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

ERCD REPORT 1204

Strategic Noise Maps for Heathrow Airport 2011

J Lee
L Edmonds
J Patel

Prepared by the Civil Aviation Authority on behalf of the Department for Transport, June 2013

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Summary

This report presents the year 2011 strategic noise maps for London Heathrow Airport, which have been produced to meet the requirements of the *Environmental Noise (England) Regulations 2006*.

June 2013

The authors of this report are employed by the Civil Aviation Authority. The work reported herein was carried out on behalf of the Department for Transport.

Any views expressed are not necessarily those of the Secretary of State for Transport.

Population data used in this report are supplied by Defra and based on the 2011 Census.

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Glossary

AIP Aeronautical Information Publication.

ANCON The UK civil aircraft noise contour model, developed and maintained by ERCD.

ATC Air Traffic Control.

CAA Civil Aviation Authority – the UK's independent specialist aviation regulator.

CDA Continuous Descent Approach.

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.

Defra Department for Environment, Food and Rural Affairs.

DfT Department for Transport (UK Government).

END Environmental Noise Directive.

EPNdB Effective Perceived Noise Level in decibels.

ERCD Environmental Research and Consultancy Department of the Civil Aviation Authority.

ILS Instrument Landing System.

$L_{Aeq,16hr}$ Equivalent sound level of aircraft noise in dBA for the 16-hour day (0700-2300 local time) period. For this report, the *annual* average day is used.

L_{day} Equivalent sound level of aircraft noise in dBA for the 12-hour annual average day (0700-1900 local time) period.

L_{den} Equivalent sound level of aircraft noise in dBA for the 24-hour annual average period with 5 dB weightings for $L_{evening}$ and 10 dB weightings for L_{night}.

Leq Equivalent sound level of aircraft noise in dBA, often called 'equivalent continuous sound level'. For conventional historical contours this is based on the daily average movements that take place within the 16-hour period (0700-2300 local time) over the 92-day summer period from 16 June to 15 September inclusive.

$L_{evening}$	Equivalent sound level of aircraft noise in dBA for the 4-hour annual average evening (1900-2300 local time) period.
L_{max}	The maximum sound level measured during an aircraft event.
L_{night}	Equivalent sound level of aircraft noise in dBA for the 8-hour annual average night (2300-0700 local time) period.
MTWA	Maximum Total Weight Authorised.
NPR	Noise Preferential Route.
NTK	Noise and Track Keeping monitoring system. The NTK system associates radar data from air traffic control radar with related data from both fixed (permanent) and mobile noise monitors at prescribed positions on the ground.
QC	Quota Count, the basis of the London airports night restrictions regime.
SID	Standard Instrument Departure.

Executive Summary

This report presents the year 2011 strategic noise maps for London Heathrow Airport that have been produced to meet the requirements of the *Environmental Noise (England) Regulations 2006*. Strategic noise maps were previously produced for the year 2006.

Noise modelling has been performed with the ANCON model, employing the mean flight tracks, average flight profiles and noise emission data associated with the Heathrow 2011 summer period Leq contours.

Noise contours have been produced for the following noise indicators: L_{day}, $L_{evening}$, L_{night}, L_{den} and annual $L_{Aeq,16hr}$. Estimates of area, population and households within the contours are provided.

Aircraft movements in 2011 at Heathrow increased by 0.7% compared to 2006 over the annual 24-hour period. In 2011 the 55 dBA L_{den} contour area was 221.9 km^2, 9% lower than in 2006 and enclosed a population of 766,100. In 2011 the 50 dBA L_{night} contour area was 74.6 km^2, 12% lower than in 2006 and enclosed a population of 211,300. Population comparisons relative to 2006 are not presented, since counts for 2006 are based on earlier Census data.

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1 Introduction

1.1 Background

1.1.1 The EU Directive 2002/49/EC relates to the assessment and management of environmental noise and is also referred to as the Environmental Noise Directive (END). The END requires member states to produce strategic noise maps for the main sources of environmental noise. This Directive was transposed into UK law by *Statutory Instrument 2006 No. 2238 The Environmental Noise (England) Regulations 2006*.

1.1.2 The Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) was commissioned by the Department for Transport (DfT) to produce strategic noise maps for Heathrow Airport for the year 2011 to meet the requirements of *The Environmental Noise (England) Regulations 2006*. Strategic noise maps for Heathrow were previously produced by ERCD for the year 2006 to meet these Regulations (**Ref 1**).

1.1.3 The Environmental Noise Regulations specify that noise maps are to be produced for the following indicators: L_{day}, $L_{evening}$, L_{night}, L_{den} and annual $L_{Aeq,16hr}$. These noise indicators are based on air traffic movements for the 365-day annual period, unlike the conventional Leq noise contours that are based on movements over the 92-day summer period.

1.1.4 L_{day} is the equivalent continuous sound level (Leq) over the time period 0700-1900 (local time). $L_{evening}$ and L_{night} are the average sound levels for 1900-2300 and 2300-0700 respectively (local time). L_{den} is the logarithmic average of L_{day}, $L_{evening}$ and L_{night} but with $L_{evening}$ and L_{night} weighted by 5 dB and 10 dB respectively. The annual $L_{Aeq,16hr}$ (0700-2300 local time) is derived from the logarithmic average of the L_{day} and $L_{evening}$ results.

1.1.5 The L_{day}, $L_{evening}$, L_{den} and annual $L_{Aeq,16hr}$ contours are plotted from 55 to 75 dBA in 5 dB steps. However, L_{night} is plotted from 50 to 70 dBA (also in 5 dB steps).

1.1.6 The objectives of this report are to describe the noise modelling methodology used to produce the year 2011 strategic noise maps for Heathrow Airport, and to present the calculated noise maps and associated area/population/household statistics for each of the required noise indicators.

1.1.7 It should be noted that at Defra's[1] request, this report presents population and household numbers which have been supplied by Defra's consultants. Defra's population figures are based on the outputs of the 2011 Census and differ from the data held by ERCD for 2011 (a 2011 update of the 2001 Census provided by

[1] The Department for Environment, Food and Rural Affairs (Defra) is responsible for the publication of noise maps for road, rail, industrial and airport noise sources on behalf of the Secretary of State to meet the requirements of the Environmental Noise (England) Regulations 2006.

CACI Ltd). In addition, Defra had previously published its own population estimates for the Heathrow 2006 END contours which did not match precisely the numbers in ERCD's report (**Ref. 1**).[2] Because of these differences in the population databases used by ERCD and Defra, it was not considered appropriate to provide comparisons between the 2011 and 2006 population and household results in this report.

1.2 Heathrow Airport

1.2.1 Heathrow Airport is situated approximately 13 miles (21 km) west of the city of London. It is surrounded by suburban housing, business premises and mixed-use open land to the north and south, suburban housing and business premises to the east, and several large reservoirs, mixed-use open land, housing and business premises to the west.

1.2.2 Heathrow Airport has two runways: Runway 09L/27R to the north, which is 3,901 m long, and Runway 09R/27L to the south, which is 3,660 m long. The landing threshold for Runway 09L is displaced by 306 m. The landing threshold for Runway 09R is also displaced, by 307 m. There are currently four passenger terminals.[3] The airport layout in 2011 is shown in **Figure 1**.

1.2.3 In the 2011 calendar year there were approximately 481,000[4] aircraft movements at Heathrow Airport, handling 69.4 million passengers (2006: 477,000 aircraft movements, 67.5 million passengers).[5]

1.2.4 Other major noise sources in the vicinity of Heathrow Airport include the surrounding roads such as the M4 and M25 motorways.

1.3 Noise control measures at Heathrow Airport

Land use planning

1.3.1 The Government's policies for land use planning and noise have for many years been set out in Planning Policy Guidance 24 (PPG24)[6]. This document gave guidance on how the planning system could be used to minimise the adverse effects of noise. Local authorities had to take its guidelines into account when assessing a proposal for residential development near an existing noise source such as an airport.

[2] It is understood that a different population database year was employed by Defra.

[3] Terminal 2 closed for rebuilding work in November 2009 and is expected to re-open in 2014.

[4] Air Transport Movements (ATMs) account for 477,000 of the total aircraft movements, thus the 480,000 ATM limit specified by the Terminal 5 Planning Condition A4 has not been exceeded.

[5] Source: CAA Regulatory Policy Group statistics (www.caa.co.uk)

[6] *Planning Policy Guidance 24: Planning and Noise*, published September 1994.

1.3.2 However, March 2012 saw the publication of the 'National Planning Policy Framework'[7] which has replaced previous Government planning policy documents. In reference to noise, it states that:

Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Operational procedures

1.3.3 Full details of noise controls relating to a range of aircraft operational procedures are set out in statutory notices and published in the UK AIP (Aeronautical Information Package).[8] Some examples of these operational procedures are given below.

1.3.4 Between 0600 and 2330 hours (local time) where the aircraft is approaching runway 27L or 27R (0700 and 2300 hours when approaching runway 09L or 09R) and is using the Instrument Landing System (ILS) it must not descend on the glidepath below an altitude of 2,500 ft before being established on the localiser, nor thereafter fly below the glidepath. Between 2330 and 0600 hours (local time) where the aircraft is approaching runway 27L or 27R (2300 and 0700 hours when approaching runway 09L or 09R) and is using the ILS it must not descend below an altitude of 3,000 ft before being established on the localiser, nor thereafter fly below the glidepath.

