Environmental Research and Consultancy Department
Civil Aviation Authority

ERCD REPORT 1403

Noise Exposure Contours for Stansted Airport 2013

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Prepared by the Civil Aviation Authority on behalf of the Department for Transport, October 2014

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Summary

This report presents the year 2013 average summer day and night noise exposure contours for London Stansted Airport. Contours have been generated for the night period (2300-0700 local time) for the first time to meet the requirements of the Aviation Policy Framework published in March 2013.

The 57 dBA Leq day contour area for 2013 based on the actual runway modal split was calculated to be 20.0 km^2, 5% lower than in 2012. The population enclosed within the actual 57 dBA contour was unchanged at 1,250. The 48 dBA Leq night actual contour area was calculated to be 51.5 km^2, enclosing a population of 6,400.

October 2014

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 based on 2011 Census data (updated for 2013) supplied by CACI Information Services.

Contents

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.

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.

CDA Continuous Descent Approach.

DfT Department for Transport (UK Government).

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

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.

NPD Noise-Power-Distance.

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.

OS Ordnance Survey®, Great Britain's national mapping agency.

SEL The Sound Exposure Level of an aircraft noise event is the steady noise level, which over a period of *one second* contains the same sound energy as the whole event. It is equivalent to the Leq of the noise event normalised to one second.

SID Standard Instrument Departure.

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Executive Summary

This report presents the year 2013 average summer day and night noise exposure contours generated for London Stansted Airport. Night period (2300-0700 local time) contours have been produced for the first time to meet the requirements of the Aviation Policy Framework published in March 2013.

The noise modelling used radar and noise data from Stansted's Noise and Track Keeping (NTK) system. Mean flight tracks and lateral dispersions for each route, and average flight profiles of aircraft height, speed and thrust for each aircraft type, were calculated using these data.

Analysis of the 2013 summer traffic data for Stansted revealed that average daily movements for the daytime period (356.0) decreased by 4% (2012: 369.6). There were on average 66.1 movements per 8-hour night over the summer period.

The area of the 2013 day actual modal split (71% south-west / 29% north-east) 57 dBA Leq contour decreased by 5% to 20.0 km^2 from 2012. This is the smallest ever contour area calculated for Stansted. The population count of 1,250 within the 2013 actual 57 dBA Leq day contour was the same as in 2012.

The area of the 2013 day standard modal split (71% south-west / 29% north-east) 57 dBA Leq contour also decreased, by 4%, to 20.0 km^2 and as such is well below the Planning Condition AN1 contour area limit of 33.9 km^2. The population count within the 57 dBA standard day Leq contour was the same as in 2012 at 1,250.

The area of the 2013 actual 48 dBA Leq night contour was 51.5 km^2, enclosing a population of 6,400.

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1 Introduction

1.1 Background

1.1.1 Each year the Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) calculates the noise exposure around London Stansted Airport on behalf of the Department for Transport (DfT). A computer model, ANCON, validated with noise measurements, is used to estimate the noise exposure. The model calculates the emission and propagation of noise from arriving and departing air traffic.

1.1.2 The noise exposure metric used is the Equivalent Continuous Sound Level, or Leq 16-hour (0700-2300 local time), which is calculated over the 92-day summer period from 16 June to 15 September. The background to the use of this index is explained in DORA Report 9023 (**Ref 1**).

1.1.3 Noise exposure is depicted in the form of noise contours, i.e. lines joining places of constant Leq, akin to the height contours shown on geographical maps or isobars on a weather chart. In the UK, Leq noise contours are normally plotted at levels from 57 to 72 dBA, in 3 dB steps.[1] The 57 dBA level denotes the approximate onset of significant community annoyance.

1.1.4 Following the publication of the Aviation Policy Framework in March 2013 (**Ref 2**), there is now a commitment by the DfT to produce night (2300-0700) noise contours on an annual basis for the designated airports. So for the first time this year, 8-hour night Leq contours have also been calculated for Stansted from 48 to 72 dBA in 3 dB steps in accordance with standard practice.

1.1.5 This report contains small-scale diagrams of the year 2013 Stansted Leq contours overlaid onto Ordnance Survey® (OS) base maps. Diagrams in Adobe® PDF and AutoCAD DXF format are also available for download from the DfT website[2].

1.1.6 The objectives of this report are to explain the noise modelling methodology used to produce the year 2013 day and night Leq contours for Stansted Airport, to present the calculated noise contours and to assess the changes from the previous year (**Ref 3**).

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[1] Aircraft noise contours are also produced on behalf of airports for the specific purpose of meeting the requirements of the Environmental Noise (England) Regulations 2006, which implemented Directive 2002/49/EC, Assessment and Management of Environmental Noise, in England. These are based on annual average values and require the use of different parameters (L_{day}, $L_{evening}$, L_{night}, $L_{eq,16hr}$ and L_{den} at 5 dB steps), so it is not possible to draw meaningful conclusions between the two types of contour maps. Further details about Directive 2002/49/EC are available on the Department for Environment, Food and Rural Affairs website at *www.gov.uk/defra* as well as ERCD Reports 1204, 1205 and 1206 (available from *www.caa.co.uk*), which cover Heathrow, Gatwick and Stansted 2011 noise mapping respectively.

