track distance for each aircraft type were reviewed, and updated where necessary, for both departures and arrivals. Noise event levels were then determined from a database expressing SEL[3] as a function of engine power setting and slant distance to the receiver – the so-called 'noise-power-distance (NPD)' relationship. The engine power settings required for the aircraft to follow the measured average height and speed profiles were calculated from data describing aircraft performance characteristics within each of the different aircraft type categories.

2.2.2 As for the aircraft flight track and profile data, the ANCON noise database is continuously reviewed and updated with adjustments made when, and where, measurements show this to be necessary. The Heathrow NTK system comprises 10 fixed monitors (positioned approximately 6.5 kilometres from start of roll) together with a number of mobile monitors which are shared amongst the three London Airports and the CAA. These can be deployed anywhere within the NTK radar coverage area. More information about validating the CAA ANCON noise model can be found on the CAA website at http://www.caa.co.uk/docs/68/Valid_ANCON.pdf. Following extensive noise measurements of departures from Heathrow in 2007, at 12, 14 and 21 kilometres from start of roll, the B744–400 family of aircraft (i.e. the B744G, B744P and B744R – see Table 1) have had their noise levels increased slightly (by between 0.5 and 1dB) at distances greater than 10 kilometres from start of roll.

2.3 Traffic Distribution by Aircraft Type and Route

2.3.1 The aircraft movements conventionally used to determine Leq are the daily averages of those which take place in the 16-hour day, 0700-2300 local time, during the 92-day period 16 June to 15 September inclusive. Table 1, which displays the distribution of movements by aircraft type, shows that the 2007 average Leq (16-hour) day movement rate was 0.8% higher than in 2006.

[3] Sound Exposure Level in dBA; a measure of noise event level which accounts for both the duration and intensity of noise.

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2.3.2 Table 2 compares the distribution of aircraft departures by route for 2006 and 2007. The percentages of use of each runway direction - the 'modal split' - for 2007 were 87% west - 13% east compared to 70% west – 30% east in 2006.

2.3.3 The table below lists the 'average summer day' movements by eight noise classes of aircraft (ranked in ascending order of noise emission, i.e. from least to most noisy) during 2006 and 2007. Table 1 and Figure 2 (at the end of the Report) state which specific aircraft types fall into which categories.

NOISE CLASS	AIRCRAFT	AVERAGE NUMBER 2006	AVERAGE NUMBER 2007	PERCENTAGE OF TOTAL 2007 MOVEMENTS	CHANGE AS PERCENTAGE OF TOTAL 2006 MOVEMENTS
	PROPELLER AIRCRAFT				
1	Small props	0.1	0.2	0.0	0.0
2	Large props	8.3	7.5	0.6	-0.1
	CHAPTER 3 JETS				
3	Short-haul	836.5	844.0	67.1	+0.6
4	Wide-body twins	229.0	235.3	18.7	+0.5
5	2nd gen wide body multis*	169.3	169.7	13.5	0.0
	LARGE CHAPTER 2/3 JETS				
6	1st gen wide-body multis*	4.7	1.0	0.1	-0.3
	2nd GENERATION TWIN JETS				
7	Narrow body twins (including Chapter 2 and hushkitted versions)	0.0	0.1	0.0	0.0
	1st GENERATION JETS				
8	Narrow body multis (including hushkitted versions)	0.1	0.4	0.0	0.0
	TOTAL MOVEMENTS	1248.0	1258.2	100.0**	+0.8**

* Multi-engined (3 or 4) aircraft
** May not sum exactly due to rounding

2.3.4 It can be seen from the above table that the average numbers in each noise class for 2007 are very similar to those for 2006, the largest difference being short-haul Chapter 3 jets (noise class 3) which rose from 836.5 per day in 2006 to 844.0 per day in 2007. Aircraft movements by 1st generation wide-body multis (noise class 6) fell from 4.7 per day in 2006 to 1.0 per day in 2007.

2.3.5 Figure 2 illustrates the changing distribution of traffic among these noise classes over the twenty-three years from 1984 to 2007[4] inclusive.

[4] The 1990 to 2007 percentages shown in Figure 2 relate to the average 16 hour Leq-day; before 1990 the percentages relate to the average 12 hour NNI-day (0700-1900 Local Time). Also, the percentages before 1992 are based on departures only, from 1992 they relate to total movements.

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3 NOISE CONTOURS

3.1 'Actual' contours

3.1.1 The actual Leq contours for 2007 (i.e. those depicting actual terrain adjusted average mode Leq exposures), from 57 to 72 dBA in steps of 3dB, are overlaid on a background map in Figure 3. In Figure 4, three of these, for 57, 63 and 69 dBA Leq, are compared with the actual contours for 2006. Immediately apparent from Figure 4 is the effect on the contours due to the change in modal split. The 2007 57 dBA Leq contour associated with westerly departures and arrivals has increased whilst the same contour associated with easterly departures and arrivals has decreased reflecting the 17% change in modal split between the two years.