1.3.5 For arriving aircraft the use of Continuous Descent Approaches (CDA) is encouraged to avoid the need for extended periods of level flight, thus keeping the aircraft higher for longer and reducing the thrust needed. Levels of CDA achievement are monitored and reported to various committees on a regular basis.

1.3.6 Between 2330 and 0600 (local time), aircraft commanders are requested to avoid the use of reverse thrust after landing, consistent with the safe operation of the aircraft.

[7] *National Planning Policy Framework*, published in March 2012 by the Department for Communities and Local Government.

[8] www.ais.org.uk; EGLL AD 2.21 - NOISE ABATEMENT PROCEDURES

Westerly preference

1.3.7 Heathrow operates a westerly preference, meaning that aircraft will take off and land in a westerly direction even if there are light easterly winds (up to 5 kts) and provided the runways are dry. The westerly preference was introduced in the 1960s to reduce the numbers of aircraft taking off in an easterly direction and therefore overflying the more heavily populated side of the airport.

Runway alternation

1.3.8 A system of runway alternation is operated at Heathrow in westerly mode[9] to provide predictable periods of relief for communities situated to the east of the airport that are overflown by landing aircraft. Currently one runway is designated for landings from 0600 until 1500, when a switchover occurs and the other runway is designated for use until the last departure. The runway designated for morning arrivals alternates between the north and south on a weekly basis. After the last departure, the runway arrangements then follow a night-time rotation schedule. The night-time schedule sets out a rotation pattern of the runway designated for landings involving both north and south runways, in both easterly and westerly operating modes. The designated runway changes on a weekly basis and follows a four-week cycle. The alternation schedule is published annually on the Heathrow Airport website.[10]

Cranford Agreement

1.3.9 The 'Cranford Agreement' was a verbal agreement made between the Government and the local community in 1952 that the airport would avoid the use of the northern runway for take-offs to the east unless absolutely necessary, to reduce noise impacts on the residents of Cranford who are situated close to the eastern end of the runway. In easterly mode, the southern runway is therefore normally used for departures and the northern runway for landings.

1.3.10 Following public consultation, a decision was made in 2009 by the Government to end the Cranford Agreement. This would allow for the more even spreading of noise around Heathrow. However, new taxiways would need to be built in order to implement the full alternation of easterly operations.

1.3.11 At the time of writing, the airport operator has decided not to submit a planning application to the London Borough of Hillingdon for these works. The reasons are two-fold: (1) it could lead to confusion given the current trial of 'Operational Freedoms' that is happening at Heathrow, under which aircraft can take-off over Cranford from the northern runway under certain circumstances; (2) the requirement for Heathrow to carefully monitor the impacts of the Operational Freedoms trial provides an opportunity to undertake ground noise monitoring in Longford and departure noise monitoring in Cranford, thereby enabling the better

[9] During the daytime, runway alternation does not occur in easterly mode due to operations in line with the Cranford Agreement.

[10] http://www.heathrowairport.com

understanding of the noise impacts of easterly departures from the northern runway. A decision on submitting a planning application will be taken at the end of the Operational Freedoms trial.

Noise preferential routes

1.3.12 Aircraft departing Heathrow are required to follow specific flight paths called Noise Preferential Routes (NPRs) unless directed otherwise by air traffic control (ATC). NPRs were designed to avoid the overflight of built-up areas where possible. They establish a path from the take-off runway to the main UK air traffic routes and form the first part of the Standard Instrument Departure (SID) routes (**Figure 2**). Associated with each NPR is a swathe extending 1.5 km either side of the NPR centreline, within which the aircraft are considered to be flying on-track.

1.3.13 Aircraft reaching an altitude of 4,000 ft at any point along an NPR may be turned off the route by ATC onto more direct headings to their destinations – a practice known as 'vectoring'. ATC may also vector aircraft from NPRs below this altitude for safety reasons, including in certain weather conditions (for example, to avoid storms).

Night restrictions

1.3.14 The current night restrictions regime was introduced in 2006 following extensive consultation. The restrictions are set by the DfT and detailed in a statutory notice published each summer and winter season in the UK AIP supplement.

1.3.15 Aircraft are assigned different Quota Count (QC) classifications based on their certificated noise levels, for departures and arrivals separately. The QC classifications of individual aircraft are published in the statutory notice.

1.3.16 During the night period (2300-0700 local time) the noisiest types of aircraft classified QC/8 and QC/16 may not be scheduled for landing or take-off. There is also a mandatory scheduling ban for QC/4 aircraft from 2330-0600, known as the 'night quota period'. Any QC/8 and QC/16 aircraft may not take off in the night period, except in the period 2300 to 2330 hours when: (a) it was scheduled to take off before 2300; (b) the take-off was delayed by reasons beyond the control of the aircraft operator; and (c) the airport authority has not given notice to the aircraft operator precluding take-off.

1.3.17 During the night quota period, aircraft movements are restricted by seasonal limits on both movement numbers and noise quotas.

1.3.18 Aircraft are exempt from the night restrictions if their certified noise level is less than 84 EPNdB.

1.3.19 Up to 10% of a current season's movement limit may be carried over to the next season if a sufficient amount of the limit is left unused, and up to 10% of the next season's movement limit may be anticipated in the event of an overrun. Any excess overrun (i.e. over 10%) is penalised in the following season at double the amount of the excess. The same arrangements apply to the noise quotas.

1.3.20 The Secretary of State has the power to specify circumstances in which movements may be disregarded from the night restrictions by the airport managers and the power to grant dispensations (i.e. to authorise that specific flights should be disregarded). The airport companies may disregard night movements when: (a) delays to aircraft are likely to lead to serious congestion at the airport, or serious hardship or suffering to passengers or animals; or (b) there are delays resulting from widespread and prolonged disruption of air traffic.

1.3.21 Usage of the movement limits and the noise quotas, including any dispensations or exemptions granted, and any movements by QC/8 and QC/16 aircraft during the night period, are reported to the Heathrow Airport Consultative Committee (HACC) and the DfT.

Noise limits

1.3.22 During the night quota period (2330-0600), the departure noise limit is 87 dBA L_{max}. For the remainder of the night period (i.e. 2300-2330 and 0600-0700) the noise limit is 89 dBA L_{max}. The noise limits apply at Heathrow's ten fixed noise monitors which are located approximately 6.5 km from start-of-roll. These night time limits are consistent with the night restrictions regime. There is also a daytime noise limit of 94 dBA L_{max}. Airlines that breach the noise limits are fined and the money donated to local community projects. There are no noise limits for arriving aircraft.

Noise monitoring

1.3.23 Heathrow has a noise and track-keeping (NTK) system which takes radar data from ATC radars and combines them with flight information and data from fixed and mobile noise monitors located around the airport. The locations of the fixed monitors take account of the noise preferential routes. Relating the noise limits to a reference distance of 6.5 km from start-of-roll encourages aircraft operators to gain height as quickly as possible and then reduce engine power (and therefore noise) at the earliest opportunity.

1.3.24 There is also a requirement for departing aircraft to attain a minimum height of 1,000 ft above aerodrome level when passing the fixed noise monitors.

Noise charges

1.3.25 Airport charges for Heathrow are published every year by the airport operator and the landing charge is assessed and paid according to the Maximum Total Weight Authorised (MTWA), with weightings for noise emissions and daytime peak periods. The aim is to encourage operators to use the quietest possible fleet.

Noise insulation schemes

1.3.26 The provision of noise insulation at Heathrow can be required on a statutory basis under section 79 of the Civil Aviation Act 1982. In practice, all Heathrow's current noise insulation schemes are provided on a voluntary basis and meet the

requirements of the previous Government's white paper on 'The Future of Air Transport'[11].

1.3.27 Specifically airport operators were expected to offer: (a) households subject to high levels of noise (69 dBA Leq or more) assistance with the costs of relocating, and (b) acoustic insulation (applied to residential properties) to other noise sensitive buildings such as schools and hospitals exposed to medium to high levels of noise (63 dBA Leq or more).

1.3.28 To address the impacts of *future* airport growth, airport operators were expected to offer: (a) to purchase properties suffering from both a high level of noise (69 dBA Leq or more) and a large increase in noise (3 dBA Leq or more), and (b) acoustic insulation to any residential property that suffers from both a medium to high level of noise (63 dBA Leq or more) and a large increase in noise (3 dBA or more).

1.3.29 The 'Community Buildings Noise Insulation Scheme' offers acoustic insulation to noise sensitive buildings in the community (e.g. schools and hospitals) that are located within the year 2002 63 dBA Leq noise contour.

1.3.30 The 'Home Relocation Assistance Scheme' provides homeowners residing within the year 2002 69 dBA Leq contour with financial assistance towards the costs of moving away from areas subject to high levels of airport noise.