[2] www.gov.uk/dft

1.2 Stansted Airport

1.2.1 Stansted Airport is situated 35 miles (56 km) north-east of London and is surrounded by countryside and small villages to the north, south and east, and by the town of Bishop's Stortford to the west (**Figure 1**).

1.2.2 Stansted Airport has a single runway (04/22), which is 3,049 m long. The landing threshold[3] for Runway 04 is displaced by 300 m. There is one main passenger terminal. The layout of the runway, taxiways and passenger terminal in 2013 is shown in **Figure 2.**[4]

1.2.3 In the 2013 calendar year there were 146,000 aircraft movements (2012: 144,000) at Stansted Airport, handling 17.9 million passengers (2012: 17.5 million).[5]

1.2.4 Following the granting of planning permission for the Stansted G1 proposal on 8 October 2008, the following planning condition ('Planning Condition AN1') came into force:

> "The area enclosed by the 57dB(A) Leq16hr (0700-2300) contour, when calculated and measured by the Civil Aviation Authority's Aircraft Noise Contour Model 2.3 or as may be amended, shall not exceed 33.9 sq km using the standardised average mode from the date of grant of this permission. Any necessary account shall be taken of this requirement in declaring the capacity of Stansted Airport for the purpose of Council Regulation (EEC) No 95/93 of 18 January 1993 on common rules for the allocation of slots at Community airports. Forecast aircraft movements and consequential noise contours for the forthcoming year shall be reported to the Local Planning Authority annually on the 31st January each year."

1.2.5 Based on the above planning condition, the area of the standard (i.e. 20-year average) runway modal split 57 dBA Leq contour is not to exceed a limit of 33.9 km^2.

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[3] The runway threshold marks the beginning of the runway available for landing aircraft. A *displaced* threshold is a runway threshold that is not located at the physical end of the runway. A displaced threshold is often employed to give arriving aircraft sufficient clearance over an obstacle.

[4] UK AIP (13 Dec 2012) AD 2-EGSS-2-1

[5] Source: Civil Aviation Authority (www.caa.co.uk/airportstatistics)

2 Noise contour modelling methodology

2.1 ANCON noise model

2.1.1 Leq 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 4**). The ANCON model is also used for the production of annual contours for Heathrow and Gatwick 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 5**). This guidance document represents internationally agreed best practice as implemented in modern aircraft noise models.

2.2 Radar data

2.2.1 The noise modelling carried out by ERCD made extensive use of radar data extracted from Stansted Airport's Noise and Track Keeping (NTK) system. Most large airports have NTK systems, which take data from Air Traffic Control (ATC) radars and combine them with flight information such as call sign, tail number, type and destination. Analyses of departure and arrival flight tracks, and flight profiles, were based on year 2013 summer radar data.

2.3 Flight tracks

2.3.1 Aircraft departing Stansted are required to follow specific flight paths called Noise Preferential Routes (NPRs) unless directed otherwise by 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. The Stansted SIDs are illustrated in **Figure 3**.

2.3.2 Associated with each NPR is a lateral swathe, which is defined by a pair of lines that diverge at 10 degrees from a point 2,000 m from start-of-roll, leading to a corridor extending 1.5 km either side of the nominal NPR centreline. Within this swathe the aircraft are considered to be flying on-track. The swathe takes account of various factors that affect track-keeping, including tolerances in navigational equipment, type and weight of aircraft, and weather conditions – particularly winds that may cause drifting when aircraft are turning. Aircraft reaching an altitude of

4,000 ft[6] 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).

2.3.3 Departure and arrival flight tracks were modelled using radar data extracted from the Stansted NTK system over the 92-day summer period, 16 June to 15 September 2013. Mean flight tracks were calculated from 24-hour data this time since both day and night contours were being produced (in previous years only daytime radar data were employed).

2.3.4 **Figure 4** shows a sample of radar flight tracks from a day in July 2013. In-house radar analysis software was used to calculate mean departure flight tracks and associated lateral dispersions for each NPR/SID. Arrival tracks for Runways 04 and 22 were modelled using evenly spaced 'spurs' about the extended runway centrelines. The majority of arriving aircraft joined the centrelines at distances between 9 and 23 km from threshold for Runway 04, and between 11 and 24 km from threshold for Runway 22.

2.4 Flight profiles

2.4.1 For each ANCON aircraft type, average flight profiles of height, speed and thrust versus track distance (for departures and arrivals separately) were reviewed and updated where necessary, using year 2013 summer radar data. The engine power settings required for the aircraft to follow the average height and speed profiles were calculated from data describing aircraft performance characteristics within each of the different aircraft type categories.