3.1.2 The total areas and populations[5] enclosed by each of the contours are listed below:

Leq LEVEL dBA	AREA SQ KM		PERCENTAGE CHANGE	POPULATION 000's		PERCENTAGE CHANGE
	2006 ACTUAL	2007 ACTUAL		2006 ACTUAL (2005 CACI data)	2007 ACTUAL (2006 CACI data)	
>57	117.4	119.6	+1.9	258.0	251.9	-2.4
>60	63.9	65.3	+2.2	110.2	100.4	-8.9
>63	38.4	37.6	-2.1	51.2	45.1	-11.9
>66	23.3	23.1	-0.9	15.9	16.2	+1.9
>69	11.9	12.2	+2.5	3.6	3.7	+2.8
>72	6.4	6.4	0.0	0.7	0.7	0.0

3.1.3 Relative to 2006, the area within the 2007 actual 57 dBA Leq contour increased by 1.9%. This increase is largely attributable to the fact that noise contours associated with westerly operations – of which there were a particularly high number in 2007 – will generally enclose a larger area than those associated with easterly operations (see para 3.2.7). The areas within the 60 dBA and 69 dBA Leq contours also increased by 2.2% and 2.5% respectively. The areas within the 63 dBA and 66 dBA Leq contours fell by 2.1% and 0.9% respectively whilst the area within the 72 dBA Leq contour remained unchanged from 2006. Percentage changes in contour areas are not necessarily accompanied by similar changes in enclosed population because the contours may be different in shape as well as size and movement of contour line(s) from year to year, especially in or around relatively highly populated areas, can cause a disproportionate change in enclosed population. Based on the updated 2006 CACI data, the population enclosed within the actual 2007 57 dBA Leq contour decreased by 2.4%. Using the earlier 2005 CACI data would have yielded a decrease of 3.2%.

[5] The population estimates shown in this Report are based on 2001 census data (updated by CACI Ltd in 2005 and 2006). Note also that area and population figures presented in this Report are cumulative.

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3.2 'Standard' contours

3.2.1 In Figure 5 the standard terrain adjusted 2007 contours (57, 63 and 69 dBA Leq) are compared with those for 2006. These show what the noise exposures would have been if the 2006 and 2007 modal splits had mirrored the 20-year rolling average. The 2006 standard contours were based on the 20 year average modal split from 1987 to 2006 inclusive of 76% west - 24% east; those for 2007 were based on the 20 year average modal split from 1988 to 2007 inclusive which was also 76% west - 24% east. The associated contour areas and populations are displayed below:

Leq LEVEL dBA	AREA SQ KM		PERCENTAGE CHANGE	POPULATION 000's		PERCENTAGE CHANGE
	2006 STANDARD	2007 STANDARD		2006 STANDARD (2005 CACI data)	2007 STANDARD (2006 CACI data)	
>57	118.7	116.3	-2.0	259.0	251.6	-2.9
>60	64.7	63.3	-2.2	105.7	103.8	-1.8
>63	38.6	37.9	-1.8	50.8	47.1	-7.3
>66	23.3	23.0	-1.3	16.3	15.1	-7.4
>69	12.0	11.9	-0.8	4.1	3.5	-14.6
>72	6.4	6.3	-1.6	0.9	0.5	-44.4

3.2.2 Relative to 2006, the area within the standard 2007 57 dBA Leq contour decreased by 2.0%. Based on the 2006 CACI data the population within the 57 dBA Leq contour decreased by 2.9% (using the earlier 2005 CACI population data would have yielded a decrease of 3.7%).

3.2.3 The standard contours normally provide a clearer indication than the actual contours of 'fleet noise level' changes because they minimise the effect of any difference between the ratios of westerly to easterly operations for the two years**.** Figure 5 shows that the 2006 and 2007 standard contours are, generally, very similar in both size and shape.

3.2.4 The 2007 standard 57 dBA Leq contour associated with departures on the Brookmans Park (BPK), Wobun (WOB) and Dover (DVR) routes from Runways 27R and 27L has contracted slightly. The 2007 57 dBA Leq contour associated with departures on the Compton/Sampton (CPT/SAM) routes from Runways 27R and 27L has expanded slightly. These slight shifts in the 57 dBA Leq contour between the two years reflect a change in the mix of aircraft types on these departure routes– in particular the number of departures by the B747-400 fleet on the CPT/SAM routes increased in 2007 whilst those on the BPK and WOB routes decreased.

3.2.5 The 2007 standard 57 dBA Leq contour associated with arrivals on Runways 27R has contracted slightly reflecting a change in the usage of the Runways between 2006 and 2007. In 2006, 54.7% of arrivals in the Leq day used Runway 27R and 45.3% used Runway 27L. In 2007, 51.9% of arrivals used Runway 27R and 48.1% used Runway 27L.

3.2.6 It can be seen from the above results for both the actual and standard contours that modal split can affect the area enclosed by the contours. At 57 dBA Leq the **actual** 2007 contour (modal split 87% west – 13% east) encloses an area of 119.6 square kilometres whilst the 57 dBA Leq **standard** 2007 contour (modal split 76% west – 24% east) has an area some 3.3 square kilometres less at 116.3 square kilometres.

3.2.7 This 'effect' is a consequence of the different operating procedures during west and east mode operations at Heathrow. During west mode operations a system of 'runway alternation' operates which means that, during the period 0600 – 1500 Local

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Time, one runway (e.g. 27R) is used for departures and the other (27L) for arrivals. After 1500, the converse is true and the departure runway becomes 27L and the arrival runway 27R. During east mode operations, because of the Cranford agreement, the vast majority of departures use Runway 09R and most arrivals use Runway 09L. Noise contours associated with westerly operations will generally enclose a larger area than those associated with easterly operations because the 'noise energy' associated with westerly movements is 'evenly spread' over two runways. During easterly operations both departures and arrivals are limited to separate runways so the 'noise energy' is more 'concentrated' over the separate runways used for departures and arrivals. Contours for any years that have high percentages of westerly operations (as in 2007) will therefore tend to enclose larger areas than years that reflect more closely the standard modal split.