1.3.31 The 'Night Noise Insulation Scheme' addresses the impacts of night flights on local communities. Noise insulation is provided to bedrooms (or bed-sitting rooms) in homes located within the landing noise footprints of the noisiest aircraft that operates regularly in the night quota period (2330-0600).

1.3.32 The 'Residential Day Noise Insulation Scheme' provides acoustic insulation to residential buildings located within the year 1994 69 dBA $L_{eq,18hr}$ noise contour, which is enhanced to take account of early morning arrival noise.

[11] *The Future of Air Transport*, published December 2003.

2 Noise contour modelling methodology

2.1 ANCON noise model

2.1.1 Noise contours were calculated with the UK civil aircraft noise model ANCON (version 2.3), which is developed and maintained by ERCD on behalf of the DfT. A technical description of ANCON is provided in R&D Report 9842 (**Ref 2**). The ANCON model is also used for the production of contours for Gatwick and Stansted airports, and a number of other UK airports.

2.1.2 ANCON is fully compliant with the latest European guidance on noise modelling, ECAC.CEAC Doc 29 (3rd edition), published in December 2005 (**Ref 3**). This guidance document represents internationally agreed best practice as implemented in modern aircraft noise models.

2.2 Flight tracks, profiles and noise emissions

2.2.1 The departure and arrival mean flight tracks, average flight profiles of height, speed and thrust, and noise emission data employed for modelling were the same as those used for the Heathrow 2011 average summer day Leq contours. Further details on the Heathrow 2011 summer Leq contours are published in ERCD Report 1201 (**Ref 4**).

2.3 Traffic distributions

2.3.1 The strategic noise maps are based on annual traffic movement data for the following three time periods (all local time):

- 0700-1900 (L_{day})
- 1900-2300 ($L_{evening}$)
- 2300-0700 (L_{night})

2.3.2 The source of this information was the NTK system. Traffic statistics from NTK data were cross-checked with runway logs supplied by NATS[12] and close agreement was found.

2.3.3 The distributions of Heathrow average daily departure and arrival movements by ANCON aircraft type for the L_{day}, $L_{evening}$, L_{night}, L_{den} and annual $L_{Aeq,16hr}$ periods are summarised in **Tables 1-5** respectively. Descriptions of the ANCON types are provided in **Table 6**.

[12] NATS is the provider of air traffic control services to Heathrow Airport.

2.3.4 The annual average 24-hour traffic movements for 2011 at Heathrow were 1317.1, 0.7% higher than in 2006 (2006: 1307.6 movements).

2.4 Runway modal splits

2.4.1 The actual runway modal splits for the different calculation time periods are summarised in the table below:

Heathrow 2011 annual runway modal splits

Scenario	Time Period (local)	% west / % east (Runway 27L/27R / 09L/09R)
L_{day}	0700-1900	71% / 29%
$L_{evening}$	1900-2300	72% / 28%
L_{night}	2300-0700	72% / 28%
L_{den}	0000-2400	71% / 29%
$L_{Aeq,16hr}$	0700-2300	71% / 29%

2.5 Topography

2.5.1 The topography around Heathrow Airport was modelled by accounting for terrain height. 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.

2.5.2 ERCD holds OS terrain height data[13] on a 200 m by 200 m grid for the whole of England. Interpolation was performed to generate height data at each of the calculation points on the receiver grid used by the ANCON noise model.

[13] Meridian™ 2

3 Noise contour results

3.1 L_{day} contours

3.1.1 The Heathrow 2011 L_{day} noise contours generated with the annual 2011 modal split of 71% west / 29% east (0700-1900) are shown in **Figure 3**. The contours are plotted from 55 to 75 dBA at 5 dB intervals. The areas, populations and households within the contours are listed by contour band (in accordance with the Environmental Noise Directive) in the table below:

Heathrow 2011 L_{day} - area, population and household estimates by contour band

L_{day} contour band (dBA)	Area (km^2)	Population (x1000)	Households (x1000)
55 – 60	103.4	338.9	143.9
60 – 65	33.1	94.4	34.5
65 – 70	16.1	19.4	6.6
70 – 75	4.8	1.7	0.7
> 75	2.9	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

3.1.2 For reference, the L_{day} contour areas, populations and households are also provided in cumulative format in **Table A1** of Appendix A.

3.2 $L_{evening}$ contours

3.2.1 The Heathrow 2011 $L_{evening}$ noise contours generated with the annual 2011 modal split of 72% west / 28% east (1900-2300) are shown in **Figure 4**. The contours are plotted from 55 to 75 dBA at 5 dB intervals. The areas, populations and households within the contours are listed by contour band in the table below:

Heathrow 2011 $L_{evening}$ - area, population and household estimates by contour band

$L_{evening}$ contour band (dBA)	Area (km^2)	Population (x1000)	Households (x1000)
55 – 60	106.7	325.2	133.5
60 – 65	32.8	84.8	30.5
65 – 70	15.6	14.3	5.0
70 – 75	4.8	1.3	0.6
> 75	3.1	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

3.2.2 For reference, the $L_{evening}$ contour areas, populations and households are also provided in cumulative format in **Table A2** of Appendix A.

3.3 L_{night} contours

3.3.1 The Heathrow 2011 L_{night} noise contours generated with the annual 2011 modal split of 72% west / 28% east (2300-0700) are shown in **Figure 5**. The contours are plotted from 50 to 70 dBA at 5 dB intervals. The areas, populations and households within the contours are listed by contour band in the table below:

Heathrow 2011 L_{night} - area, population and household estimates by contour band

L_{night} contour band (dBA)	Area (km^2)	Population (x1000)	Households (x1000)
50 – 55	47.8	144.2	60.7
55 – 60	17.6	51.9	18.3
60 – 65	5.9	13.7	4.4
65 – 70	1.8	1.5	0.5
> 70	1.5	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

3.3.2 For reference, the L_{night} contour areas, populations and households are also provided in cumulative format in **Table A3** of Appendix A. The area of the 50 dBA L_{night} contour in 2011 was 12% smaller than in 2006.

3.4 L_{den} contours

3.4.1 The Heathrow 2011 L_{den} noise contours (modal split 71% west / 29% east) are shown in **Figure 6**. The contours are plotted from 55 to 75 dBA at 5 dB intervals. The areas, populations and households within the contours are listed by contour band in the table below:

Heathrow 2011 L_{den} - area, population and household estimates by contour band

L_{den} contour band (dBA)	Area (km^2)	Population (x1000)	Households (x1000)
55 – 60	142.0	574.6	256.3
60 – 65	48.0	138.8	55.4
65 – 70	21.0	46.1	16.0
70 – 75	7.0	6.5	2.2
> 75	3.9	0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

3.4.2 For reference, the L_{den} contour areas, populations and households are also provided in cumulative format in **Table A4** of Appendix A. The area of the 55 dBA L_{den} contour in 2011 was 9% smaller than in 2006.

3.5 Annual $L_{Aeq,16hr}$ contours

3.5.1 The Heathrow 2011 annual $L_{Aeq,16hr}$ noise contours (modal split 71% west / 29% east for 0700-2300) are shown in **Figure 7**. The contours are plotted from 55 to 75 dBA at 5 dB intervals. The areas, populations and households within the contours are listed by contour band in the following table:

Heathrow 2011 annual $L_{Aeq,16hr}$ - area, population and household estimates by contour band

Annual $L_{Aeq,16hr}$ contour band (dBA)	**Area (km^2)**	**Population (x1000)**	**Households (x1000)**
55 – 60	103.5	338.8	142.5
60 – 65	32.9	91.0	33.0
65 – 70	15.9	17.8	6.0
70 – 75	4.8	1.5	0.6
> 75	3.0	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

3.5.2 For reference, the annual $L_{Aeq,16hr}$ contour areas, populations and households are also provided in cumulative format in **Table A5** of Appendix A.

3.6 Noise grid datasets

3.6.1 Noise results were also produced for a 10 m by 10 m grid (via interpolation of the receiver grid results) for each of the noise indicators. This grid was large enough to cover the extents of a theoretical contour 5 dB lower than the lowest level normally plotted, i.e. 50 dBA for L_{day}, $L_{evening}$, L_{den} and annual $L_{Aeq,16hr}$, and 45 dBA for L_{night}.

4 Conclusions

4.1 Year 2011 strategic noise maps have been generated for Heathrow Airport using the ANCON noise model to meet the requirements of the *Environmental Noise (England) Regulations 2006*.

4.2 Noise contours have been produced for the following noise indicators: L_{day}, $L_{evening}$, L_{night}, L_{den} and annual $L_{Aeq,16hr}$. Estimated areas, populations and households within the contours have been provided. The annual average 24-hour period traffic movements at Heathrow for 2011 were 0.7% higher than in 2006.

4.3 In 2011 the 55 dBA L_{den} contour area was 221.9 km^2, 9% lower than in 2006 and enclosed a population of 766,100. In 2011 the 50 dBA L_{night} contour area was 74.6 km^2, 12% lower than in 2006 and enclosed a population of 211,300. Population comparisons relative to 2006 are not presented, since counts for 2006 are based on earlier Census data.