2.4.2 Daytime flight profiles were generated as in previous years. Following a check on night-time profile data, it was concluded that the profiles generated from the daytime data were appropriate for use with the night contours.

2.4.3 Examination of the 2013 radar data indicated that, as in the preceding years, at distances greater than 10 km from the runway threshold, the average aircraft heights for arrivals on Runway 04 were generally somewhat lower than on Runway 22. This follows the introduction of Continuous Descent Approach (CDA) for Runway 22 arrivals via the Abbott stack from 4 November 1999 and its extension to all Runway 22 arrivals in 2000. Separate Runway 22 and Runway 04 descent profiles were therefore used to model arrivals for all aircraft types.

2.4.4 The application of reverse thrust following touchdown was modelled for all ANCON types where applicable. Reverse thrust was included in both the day and night contours.

[6] 3,000 ft for aircraft on the 'Buzad' departure routes in the period 0600-2330.

2.5 Noise emissions

2.5.1 At Stansted, the NTK system captures data from both fixed and mobile noise monitors around the airport. Noise event data for individual aircraft operations are then matched to operational data provided by the airport. The Stansted NTK system employs 8 fixed monitors (positioned approximately 6.5 km from start-of-roll), together with a number of mobile monitors that can be deployed anywhere within the NTK radar coverage area.[7]

2.5.2 The noise data collected are screened by ERCD with reference to several criteria so that only high quality data are used in the analysis. First of all, noise data that lie outside a 'weather window' are discarded. This ensures that the data used are not affected by adverse meteorological conditions such as precipitation and strong winds. Secondly, the maximum noise level of the aircraft event must exceed the noise monitor threshold by at least 10 dB to avoid underestimates of the Sound Exposure Level (SEL). Thirdly, only measurements obtained from aircraft operations that pass through a 60-degree inverted cone, centred at the noise monitor, are retained in order to minimise the effects of lateral attenuation[8] and lateral directivity[9].

2.5.3 The ANCON model calculates aircraft noise using a noise database expressing SEL as a function of engine power setting and slant distance to the receiver – the so-called 'Noise-Power-Distance' (NPD) relationship. The ANCON noise database is continually reviewed and updated with adjustments made annually when measurements show this to be necessary.

2.6 Traffic distributions

2.6.1 The Leq contours are based on the daily average movements that take place during the 16-hour day (0700-2300 local time) and 8-hour night (2300-0700 local time), over the 92-day summer period from 16 June to 15 September inclusive. The source of this information is the NTK system, which stores radar data supplemented by daily flight plans. Traffic statistics from NTK data were cross-checked with runway logs supplied by NATS[10] and close agreement was found.

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[7] Further information on the noise monitors can be found in CAP 1149 (**Ref 6**).

[8] Lateral attenuation is the excess sound attenuation caused by the ground surface, which can be significant at low angles of elevation.

[9] Lateral directivity is the non-uniform directionality of sound radiated laterally about the roll axis of the aircraft – this is influenced to a large extent by the positioning of the engines.

[10] NATS is the provider of air traffic control services to Stansted Airport.

Daytime traffic distribution by noise class

2.6.2 The average number of daily movements at Stansted over the 2013 summer day period (356.0) was 4% lower than in the previous year (2012: 369.6).

2.6.3 **Table 1a** lists the average summer day movements[11] by 8 noise classes of aircraft, ranked in ascending order of noise emission, i.e. from least to most noisy, in 2012 and 2013. As in 2012, the vast majority of movements (93%) were by short-haul jet aircraft (Noise Class 3), however, their numbers declined by 4% to 330 per day in 2013. (Note: in 2013 an estimated 99% of the aircraft within Noise Class 3 for the daytime period were compliant with the 'Chapter 4' noise standard[12]).

2.6.4 There were relatively few movements by aircraft in Noise Classes 2, 4 and 5, and almost insignificant numbers in Noise Classes 1, 6, 7 and 8. Noise Class 5 (second-generation wide-body 3/4-engine aircraft, e.g. B747-8) had the second highest number of aircraft, but only comprised 2.8% of total movements. This was closely followed by Noise Class 2 (large propeller aircraft), representing 2.5% of total movements.

2.6.5 **Figure 5** illustrates the changing distribution of traffic among the 8 noise classes over the period from 1988 to 2013 inclusive. The increasing dominance of short-haul Chapter 3 & 4 jet movements (Noise Class 3) over the years at Stansted can be clearly seen.

Night-time traffic distribution by noise class

2.6.6 Average movements per 8-hour night were 66.1, of which 53% were arrivals.

2.6.7 **Table 1b** lists the average summer night movements by 8 noise classes of aircraft, ranked in ascending order of noise emission, i.e. from least to most noisy, in 2013. Short-haul jet aircraft (Noise Class 3) formed the highest proportion of movements (91%). (Note: in 2013 an estimated 98% of the aircraft within Noise Class 3 for the night period were compliant with the 'Chapter 4' noise standard).