4 HEATHROW TRAFFIC AND NOISE: HISTORICAL TRENDS

4.1 Figure 6 shows how the average mode 57 dBA Leq contours, based on actual modal splits, have changed since 1988 by comparison with the *total annual* aircraft movements.

4.2 The contour area figures give a better indication of the actual noise than the population figures because the latter are more susceptible to the 'modal split' between easterly and westerly operations[6]. This is particularly noticeable in 1995 which had an atypical modal split of 54% west – 46% east (compared with the 20-year average of 77% west – 23% east for that year). Also, as stated in paragraph 3.1.3, percentage changes in contour areas are not necessarily accompanied by similar changes in enclosed population because the contours may be different in shape as well as size and movement of contour line(s) from year to year, especially in or around relatively highly populated areas, can cause a disproportionate change in enclosed population. The recorded increase in enclosed population between 1998 and 1999 reflected demographic changes that occurred between the 1991 census and the subsequent update.

4.3 The sharp rate of decline in contour area recorded in the late eighties and early nineties has diminished. The area reductions in 2000 and 2001 reflect reduced numbers of Concorde movements in those years (2.5 per day in 2000 and 0.1 per day in 2001). This followed the grounding of Concorde after the crash at Paris, Charles de Gaulle airport in July 2000. Concorde movements in 2002 and 2003 never reached the level of 1999. The dashed line on the figure shows what the 2003 areas and populations would have been had there been no movements by Concorde in the Leq period for that year. In October 2003 Concorde was retired from service so there were no movements by Concorde in 2004.

4.4 Against the trend of a general decrease in contour area, the number of aircraft movements has risen steadily each year, the only trough occurring in 1991, the year of the First Gulf War. The annual movement figure for 2001 was slightly lower than the preceding year and reflected the disruption to traffic following the events of 11th September 2001. The total annual movement figure for 2005 was 1.7% higher than that for 2004 compared with the 1.1% decrease for the 16-hour average summer Leq day. Movements during the summer 2005 period were affected by 3 days of industrial action in August and possibly by the terrorist attacks in central London on the 7th July. A separate analysis showed that total movements in July and August of 2005 were less than those for the same months in 2004.

[6] Actual modal split data are used in this figure because contours based on standard modal split are a relatively recent innovation and data prior to 1995 are not available.

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4.5 The total annual movements in 2006 (477,000[7]) were 0.2% lower than in 2005 (477,900). Traffic levels during the summer 2006 Leq period were affected by new tighter security restrictions which were introduced in mid August 2006. Flights at Heathrow were also disrupted in December 2006 by heavy fog.

4.6 In 2007, the total annual movements were 481,500[8], 0.9 % higher than in 2006.

[7] Total annual movement figures rounded to nearest 100.

[8] Figure relates to **total annual movements** which includes Air Transport Movements (ATMs), Positioning flights, Business Aviation and Official flights. The total ATMs at Heathrow in 2007 were 477,100 (rounded to nearest 100).

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Table 1:

DISTRIBUTION OF HEATHROW AVERAGE DAILY AIRCRAFT MOVEMENTS BY TYPE (0700-2300 LOCAL TIME, 16 JUNE-15 SEPTEMBER)

AIRCRAFT TYPE(S)	NOISE CLASS	AVERAGE NUMBER 2006	AVERAGE NUMBER 2007	PERCENTAGE OF TOTAL 2007 MOVEMENTS	CHANGE AS PERCENTAGE OF TOTAL 2006 MOVEMENTS
Small Props	1	0.1	0.2	0.0	0.0
Large Props	2	8.3	7.5	0.6	-0.1
B737-300, 400, 500	3	33.6	55.3	4.4	+1.7
B737-600, 700	3	15.5	9.3	0.7	-0.5
B737-800, 900	3	17.1	13.6	1.1	-0.3
B757E (RB211-535E4, E4B)	3	54.6	55.4	4.4	+0.1
B757C (RB211-535C)	3	0.6	0.6	0.0	0.0
B757P (Pratt and Whitney)	3	1.2	1.6	0.1	0.0
BAe146	3	3.4	0.6	0.0	-0.2
A318	3	3.3	3.4	0.3	0.0
A319C (CFM-56)	3	16.5	18.5	1.5	+0.2
A319V (IAE-V2500)	3	214.0	222.1	17.7	+0.6
A320C (CFM-56)	3	139.0	122.7	9.8	-1.3
A320V (IAE-V2500)	3	139.6	128.0	10.2	-0.9
A321C (CFM-56)	3	67.0	70.7	5.6	+0.3
A321V (IAE-V2500)	3	71.2	72.0	5.7	+0.1
Business Jet (Ch 3)	3	5.3	3.8	0.3	-0.1
Bombardier Regional Jet 100/200	3	3.3	0.7	0.1	-0.2
Bombardier Regional Jet 700/900	3	2.1	1.8	0.1	0.0
Embraer EMB 135/145	3	16.6	31.9	2.5	+1.2
Embraer E-170	3	0.4	0.4	0.0	0.0
F100	3	2.4	3.3	0.3	+0.1
MD80	3	29.8	28.3	2.2	-0.1
B767-200	4	3.4	3.2	0.3	0.0
B767-300G (General Electric)	4	10.1	12.6	1.0	+0.2
B767-300P (Pratt and Whitney)	4	13.1	10.1	0.8	-0.2
B767-300R (Rolls Royce)	4	35.7	39.5	3.1	+0.3
B777-200G (General Electric)	4	31.2	33.0	2.6	+0.1
B777-200P (Pratt and Whitney)	4	16.6	13.6	1.1	-0.2
B777-200R (Rolls Royce)	4	57.4	55.2	4.4	-0.2
B777-300G (General Electric)	4	7.5	13.9	1.1	+0.5
B777-300R (Rolls Royce)	4	1.2	2.3	0.2	+0.1
A300	4	12.8	12.9	1.0	0.0
A310	4	5.9	5.6	0.4	0.0
A330	4	34.1	33.4	2.7	-0.1
B747-400G (General Electric)	5	18.4	17.0	1.4	-0.1
B747-400P (Pratt and Whitney)	5	24.2	21.2	1.7	-0.2
B747-400R (Rolls Royce)	5	68.0	69.7	5.5	+0.1
B747SP	5	1.3	0.2	0.0	-0.1
A340-200/300	5	35.3	28.3	2.2	-0.6
A340-500/600	5	21.2	32.7	2.6	+0.9
MD11	5	0.9	0.6	0.0	0.0
B747-100*	6	0.5	0.0	0.0	0.0
B747-200, 300 (Ch 3)	6	3.6	0.9	0.1	-0.2
DC10	6	0.5	0.1	0.0	0.0
Tristar	6	0.1	0.0	0.0	0.0
Business Jet (Ch 2)	7	0.0	0.1	0.0	0.0
B727 (Ch 3)	8	0.1	0.2	0.0	0.0
Tu154M*	8	0.0	0.2	0.0	0.0
TOTAL MOVEMENTS		**1248.0**	**1258.2**	**100.0****	**+0.8****