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Noise Exposure Contours for Heathrow Airport 2011
ERCD Report 1201, September 2012

Table 1 Heathrow 2011 annual average 12-hour day (0700-1900) movements by ANCON aircraft type

ANCON type	Departures	Arrivals	Total movements
B717	1.38	0.82	2.20
B727	0.03	0.04	0.07
B732	0.11	0.11	0.22
B733	7.97	9.51	17.48
B736	7.52	8.46	15.98
B738	9.05	10.05	19.10
B744G	3.90	4.12	8.02
B744P	2.76	3.44	6.21
B744R	27.03	22.56	49.59
B747	0.00	0.02	0.02
B747SP	0.06	0.06	0.12
B753	0.02	0.02	0.05
B757C	0.00	0.13	0.13
B757E	7.67	5.24	12.91
B757P	0.39	0.45	0.83
B762	0.13	0.12	0.25
B763G	7.26	4.58	11.84
B763P	5.32	3.78	9.10
B763R	16.61	15.15	31.76
B764	8.29	6.68	14.97
B772G	19.07	13.92	32.99
B772P	4.34	3.78	8.12
B772R	19.80	18.86	38.66
B773G	12.06	16.32	28.39
B773R	0.94	0.47	1.41
BA46	2.07	1.79	3.86
CRJ	0.06	0.08	0.14
CRJ700	0.15	0.22	0.38
CRJ900	1.12	1.25	2.37
EA30	1.30	1.43	2.73
EA31	0.52	0.78	1.30
EA318	0.98	0.84	1.82
EA319C	11.05	10.82	21.87
EA319V	84.87	78.75	163.62
EA320C	43.45	44.89	88.34
EA320V	80.02	70.79	150.81
EA321C	15.94	16.11	32.05
EA321V	39.62	36.32	75.94
EA33	10.43	13.37	23.80
EA34	3.91	5.53	9.44
EA346	10.61	13.46	24.07
EA38GP	1.04	1.86	2.90
EA38R	1.94	0.58	2.52
ERJ	11.66	10.40	22.06
ERJ170	0.15	0.14	0.28
ERJ190	0.61	0.62	1.23
EXE2	0.02	0.01	0.03
EXE3	2.09	1.95	4.04
FK10	3.84	4.93	8.77
IL62	< 0.01	0.00	< 0.01
L4P	< 0.01	< 0.01	0.01
LTT	0.38	0.04	0.42

ANCON type	Departures	Arrivals	Total movements
MD80	3.55	3.98	7.53
STP	0.01	0.00	0.01
STT	0.04	0.04	0.08
TU54	0.01	0.01	0.02
Total	**493.15**	**469.68**	**962.84**

Note: Totals may not sum exactly due to rounding.

Table 2 Heathrow 2011 annual average 4-hour evening (1900-2300) movements by ANCON aircraft type

ANCON type	Departures	Arrivals	Total movements
B717	0.15	0.69	0.85
B727	0.01	0.00	0.01
B732	< 0.01	< 0.01	0.01
B733	2.51	2.17	4.68
B736	2.90	2.01	4.92
B738	2.47	2.12	4.59
B744G	1.53	0.40	1.93
B744P	2.80	0.34	3.14
B744R	11.04	1.56	12.60
B747	0.01	0.00	0.01
B747SP	0.02	0.02	0.03
B753	0.18	0.19	0.38
B757C	0.49	0.54	1.03
B757E	1.26	2.77	4.03
B757P	0.29	0.23	0.51
B762	0.08	0.10	0.19
B763G	0.31	1.61	1.92
B763P	0.85	1.56	2.41
B763R	3.95	4.84	8.80
B764	0.01	0.00	0.02
B772G	5.10	1.92	7.02
B772P	0.73	0.04	0.78
B772R	5.68	1.31	6.99
B773G	8.40	2.52	10.92
B773R	0.67	0.77	1.44
BA46	0.73	1.12	1.85
CRJ	0.03	0.01	0.04
CRJ700	0.10	0.03	0.13
CRJ900	0.15	0.01	0.17
EA30	0.44	0.85	1.29
EA31	0.31	0.07	0.38
EA318	0.14	0.28	0.42
EA319C	4.04	5.11	9.14
EA319V	17.27	25.43	42.70
EA320C	13.44	14.77	28.22
EA320V	17.59	27.77	45.36
EA321C	3.66	4.63	8.28
EA321V	8.44	12.60	21.04
EA33	7.78	2.14	9.92
EA34	5.06	1.60	6.66
EA346	7.34	0.93	8.27
EA38GP	0.98	0.19	1.17
EA38R	1.73	0.68	2.41
ERJ	2.22	3.55	5.77
ERJ170	0.00	0.06	0.06
ERJ190	0.12	0.16	0.28
EXE3	0.52	0.63	1.15
FK10	1.26	0.46	1.72
IL62	0.00	< 0.01	< 0.01
L101	< 0.01	< 0.01	0.01
L4P	< 0.01	< 0.01	0.01
LTT	0.01	0.38	0.40
MD80	0.84	0.47	1.32
STP	0.00	< 0.01	< 0.01
Total	**145.67**	**131.68**	**277.35**

Note: Totals may not sum exactly due to rounding.

Table 3 Heathrow 2011 annual average 8-hour night (2300-0700) movements by ANCON aircraft type

ANCON type	Departures	Arrivals	Total movements
B717	0.00	0.02	0.02
B733	1.23	0.02	1.25
B736	0.04	0.00	0.04
B738	0.66	0.02	0.68
B744G	0.07	0.98	1.05
B744P	0.23	1.99	2.22
B744R	0.71	14.70	15.41
B747SP	0.01	0.00	0.01
B753	0.01	0.00	0.01
B757C	0.18	0.00	0.18
B757E	0.10	1.01	1.12
B757P	0.02	0.01	0.03
B762	0.02	0.01	0.02
B763G	0.01	1.39	1.40
B763P	0.11	0.93	1.04
B763R	0.34	0.93	1.27
B764	0.00	1.62	1.63
B772G	0.51	8.84	9.35
B772P	0.00	1.26	1.26
B772R	0.26	5.58	5.83
B773G	0.42	2.03	2.46
B773R	0.11	0.48	0.59
BA46	0.13	0.01	0.14
CRJ900	0.00	< 0.01	< 0.01
EA30	0.54	0.01	0.55
EA31	0.02	0.00	0.03
EA319C	1.12	0.29	1.41
EA319V	2.50	0.47	2.97
EA320C	2.99	0.20	3.20
EA320V	2.24	1.28	3.52
EA321C	1.29	0.15	1.44
EA321V	1.25	0.41	1.66
EA33	0.35	3.04	3.39
EA34	0.35	2.18	2.53
EA346	0.77	4.33	5.10
EA38GP	0.03	0.00	0.03
EA38R	0.07	2.46	2.53
ERJ	0.14	0.08	0.22
ERJ170	0.05	0.00	0.05
ERJ190	0.06	0.00	0.06
EXE2	0.00	< 0.01	< 0.01
EXE3	0.24	0.34	0.58
FK10	0.30	0.01	0.30
LTT	0.13	0.08	0.21
MD80	0.06	0.00	0.06
STP	0.01	0.01	0.02
STT	0.01	0.01	0.02
Total	**19.68**	**57.22**	**76.90**

Note: Totals may not sum exactly due to rounding.

Table 4 Heathrow 2011 annual average 24-hour (0000-2400) movements by ANCON aircraft type

ANCON type	Departures	Arrivals	Total movements
B717	1.53	1.53	3.07
B727	0.04	0.04	0.08
B732	0.11	0.11	0.22
B733	11.71	11.70	23.42
B736	10.47	10.47	20.93
B738	12.18	12.19	24.37
B744G	5.50	5.50	11.00
B744P	5.78	5.78	11.56
B744R	38.78	38.82	77.60
B747	0.02	0.02	0.03
B747SP	0.08	0.08	0.16
B753	0.22	0.22	0.44
B757C	0.67	0.67	1.34
B757E	9.04	9.02	18.06
B757P	0.69	0.68	1.37
B762	0.23	0.23	0.46
B763G	7.58	7.58	15.16
B763P	6.28	6.28	12.55
B763R	20.90	20.92	41.83
B764	8.31	8.30	16.61
B772G	24.68	24.68	49.36
B772P	5.08	5.08	10.16
B772R	25.74	25.75	51.48
B773G	20.89	20.87	41.76
B773R	1.72	1.72	3.44
BA46	2.92	2.92	5.85
CRJ	0.09	0.09	0.19
CRJ700	0.25	0.25	0.50
CRJ900	1.27	1.27	2.54
EA30	2.28	2.29	4.57
EA31	0.85	0.85	1.71
EA318	1.12	1.12	2.24
EA319C	16.21	16.22	32.42
EA319V	104.64	104.65	209.29
EA320C	59.88	59.87	119.75
EA320V	99.85	99.85	199.70
EA321C	20.89	20.89	41.77
EA321V	49.31	49.33	98.64
EA33	18.56	18.55	37.11
EA34	9.32	9.32	18.63
EA346	18.72	18.72	37.44
EA38GP	2.05	2.05	4.09
EA38R	3.73	3.73	7.46
ERJ	14.02	14.04	28.06
ERJ170	0.20	0.20	0.39
ERJ190	0.78	0.78	1.57
EXE2	0.02	0.02	0.03
EXE3	2.85	2.92	5.76
FK10	5.40	5.39	10.79
IL62	< 0.01	< 0.01	0.01
L101	< 0.01	< 0.01	0.01
L4P	0.01	0.01	0.01
LTT	0.53	0.51	1.03
MD80	4.45	4.45	8.90
STP	0.02	0.01	0.03

ANCON type	Departures	Arrivals	Total movements
STT	0.05	0.05	0.10
TU54	0.01	0.01	0.02
Total	**658.51**	**658.59**	**1317.09**

Note: Totals may not sum exactly due to rounding.