Daytime traffic distribution by ANCON aircraft type

2.6.8 A more detailed breakdown of the year 2013 average summer day movements, indicating the ANCON aircraft types that fall into each noise class, is provided in **Table 2a**. Comparison of the daily movement numbers for 2012 and 2013 shows that the largest reduction by far was for the ANCON type EA319C[13], with a

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[11] Includes departures and arrivals.

[12] In June 2001, following the fifth meeting of the Committee on Aviation Environmental Protection (CAEP/5), the Council of ICAO adopted a new 'Chapter 4' noise standard, which was more stringent than the previous 'Chapter 3' standard.

[13] EA319C = Airbus A319 with CFM-56 engines

decrease of 14 daily movements. The next largest decrease was for the EXE3[14], by 2 movements per day. The largest *increase* was an additional 4 daily movements for the ANCON type EA320C[15].

2.6.9 **Figure 6a** illustrates the numbers of movements by ANCON aircraft type for the 2013 average summer day. The B738 was clearly the most common ANCON aircraft type at Stansted, with 232 daily movements (65% of total movements), followed by the EA319C, with 52 daily movements (15% of total movements).

2.6.10 The B738 was the noise dominant ANCON type at Stansted because it was responsible for the highest contribution of 'noise energy', which is a function of both aircraft noise level and movement numbers.

Night-time traffic distribution by ANCON aircraft type

2.6.11 A more detailed breakdown of the year 2013 average summer night movements, indicating the ANCON types that fall into each noise class, is provided in **Table 2b**.

2.6.12 **Figure 6b** illustrates the numbers of movements by ANCON aircraft type for the 2013 average summer night. As for daytime, night movements were dominated by the B738 ANCON aircraft type with an average of 38 movements (58% of total night movements).

Daytime traffic distribution by SID route

2.6.13 **Figure 7a** shows the distribution of departing aircraft by SID route for the 2013 summer day period, including figures from 2012 for comparison. As in the previous year, the Runway 22 BUZ/BKY/CPT SIDs took the highest proportion of departure traffic over the summer period (32%), although this was 6% lower than in 2012. A significant decrease in traffic (-9%) was also seen on the Runway 22 DVR/LAM/LYD SIDs in 2013. Traffic increased by up to 6% on the Runway 04 SIDs.

Night-time traffic distribution by SID route

2.6.14 **Figure 7b** shows the distribution of departing aircraft by SID route for the 2013 summer night period. As for daytime the Runway 22 BUZ/BKY/CPT SIDs took the highest proportion of departure traffic over the summer night period (34%), followed by the Runway 22 DVR/LAM/LYD SIDs (24%).

[14] EXE3 = Executive Business Jet (Chapter 3)

[15] EA320C = Airbus A320 with CFM-56 engines

2.7 Runway modal splits

2.7.1 In general, aircraft will take-off and land into a headwind to maximise lift during take-off and maximise deceleration upon landing. The wind direction, which varies over the course of a year, will therefore have an important influence on the usage of runways. The ratio of south-westerly (i.e. Runway 22) and north-easterly (i.e. Runway 04) operations is referred to as the *runway modal split*.

2.7.2 Two sets of contours have been produced for the year 2013 summer day:

(i) Contours using the 'actual' modal split over the Leq day period; and

(ii) Contours assuming the 'standard' modal split over the Leq day period, i.e. the long-term modal split calculated from the 20-year rolling average; for 2013, this is the 20-year period from 1994 to 2013. Use of the standard modal split enables year-on-year comparisons without the runway usage significantly affecting the contour shape.

2.7.3 The actual and standard daytime modal splits for 2013, together with the previous year, are summarised in the table below:

Stansted summer day runway modal splits for 2013 and 2012

Modal split scenario	% south-west (Runway 22)	% north-east (Runway 04)
Actual 2013	71%	29%
Actual 2012	85%	15%
Standard 2013	71%	29%
Standard 2012	71%	29%

2.7.4 It can be seen that in 2013 the proportion of actual south-westerly movements reduced significantly, by 14%, compared to year 2012. The 2013 standard modal split of 71% south-west / 29% north-east was unchanged from 2012, and happened to be the same as the actual modal split. Historical runway modal splits at Stansted for the past 20 years are summarised in **Figure 8**.

2.7.5 The night-time actual runway modal split for the 2013 summer period was 70% south-west / 30% north-east.

2.8 Topography

2.8.1 The topography around Stansted 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.

2.8.2 ERCD holds OS terrain height data[16] 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. The terrain heights in the vicinity of Stansted Airport are depicted diagrammatically in **Figure 9**.