* In 2006 and 2007 all Chapter3 versions
** May not sum exactly due to rounding

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Table 2:

PERCENTAGE OF HEATHROW AVERAGE DAILY AIRCRAFT DEPARTURES BY ROUTE*
(0700-2300 LOCAL TIME, 16 JUNE - 15 SEPTEMBER)

WESTERLY DEPARTURE ROUTE	PERCENTAGE OF TOTAL DEPARTURES 2006	PERCENTAGE OF TOTAL DEPARTURES 2007	CHANGE (% OF TOTAL)
WOB/BPK	30.3	37.0	+6.7
DVR/DET	17.6	20.7	+3.1
MID	11.3	14.1	+2.8
CPT/SAM	10.8	15.2	+4.4
PERCENTAGE WEST	70.0	87.0	+17.0
EASTERLY DEPARTURE ROUTE	PERCENTAGE OF TOTAL DEPARTURES 2006	PERCENTAGE OF TOTAL DEPARTURES 2007	CHANGE (% OF TOTAL)
BUZ/BPK	12.8	5.4	-7.4
DVR/DET	7.2	3.1	-4.1
MID/SAM	6.6	2.8	-3.8
CPT	3.4	1.7	-1.7
PERCENTAGE EAST	30.0	13.0	-17.0

* See Figure 1

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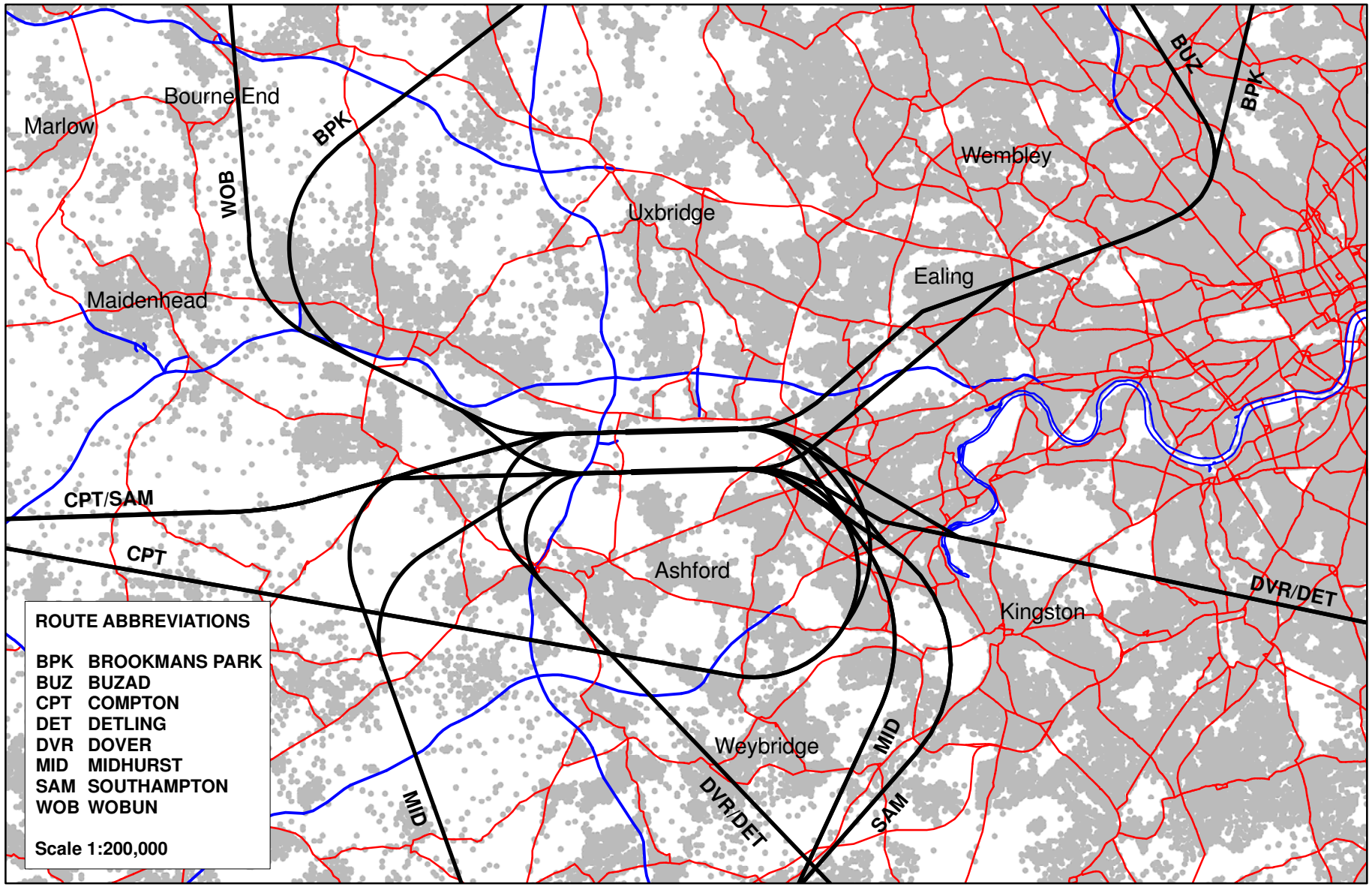