Table 5 Heathrow 2011 annual average 16-hour (0700-2300) movements by ANCON aircraft type

ANCON type	Departures	Arrivals	Total movements
B717	1.53	1.51	3.04
B727	0.04	0.04	0.08
B732	0.11	0.11	0.22
B733	10.48	11.68	22.16
B736	10.43	10.47	20.90
B738	11.52	12.16	23.68
B744G	5.43	4.52	9.95
B744P	5.56	3.79	9.34
B744R	38.08	24.12	62.19
B747	0.02	0.02	0.03
B747SP	0.07	0.07	0.15
B753	0.21	0.22	0.43
B757C	0.49	0.67	1.16
B757E	8.94	8.01	16.94
B757P	0.67	0.67	1.35
B762	0.21	0.22	0.44
B763G	7.57	6.19	13.76
B763P	6.17	5.34	11.51
B763R	20.56	19.99	40.55
B764	8.30	6.68	14.98
B772G	24.17	15.84	40.01
B772P	5.07	3.82	8.90
B772R	25.48	20.17	45.65
B773G	20.46	18.84	39.30
B773R	1.61	1.24	2.85
BA46	2.80	2.91	5.71
CRJ	0.09	0.09	0.19
CRJ700	0.25	0.25	0.50
CRJ900	1.27	1.27	2.53
EA30	1.75	2.28	4.03
EA31	0.83	0.85	1.68
EA318	1.12	1.12	2.24
EA319C	15.09	15.92	31.01
EA319V	102.14	104.19	206.32
EA320C	56.89	59.67	116.55
EA320V	97.61	98.56	196.17
EA321C	19.60	20.74	40.34
EA321V	48.06	48.92	96.98
EA33	18.21	15.51	33.72
EA34	8.97	7.13	16.10
EA346	17.95	14.39	32.34
EA38GP	2.02	2.04	4.06
EA38R	3.66	1.27	4.93
ERJ	13.88	13.95	27.84
ERJ170	0.15	0.20	0.35
ERJ190	0.73	0.78	1.51
EXE2	0.02	0.01	0.03
EXE3	2.61	2.58	5.19
FK10	5.10	5.39	10.49
IL62	< 0.01	< 0.01	0.01
L101	< 0.01	< 0.01	0.01
L4P	0.01	0.01	0.01
LTT	0.39	0.42	0.82
MD80	4.39	4.45	8.85
STP	0.01	0.01	0.01

ANCON type	Departures	Arrivals	Total movements
STT	0.04	0.04	0.08
TU54	0.01	0.01	0.02
Total	**638.83**	**601.36**	**1240.19**

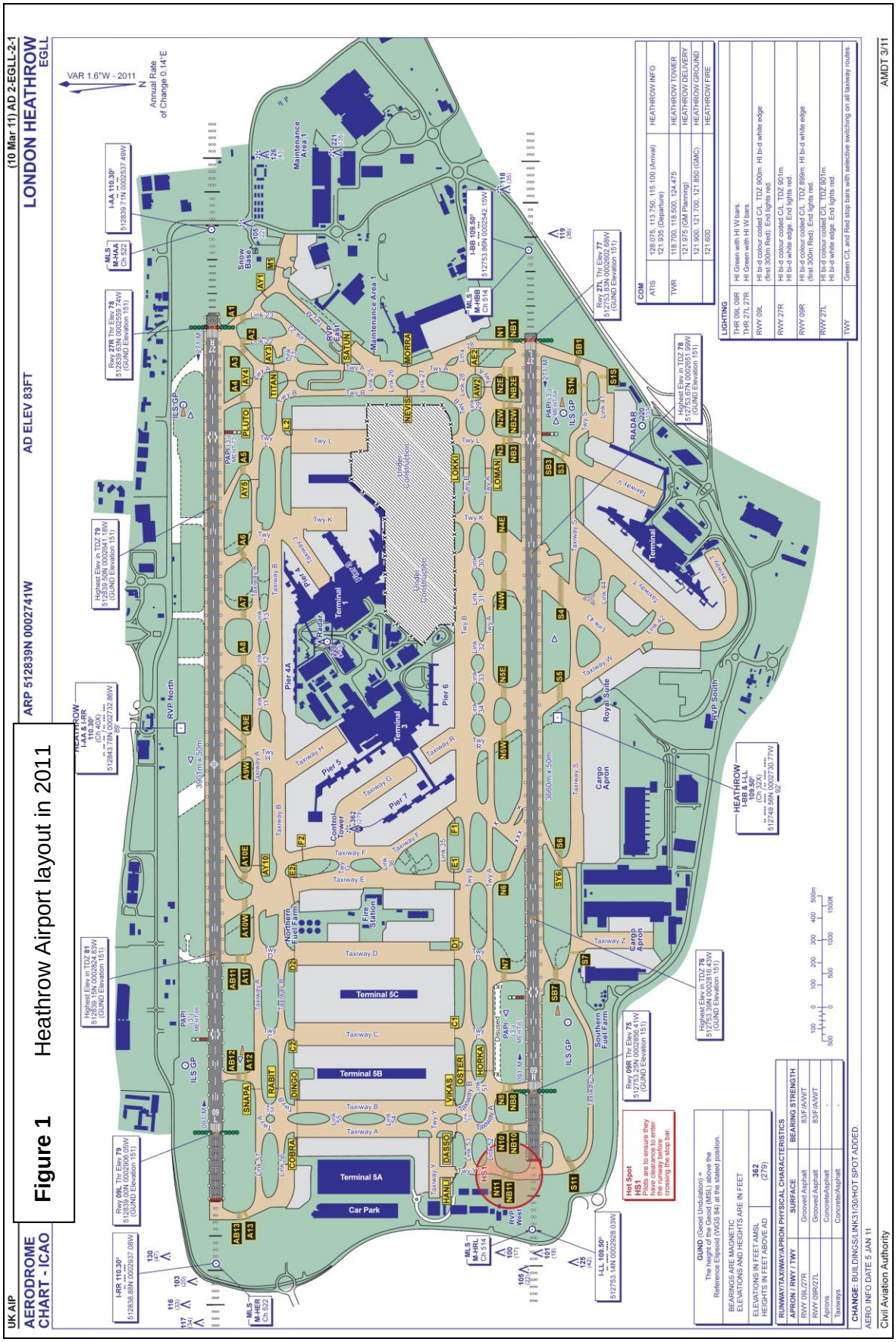
Note: Totals may not sum exactly due to rounding.

Table 6 ANCON aircraft type descriptions

ANCON Type	Type Description
B717	Boeing 717
B727	Boeing 727 (Chapter 2&3)
B732	Boeing 737-200 (Chapter 2&3)
B733	Boeing 737-300/400/500 series
B736	Boeing 737-600/700 series
B738	Boeing 737-800/900 series
B747	Boeing 747-100 & 200/300 series (certificated to Chapter 3)
B744G	Boeing 747-400 series with General Electric engines
B744P	Boeing 747-400 series with Pratt and Whitney engines
B744R	Boeing 747-400 series with Rolls-Royce engines
B747SP	Boeing 747SP series
B753	Boeing 757-300
B757C	Boeing 757-200 series with RB211-535C engines
B757E	Boeing 757-200 series with RB211-535E4/E4B engines
B757P	Boeing 757-200 series with Pratt and Whitney engines
B762	Boeing 767-200 series
B763G	Boeing 767-300 series with General Electric engines
B763P	Boeing 767-300 series with Pratt and Whitney engines
B763R	Boeing 767-300 series with Rolls-Royce engines
B764	Boeing 767-400 series
B772G	Boeing 777-200 series with General Electric engines
B772P	Boeing 777-200 series with Pratt and Whitney engines
B772R	Boeing 777-200 series with Rolls-Royce engines
B773G	Boeing 777-300 series with General Electric engines
B773R	Boeing 777-300 series with Rolls-Royce engines
BA46	BAe 146/Avro RJ series
CRJ	Bombardier Regional Jet 100/200
CRJ700	Bombardier Regional Jet 700
CRJ900	Bombardier Regional Jet 900
DC8	McDonnell Douglas DC8 series
DC87	McDonnell Douglas DC8-70 series
DC9	McDonnell Douglas DC9 series
DC10	McDonnell Douglas DC10 series
EA30	Airbus A300 series
EA31	Airbus A310 series
EA318	Airbus A318 series
EA319C	Airbus A319 series with CFM-56 engines
EA319V	Airbus A319 series with AE-V2500 engines
EA320C	Airbus A320 series with CFM-56 engines
EA320V	Airbus A320 series with AE-V2500 engines
EA321C	Airbus A321 series with CFM-56 engines
EA321V	Airbus A321 series with AE-V2500 engines
EA33	Airbus A330 series
EA34	Airbus A340-200/300/500 series
EA346	Airbus A340-600
EA38GP	Airbus A380 with Engine Alliance GP7000 engines
EA38R	Airbus A380 with Rolls-Royce Trent 900 engines
ERJ	Embraer EMB135/145 series
ERJ170	Embraer E-170
ERJ190	Embraer E-190