2.9 Population and 'Points of Interest' databases

2.9.1 Estimates were made of the numbers of people and households enclosed within the noise contours. The population data used in this report are a 2013 update of the latest 2011 Census supplied by CACI Limited[17]. It should be noted that the population database used for the year 2012 contours was a 2012 update of the earlier 2001 Census (i.e. the most up-to-date database available at the time). Within the extent of the 2013 actual 57 dBA contour, the population count with the 2013 population database was only 1% higher than that using the previous 2012 database, so the effect of the 2013 database update was only of marginal significance at Stansted.

2.9.2 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. The postcode data points and associated population counts for the area around Stansted Airport are illustrated in **Figure 10**.

2.9.3 Estimates have also been made of the numbers of noise sensitive buildings situated within the daytime contours, using the *InterestMap*™[18] 'Points of Interest' (2013) database. For the purposes of this study, the noise sensitive buildings that have been considered are schools, hospitals and places of worship.

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[16] Meridian™ 2

[17] www.caci.co.uk

[18] InterestMap™ is distributed by Landmark Information Group Ltd and derived from Ordnance Survey 'Points of Interest' data.

3 Noise contour results

3.1 Day actual modal split contours

3.1.1 The Stansted 2013 day Leq noise contours generated with the actual 2013 summer period runway modal split (71% south-west / 29% north-east) are shown in **Figure 11a**. The contours are plotted from 57 to 72 dBA at 3 dB intervals.

3.1.2 The cumulative areas, populations and households within the 2013 day actual modal split contours are provided in the table below:

Stansted 2013 day actual contours - area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 57	20.0	1,250	450
> 60	10.6	350	100
> 63	5.6	100	50
> 66	2.9	0	0
> 69	1.6	0	0
> 72	0.9	0	0

Note: Populations and households are given to the nearest 50.

3.1.3 Estimates of the cumulative numbers of noise sensitive buildings within the 2013 day actual modal split contours are provided in the table below:

Stansted 2013 day actual contours - noise sensitive building estimates

Leq (dBA)	Schools	Hospitals	Places of worship
> 57	2	0	2
> 60	0	0	2
> 63	0	0	0
> 66	0	0	0
> 69	0	0	0
> 72	0	0	0

3.2 Night actual modal split contours

3.2.1 The Stansted 2013 night Leq noise contours generated with the actual 2013 summer night period runway modal split (70% south-west / 30% north-east) are shown in **Figure 11b**. The contours are plotted from 48 to 66 dBA at 3 dB intervals (note: the 69 and 72 dBA contours have been omitted to improve clarity).

3.2.2 The cumulative areas, populations and households within the 2013 night actual modal split contours are provided in the following table:

Stansted 2013 night actual contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 48	51.5	6,400	2,500
> 51	28.6	2,250	850
> 54	15.6	850	300
> 57	8.3	250	100
> 60	4.4	50	< 50
> 63	2.3	0	0
> 66	1.3	0	0
> 69	0.8	0	0
> 72	0.5	0	0

Note: Populations and households are given to the nearest 50.

3.2.3 The 2013 night actual modal split 48 dBA contour enclosed an area of 51.5 km^2 and a population of 6,400.

3.3 Day standard modal split contours

3.3.1 The Stansted 2013 day Leq noise contours generated with the standard 2013 summer period runway modal split (71% south-west / 29% north-east) are shown in **Figure 12**. The standard contours, which for year 2013 are identical to the actual modal split contours, are plotted from 57 to 72 dBA at 3 dB intervals.

3.3.2 The cumulative areas, populations and households within the 2013 day standard modal split contours are provided in the following table:

Stansted 2013 day standard contours - area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 57	20.0	1,250	450
> 60	10.6	350	100
> 63	5.6	100	50
> 66	2.9	0	0
> 69	1.6	0	0
> 72	0.9	0	0

Note: Populations and households are given to the nearest 50.

3.3.3 Estimates of the cumulative numbers of noise sensitive buildings within the 2013 day standard modal split contours are provided in the table below:

Stansted 2013 day standard contours - noise sensitive building estimates

Leq (dBA)	Schools	Hospitals	Places of worship
> 57	2	0	2
> 60	0	0	2
> 63	0	0	0
> 66	0	0	0
> 69	0	0	0
> 72	0	0	0

4 Analysis of results

4.1 Day actual modal split contours – comparison with 2012 contours

4.1.1 The Stansted 2013 day actual modal split Leq contours are compared against the 2012 day actual Leq contours in **Figure 13**. The table below summarises the areas, populations and percentage changes from 2012 to 2013:

Stansted day actual contours - areas and populations for 2012 and 2013

Leq (dBA)	2012 Area (km^2)	2013 Area (km^2)	Area change (%)	2012 Pop.	2013 Pop.	Pop. change (%)
> 57	21.1	20.0	-5%	1,250	1,250	0%
> 60	11.1	10.6	-5%	450	350	-22%
> 63	6.0	5.6	-7%	100	100	0%
> 66	3.0	2.9	-3%	< 50	0	(n/a)
> 69	1.6	1.6	0%	0	0	(n/a)
> 72	0.9	0.9	0%	0	0	(n/a)

Note: The actual runway modal split was 85% SW / 15% NE in 2012, and 71% SW / 29% NE in 2013.