Figure 1: London Heathrow Airport Standard Instrument Departure Routes

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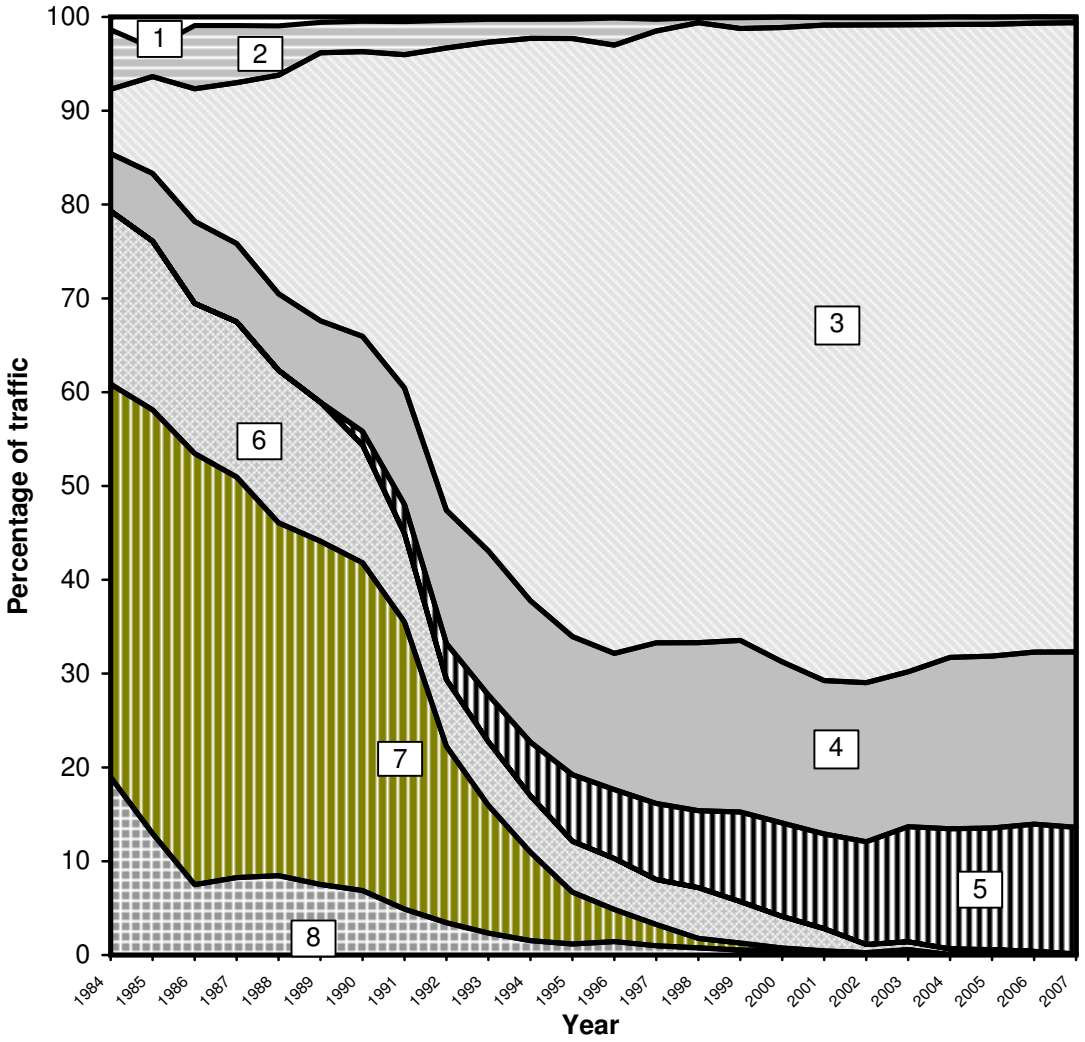

Propeller aircraft:

1 Small props: Single and twin pistons and turboprop light, business and commuter aircraft

2 Large props: 2- & 4-propeller transports; eg SF340 BAe-ATP, ATR42, F50, HS748, Saab 2000, Electra, Hercules, Viscount, Vanguard

Chapter 3 jets:

3 Short-haul: eg A320, BAe146, B717, B737-300, B757, F100, MD80, RJ50, re-engined narrow-bodies, some business jets

4 Wide-body twins: A300, A310, A330, B767, B777

5 2nd gen. wide-body multis*: A340, MD11, B747-400

Large Chapter 2/3 jets:

6 1st gen. wide-body multis* (Chapter 2 & 3): 'Classic' 747, Tristar, DC-10, An124, IL76, IL86

2nd generation twin jets:

7 Narrow body twins (including hushkitted versions): eg F28, BAC 1-11, DC-9, B737-200 other business jets

1st generation jets & Concorde: (including hushkitted versions)

8 eg Trident, 707, DC-8, B727, IL62, Tu154

* Multi = 3- or 4- engined aircraft

Figure 2: Noise Class of Heathrow aircraft 1984 - 2007

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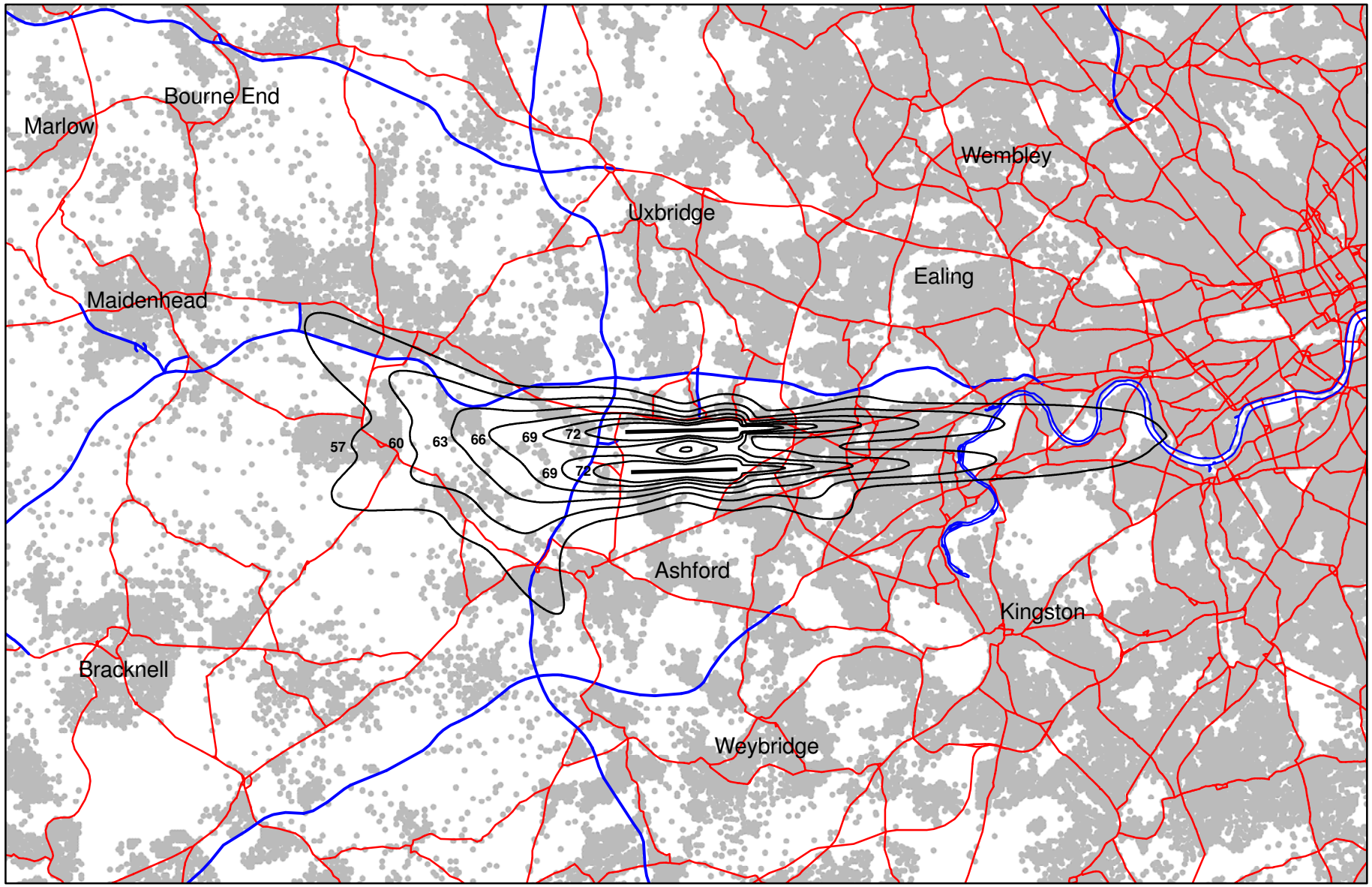

Figure 3: Heathrow actual 2007 average mode (87% west - 13% east) terrain adjusted 16hr Leq contours on population map