ANCON Type	Type Description
EXE2	Chapter 2 executive jets
EXE3	Chapter 3 executive jets
FK10	Fokker 70/100 series
IL62	Ilyushin IL-62/VC10
L101	Lockheed L1011-TriStar series
L4P	Large four-engined propeller
LTT	Large twin-turboprop
MD11	McDonnell-Douglas MD11 series
MD80	McDonnell-Douglas MD80 series
MD90	McDonnell-Douglas MD90 series
SP	Single piston
STP	Small twin-piston
STT	Small twin-turboprop
TU54	Tupolev Tu-154 series

Figure 1 Heathrow Airport layout in 2011



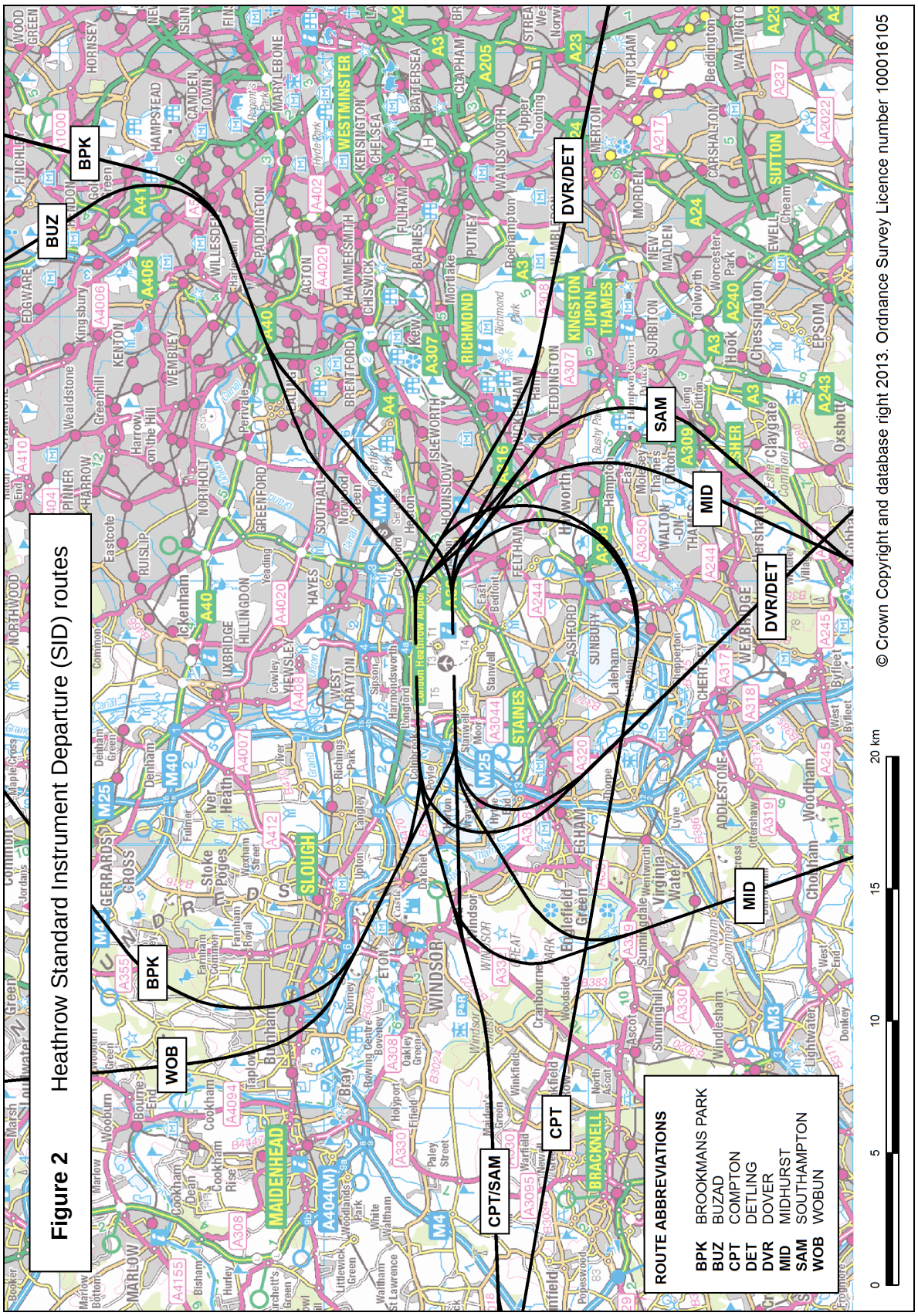


Figure 2 Heathrow Standard Instrument Departure (SID) routes
BPK
BUZ
BPK
WOB
CPT/SAM
CPT
MID
DVR/DET
SAM
MID
DVR/DET
ROUTE ABBREVIATIONS
BPK BROOKMANS PARK
BUZ BUZAD
CPT COMPTON
DET DETLING
DVR DOVER
MID MIDHURST
SAM SOUTHAMPTON
WOB WOBUN
0 5 10 15 20 km
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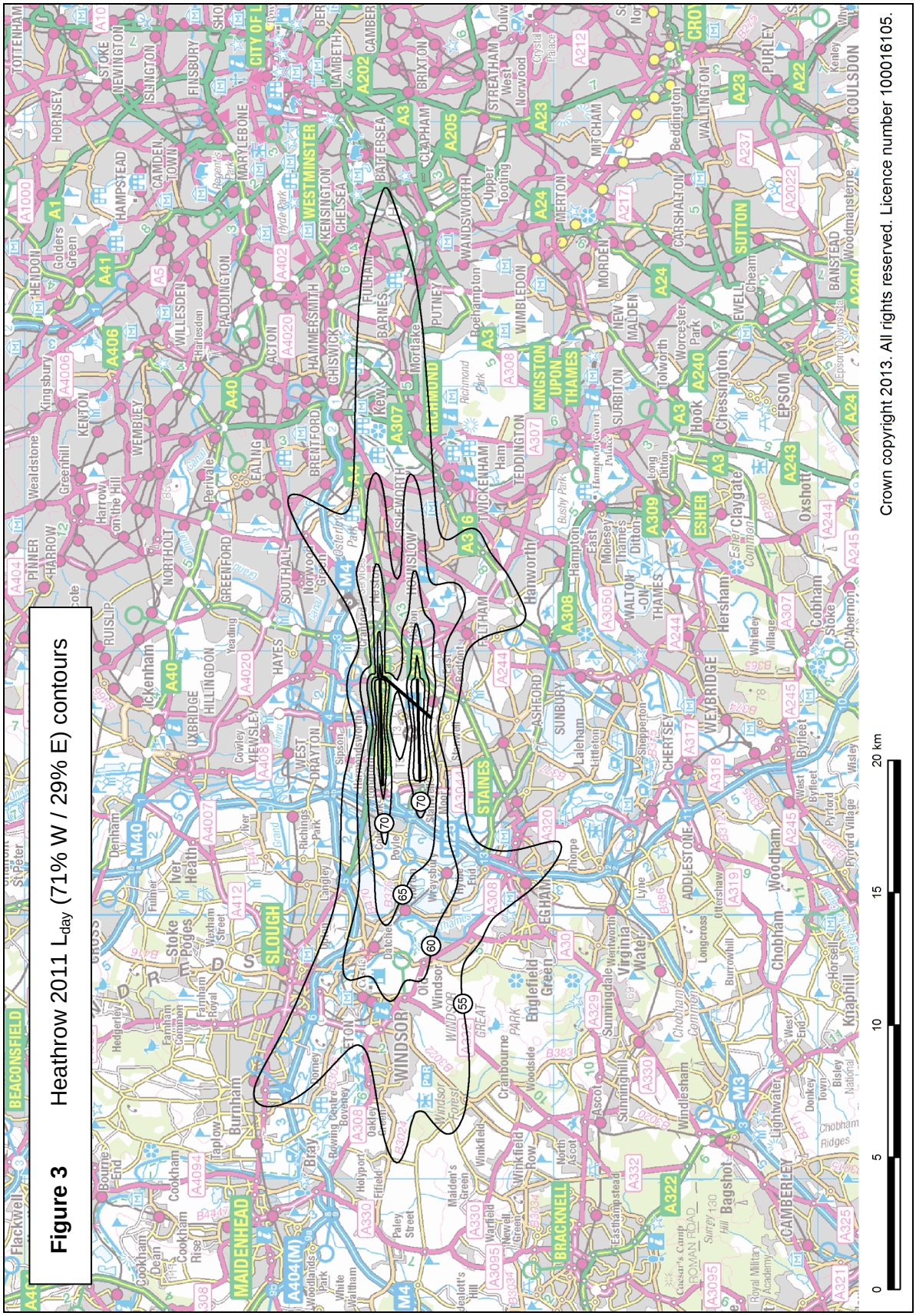