4.1.2 The 57 dBA contour area decreased by 5% in 2013, broadly in line with the 4% reduction in total movements. Reductions in contour area of up to 7% were also evident at some of the higher contour levels. Populations were generally unchanged, except for the 60 dBA contour, where the population count dropped by 100. This was due primarily to retraction of the 60 dBA contour to the south of the airport away from the hamlet of Bedlar's Green.

4.1.3 It should be noted that percentage changes in contour areas are not necessarily accompanied by similar changes in enclosed population because of the uneven distribution of populations around the airport.

4.1.4 The effect of the higher proportion of north-easterly operations in year 2013 on contour shapes can be clearly seen in **Figure 13**. The contour lobes caused by Runway 22 departures heading to the south and east are smaller, as are the Runway 22 arrival contour tips to the north-east of the airport. Conversely, the 57 dBA contour tip due to landings on Runway 04 is more pronounced, and the sides of the contours immediately to the north-east of the airport have widened, reflecting higher numbers of easterly departures.

4.2 Day standard modal split contours – comparison with 2012 contours

4.2.1 The Stansted 2013 day standard modal split Leq contours are compared against the 2012 standard Leq contours in **Figure 14**. The following table summarises the areas, populations and percentage changes from 2012 to 2013:

Stansted day standard contours - areas and populations for 2012 and 2013

Leq (dBA)	2012 Area (km^2)	2013 Area (km^2)	Area change (%)	2012 Pop.	2013 Pop.	Pop. change (%)
> 57	20.9	20.0	-4%	1,250	1,250	0%
> 60	11.0	10.6	-4%	350	350	0%
> 63	5.8	5.6	-3%	100	100	0%
> 66	3.0	2.9	-3%	< 50	0	(n/a)
> 69	1.6	1.6	0%	0	0	(n/a)
> 72	0.9	0.9	0%	0	0	(n/a)

Note: The standard runway modal splits in 2012 and 2013 were both 71% SW / 29% NE.

4.2.2 The 57 dBA contour area decreased by 4% in 2013 in line with the 4% reduction in total movements, with similar changes at some of the higher contour levels. The overall reduction in the size of the contours in year 2013 compared to 2012 can be seen in **Figure 14**. Populations were unchanged within the 57 dB(A) contour and also at the majority of the higher contour levels.

4.2.3 It is noted that the 57 dBA Leq standard modal split contour of 20.0 km^2 is well below the Planning Condition AN1 contour area limit of 33.9 km^2 (see section 1.2.4).

4.2.4 The standard contours normally provide a clearer indication than the actual contours of 'fleet noise level' changes from year to year because they minimise the effect of any difference between the ratios of south-westerly to north-easterly operations.

4.3 Noise contour historical trend

4.3.1 **Figure 15** shows how the 57 dBA Leq day actual modal split contour has changed in area and population terms since 1988 by comparison with the total annual (365-day) aircraft movements. (Actual modal split data are used in this figure because standard modal split contours were not produced prior to 1995).

Movement trend

4.3.2 Annual movements at Stansted rose steadily between 1990 and 2001 showing particularly rapid growth between 1997 and 1999. The number of movements in 2001 and 2002 were similar but in 2003 the annual figure rose by 9% over the preceding year. Another rise in 2006 was followed by a slight increase in the annual figure in 2007, representing a peak level.

4.3.3 The total annual movement figure for 2008 dropped by 7% – this can be attributed to the economic downturn and fluctuating oil price. The figure dropped even further in 2009, by 13%, as the global recession continued to impact upon the aviation industry.

4.3.4 The year 2010 saw another large fall in traffic for the third year running, this time by 8%. The volcanic ash crisis in April, industrial action in May, adverse winter weather and a continued reduction in demand for leisure travel were factors causing the decline in traffic.

4.3.5 Annual traffic dropped further in 2011 by 4% and also in 2012 for the fifth year running (also by 4%) as the demand for flights continued to fall. However, 2013 saw the first increase in annual flights since the five years of continual decline that followed the 2007 peak.

Area and population trend

4.3.6 Up to 1998, areas and populations within the 57 dBA Leq contour have generally risen in line with movements but in 1999, despite the high traffic growth, the area fell by 19%. This decrease was attributable to fewer movements of older, noisier, Chapter 2 aircraft – in particular those by the BAC 1-11 which fell by 64% in that year.