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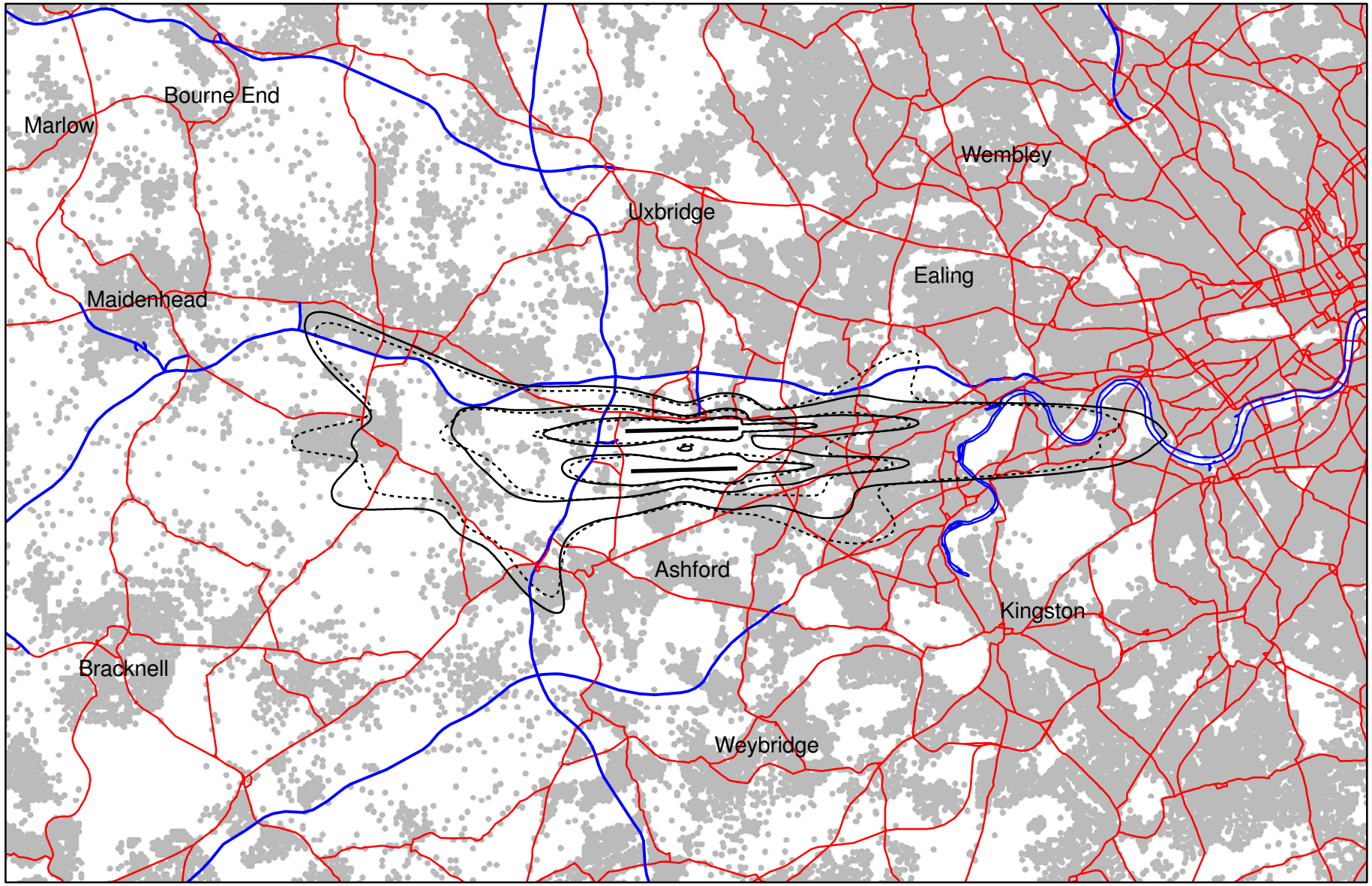

Figure 4: Heathrow actual 57, 63 and 69 Leq contours - 2006 dotted (70% west - 30% east) - 2007 solid (87% west - 13% east)

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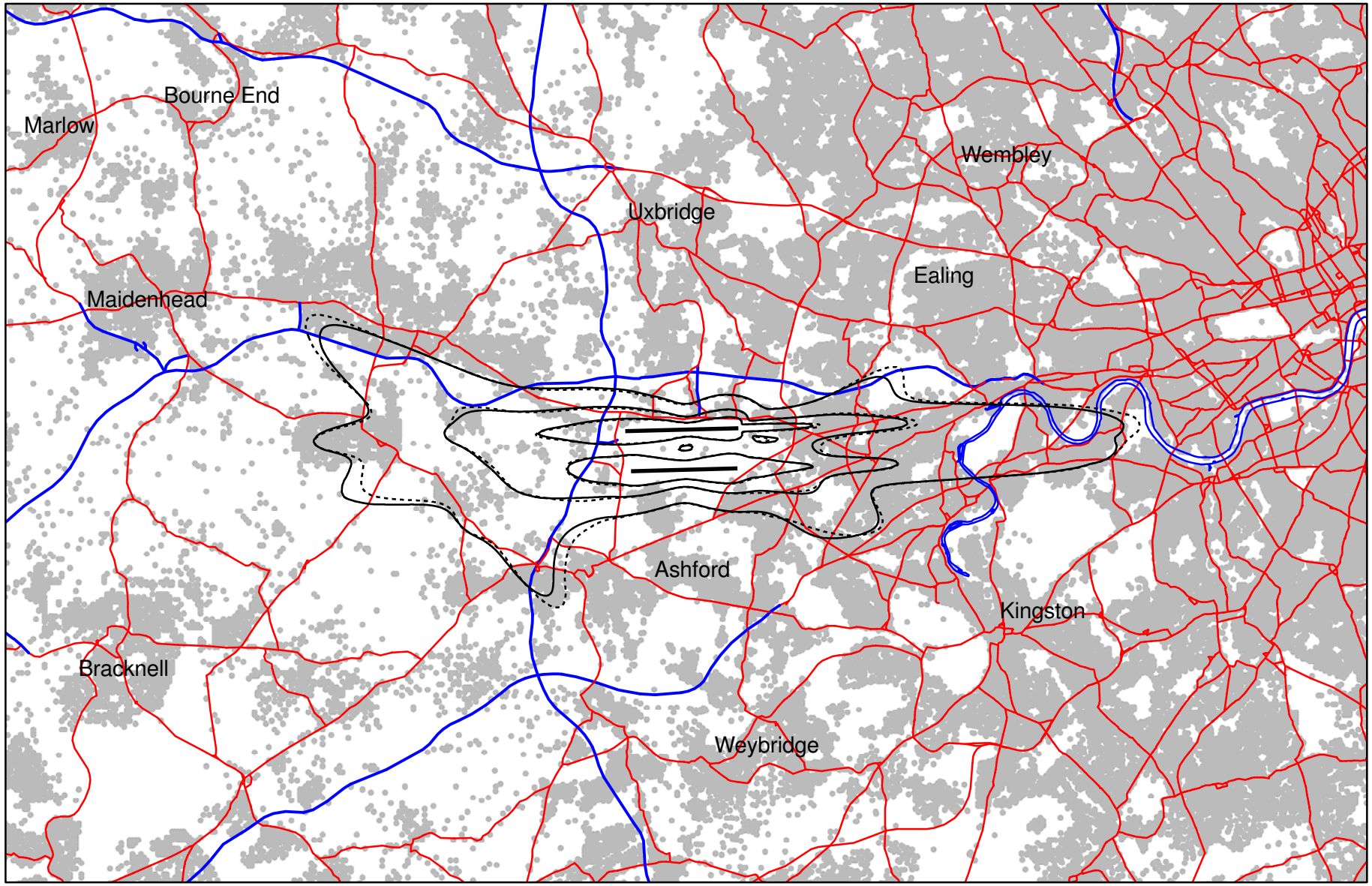