Figure 3 Heathrow 2011 L_{day} (71% W / 29% E) contours

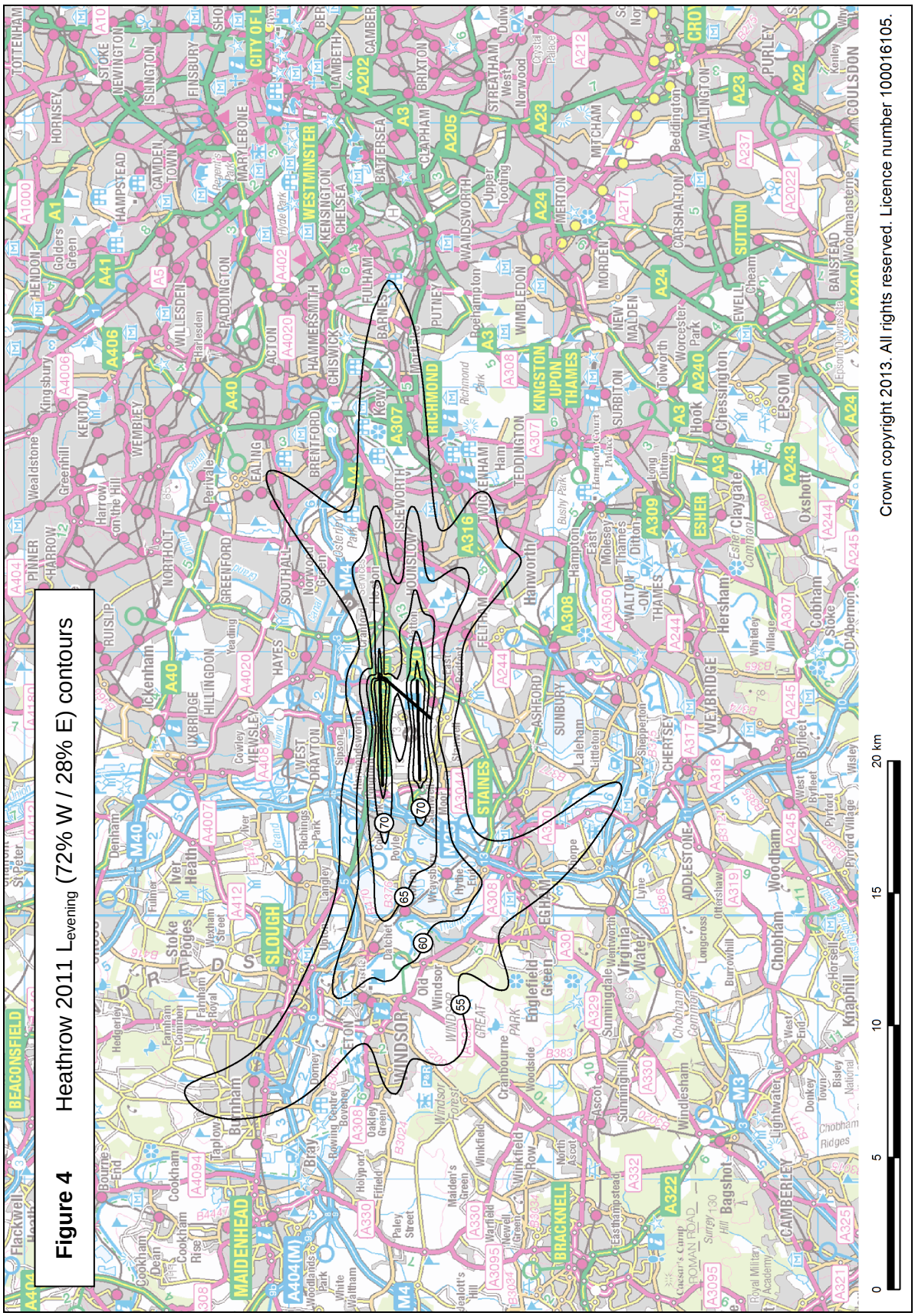
Heathrow 2011 Levening (72% W / 28% E) contours
70
70
65
60
55
0
5
10
15
20 km
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Figure 4

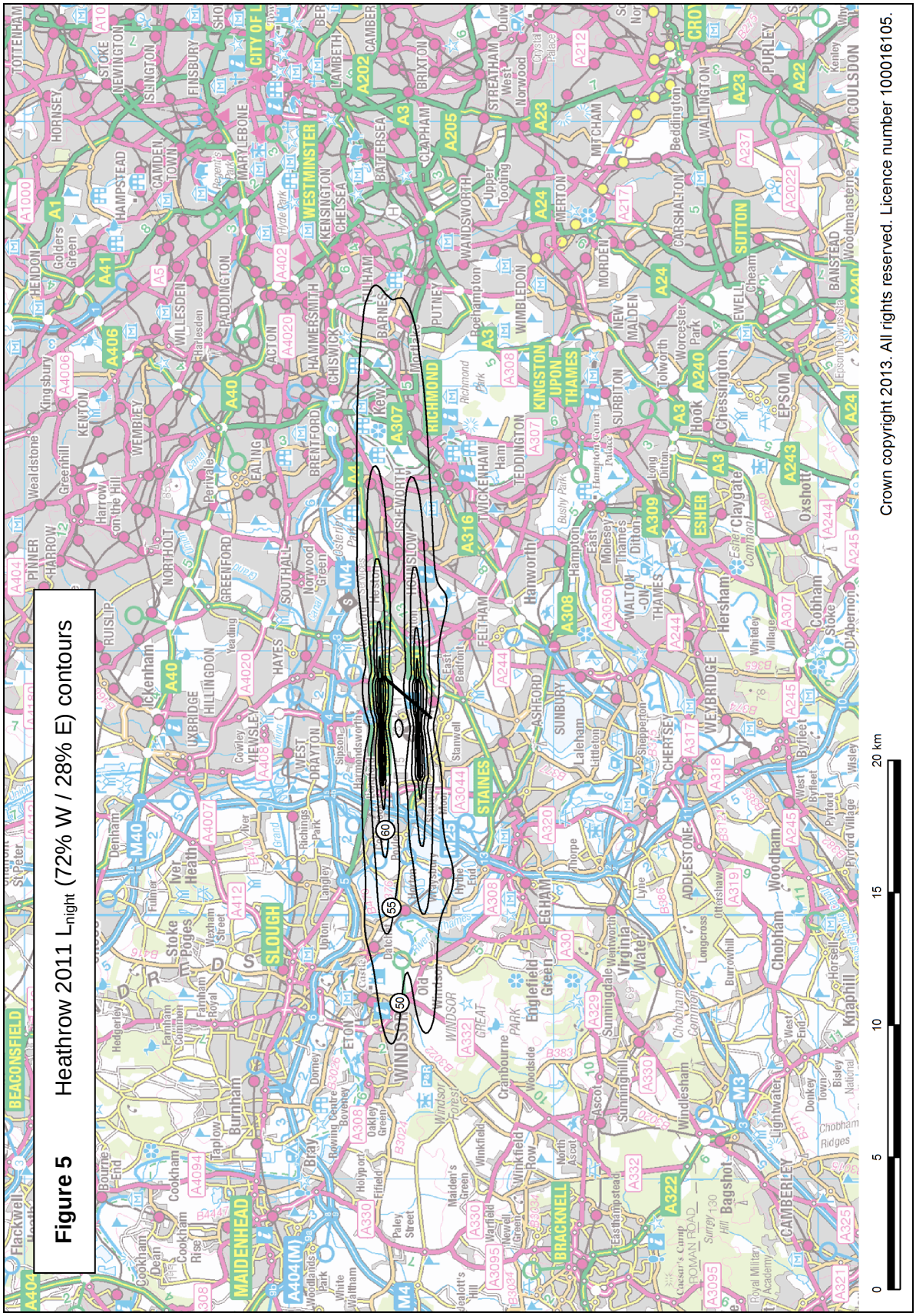
Heathrow 2011 Lnight (72% W / 28% E) contours
50
55
60
0
5
10
15
20 km
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Figure 5