4.3.7 Areas have generally declined since 2001 following completion of the phase-out of Chapter 2 aircraft. There was a 7% decrease in traffic in 2008 and the area fell by 6% relative to 2007. The area further reduced in 2009 and again in 2010 as total movements dropped substantially. The 2011 and then the 2012 areas dropped to the lowest levels seen at Stansted since 1990 as traffic continued to fall. The area decreased again in 2013 to 20.0 km^2 as summer period traffic fell (despite the overall movements increase seen over the annual period), and was the lowest ever contour area calculated for Stansted. The previous low was 20.1 km^2 back in 1990.

4.3.8 From 2001 to 2008, population counts fluctuated within a range from approximately 2,000 to 2,900. The years with higher proportions of south-westerly movements have tended to produce the higher population counts. In 2009, the shift in modal split to a lower proportion of south-westerly movements along with significantly lower movement numbers caused the population count to dip markedly to 1,500. Since 2009, population counts have been relatively steady, albeit reducing slightly as contour areas continued to fall year-on-year.

5 Conclusions

5.1 Year 2013 average summer 16-hour day and 8-hour night Leq noise exposure contours have been generated for Stansted Airport using the ANCON noise model.

5.2 The results show that the actual modal split 57 dBA Leq contour area decreased by 5% to 20.0 km^2 in 2013 (2012: 21.1 km^2). Overall movements over the summer day period decreased by 4%, with the largest reduction being for the EA319C ANCON type. The 2013 contour area of 20.0 km^2 was the smallest ever calculated for Stansted. The population enclosed within the actual 57 dBA Leq contour was unchanged from 2012 at 1,250.

5.3 The year 2013 57 dBA Leq standard contour area decreased by 4% from 2012 to 20.0 km^2, which was well within the 33.9 km^2 contour area limit imposed by the Stansted Planning Condition AN1. The population count within the standard contour was unchanged from the previous year at 1,250.

5.4 Night period Leq contours have been produced for the first time. The actual modal split 48 dBA contour enclosed an area of 51.5 km^2 with a population of 6,400.

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5 European Civil Aviation Conference
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Table 1a Stansted 2012 and 2013 average summer day movements by noise class

Noise Class	Description	2012	2013	Percentage of total 2013 movements	Change
	PROPELLER AIRCRAFT				
1	Small propeller aircraft	0.4	0.6	0.2%	+0.2 (*)
2	Large propeller aircraft	10.1	9.0	2.5%	-1.1 (-11%)
	CHAPTER 3/4 JETS **				
3	Short-haul aircraft	343.8	330.3	92.8%	-13.5 (-4%)
4	Wide-body twin-engine aircraft	4.7	5.7	1.6%	+1.0 (+21%)
5	2nd generation wide-body 3,4-engine aircraft	9.8	10.1	2.8%	+0.3 (+3%)
	LARGE CHAPTER 2/3 JETS				
6	1st generation wide-body 3,4-engine aircraft	< 0.1	< 0.1	0.0%	0.0 (*)
	2nd GENERATION TWIN JETS				
7	Narrow-body twin-engine *(including Ch.2 and hushkitted versions)*	0.2	< 0.1	0.0%	-0.2 (*)
	1st GENERATION JETS				
8	Narrow-body 3,4-engine aircraft	0.6	0.2	0.1%	-0.4 (*)
	TOTAL	369.6	**356.0**	100%	**-13.6 (-4%)**

* Percentage changes not shown due to low numbers and limited data resolution.
** An estimated 99% of *Noise Class 3* aircraft in 2013 met the 'Chapter 4' noise standard (2012: 100%).

Note: Totals may not sum exactly due to rounding.

Table 1b Stansted 2013 average summer night movements by noise class

Noise Class	Description	2013 movements	Percentage of total 2013 movements
	PROPELLER AIRCRAFT		
1	Small propeller aircraft	0.2	0.3%
2	Large propeller aircraft	1.2	1.8%
	CHAPTER 3/4 JETS *		
3	Short-haul aircraft	60.1	90.9%
4	Wide-body twin-engine aircraft	3.6	5.4%
5	2nd generation wide-body 3,4-engine aircraft	1.1	1.6%
	LARGE CHAPTER 2/3 JETS		
6	1st generation wide-body 3,4-engine aircraft	0.0	0.0%
	2nd GENERATION TWIN JETS		
7	Narrow-body twin-engine aircraft *(including Ch.2 and hushkitted versions)*	0.0	0.0%
	1st GENERATION JETS		
8	Narrow-body 3,4-engine aircraft	0.0	0.0%
	TOTAL	**66.1**	100%

* An estimated 98% of *Noise Class 3* aircraft in 2013 met the 'Chapter 4' noise standard.

Note: Totals may not sum exactly due to rounding.