Figure 5: Heathrow standard 57, 63 and 69 Leq contours - 2006 dotted (76% west - 24% east) - 2007 solid (76% west - 24% east)

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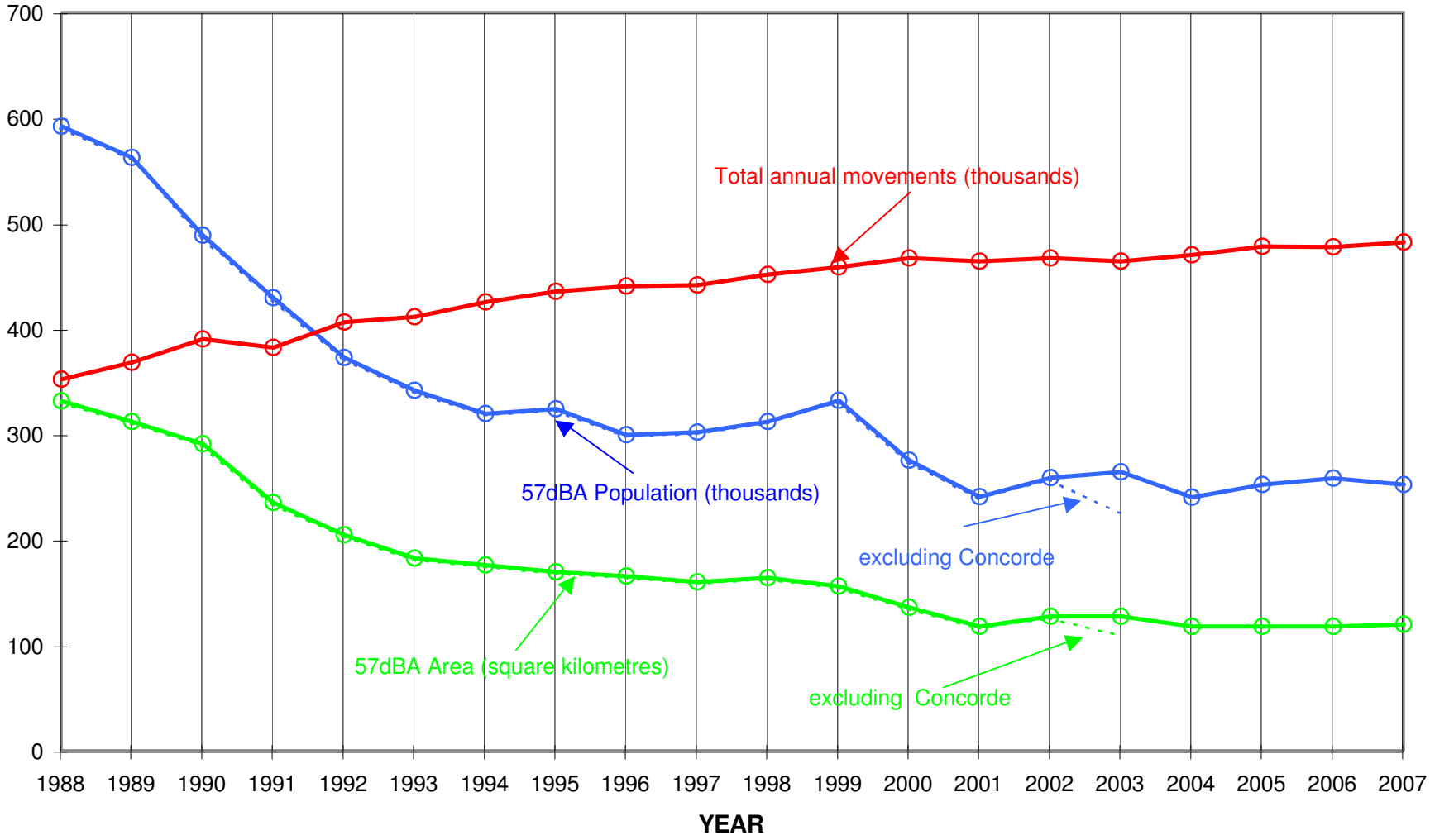

Figure 6: Heathrow traffic and noise 1988 - 2007