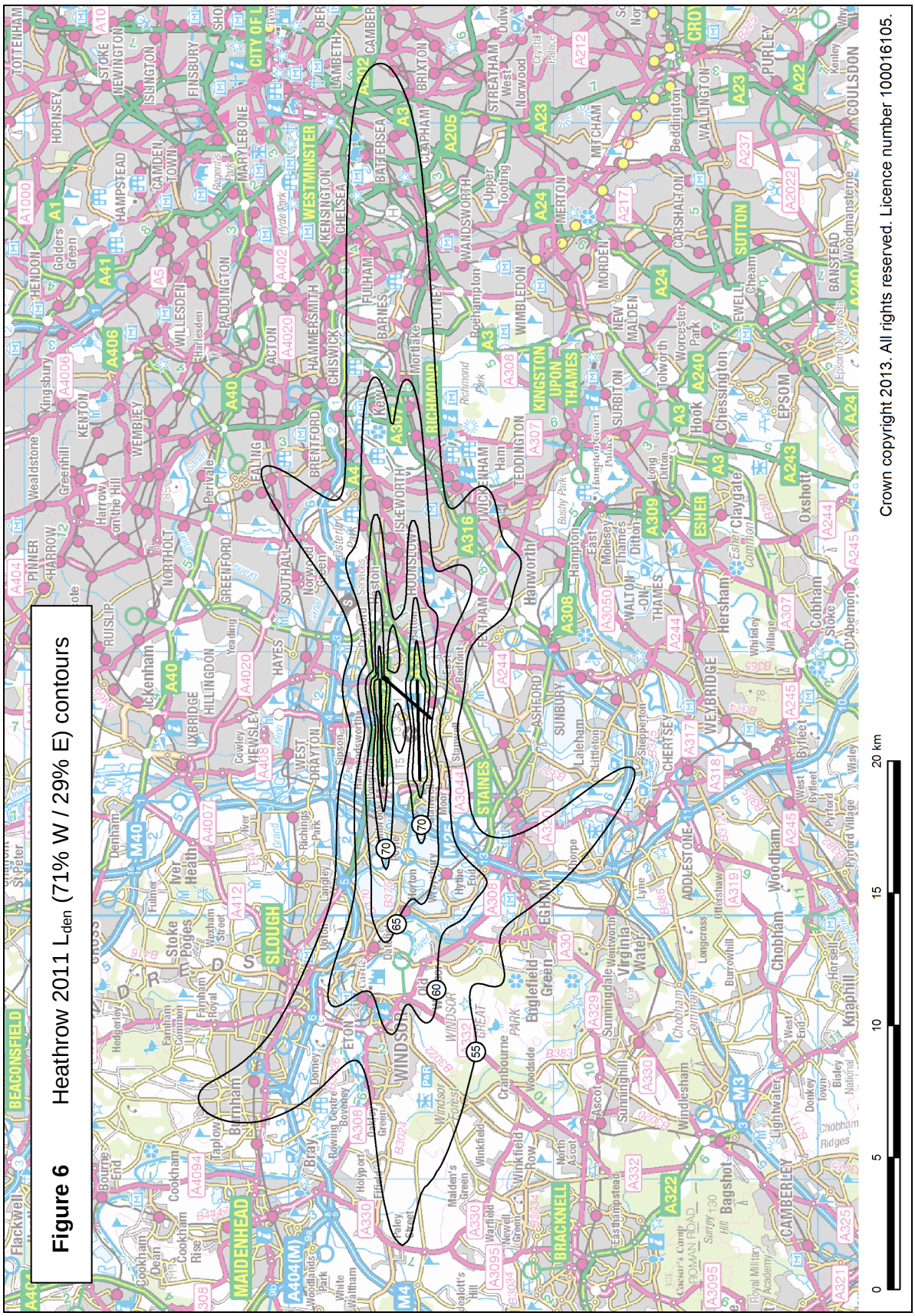

Figure 6

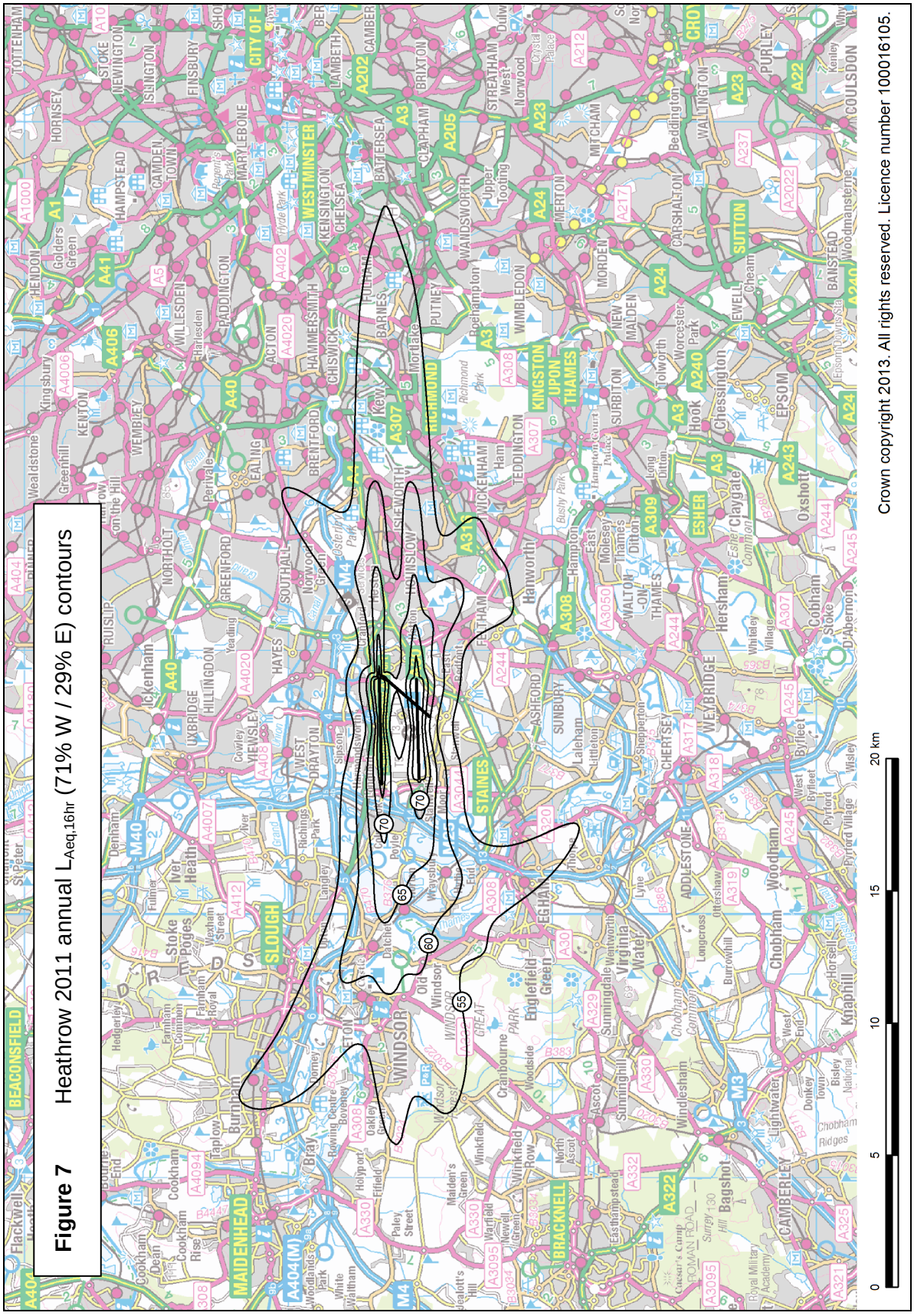

Figure 7 Heathrow 2011 annual $L_{Aeq,16hr}$ (71% W / 29% E) contours

Appendix A – Results in Cumulative Format

Table A1 Heathrow 2011 L_{day} - area, population and household estimates in cumulative format

L_{day} contour (dBA)	**Area (km^2)**	**Population (x1000)**	**Households (x1000)**
> 55	160.3	454.5	185.7
> 60	56.9	115.5	41.7
> 65	23.8	21.1	7.2
> 70	7.7	1.7	0.7
> 75	2.9	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

Table A2 Heathrow 2011 $L_{evening}$ - area, population and household estimates in cumulative format

$L_{evening}$ contour (dBA)	**Area (km^2)**	**Population (x1000)**	**Households (x1000)**
> 55	163.0	425.5	169.5
> 60	56.3	100.4	36.0
> 65	23.5	15.6	5.5
> 70	7.9	1.3	0.6
> 75	3.1	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

Table A3 Heathrow 2011 L_{night} - area, population and household estimates in cumulative format

L_{night} contour (dBA)	**Area (km^2)**	**Population (x1000)**	**Households (x1000)**
> 50	74.6	211.3	83.8
> 55	26.8	67.1	23.2
> 60	9.2	15.2	4.9
> 65	3.3	1.6	0.5
> 70	1.5	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

Table A4 Heathrow 2011 L_{den} - area, population and household estimates in cumulative format

L_{den} contour (dBA)	**Area (km^2)**	**Population (x1000)**	**Households (x1000)**
> 55	221.9	766.1	329.9
> 60	79.9	191.5	73.6
> 65	31.9	52.7	18.3
> 70	10.9	6.6	2.2
> 75	3.9	0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.

Table A5 Heathrow 2011 annual $L_{Aeq,16hr}$ - area, population and household estimates in cumulative format

Annual $L_{Aeq,16hr}$ contour (dBA)	**Area (km^2)**	**Population (x1000)**	**Households (x1000)**
> 55	160.1	449.1	182.1
> 60	56.6	110.4	39.6
> 65	23.7	19.3	6.6
> 70	7.8	1.5	0.6
> 75	3.0	< 0.1	< 0.1

Note: Population and household estimates have been supplied by Defra and are based on the 2011 Census.