Table 2a Stansted 2012 and 2013 average summer day movements by ANCON aircraft type

Aircraft type	Noise class	ANCON type	2012	2013	Change
Single piston propeller	1	SP	< 0.1	0.1	+0.1
Small twin-piston propeller	1	STP	0.1	0.1	0.0
Small twin-turboprop	1	STT	0.3	0.4	+0.1
Large twin-turboprop	2	LTT	9.9	9.0	-0.9
Large four-engine propeller	2	L4P	0.2	0.0	-0.2
Boeing 737-300/400/500	3	B733	4.1	3.9	-0.2
Boeing 737-600/700	3	B736	0.9	0.9	0.0
Boeing 737-800/900	3	B738	231.7	232.4	+0.7
Boeing 757-200 (RB211-535C engines)	3	B757C	0.0	0.1	+0.1
Boeing 757-200 (RB211-535E4/E4B engines)	3	B757E	1.3	1.3	0.0
Boeing 757-200 (PW2037/2040 engines)	3	B757P	0.1	0.2	+0.1
BAe 146/Avro RJ	3	BA46	2.5	1.9	-0.6
Airbus A318	3	EA318	0.2	< 0.1	-0.2
Airbus A319 (CFM-56 engines)	3	EA319C	66.1	52.2	-13.9
Airbus A319 (IAE-V2500 engines)	3	EA319V	7.8	7.4	-0.4
Airbus A320 (CFM-56 engines)	3	EA320C	5.9	10.1	+4.2
Airbus A320 (IAE-V2500 engines)	3	EA320V	4.5	2.9	-1.6
Airbus A321 (CFM56 engines)	3	EA321C	2.0	1.5	-0.5
Airbus A321 (IAE-V2500 engines)	3	EA321V	< 0.1	0.2	+0.2
Executive Business Jet (Chapter 3)	3	EXE3	14.2	12.5	-1.7
Bombardier Regional Jet 100/200	3	CRJ	0.0	< 0.1	0.0
Bombardier Regional Jet 900	3	CRJ900	0.0	< 0.1	0.0
Embraer 135/145	3	ERJ	2.0	1.8	-0.2
Embraer 170	3	ERJ170	0.0	0.1	+0.1
Embraer 190	3	ERJ190	0.3	0.9	+0.6
Fokker 100	3	FK10	< 0.1	< 0.1	0.0
McDonnell Douglas MD80 series	3	MD80	0.0	< 0.1	0.0
McDonnell Douglas MD90 series	3	MD90	< 0.1	0.0	0.0
Boeing 767-200	4	B762	0.9	1.0	+0.1
Boeing 767-300 (GE CF6-80 engines)	4	B763G	1.8	2.5	+0.7
Boeing 767-300 (PW4000 engines)	4	B763P	< 0.1	0.1	+0.1
Boeing 777-200 (GE GE90 engines)	4	B772G	0.2	0.2	0.0
Boeing 777-200LR/300ER (GE GE90 engines)	4	B773G	0.4	0.1	-0.3
Airbus A300	4	EA30	1.1	1.4	+0.3
Airbus A310	4	EA31	< 0.1	0.2	+0.2
Airbus A330	4	EA33	0.2	0.3	+0.1
Airbus A340-200/300	5	EA34	0.4	0.3	-0.1
Airbus A340-600	5	EA346	0.0	0.2	+0.2
Airbus A380 (RR Trent 900 engines)	5	EA38R	0.0	< 0.1	0.0
Boeing 747-400 (GE CF6-80F engines)	5	B744G	1.0	0.7	-0.3
Boeing 747-400 (PW4000 engines)	5	B744P	0.7	0.8	+0.1
Boeing 747-400 (RR RB211 engines)	5	B744R	0.1	0.2	+0.1
Boeing 747SP	5	B747SP	0.2	0.2	0.0
Boeing 747-8	5	B748	3.2	3.1	-0.1
McDonnell Douglas MD-11	5	MD11	4.2	4.6	+0.4
Boeing 747-100/200/300	6	B747	< 0.1	< 0.1	0.0

Aircraft type	Noise class	ANCON type	2012	2013	Change
Boeing 737-200 (Chapter 3)	7	B732	< 0.1	0.0	0.0
Executive Business Jet (Chapter 2)	7	EXE2	0.2	0.0	-0.2
Boeing 707	8	B707	< 0.1	< 0.1	0.0
Boeing 727 (Chapter 3)	8	B727	0.3	0.2	-0.1
McDonnell Douglas DC-8-70	8	DC87	0.1	0.0	-0.1
Ilyushin IL-62	8	IL62	0.1	0.0	-0.1
Tupolev Tu-154	8	TU54	< 0.1	0.0	0.0
		TOTAL	369.6	**356.0**	**-13.6 (-4%)**

Note: Totals may not sum exactly due to rounding.

Table 2b Stansted 2013 average summer night movements by ANCON aircraft type

Aircraft type	Noise class	ANCON type	Movements
Small twin-piston propeller	1	STP	0.1
Small twin-turboprop	1	STT	0.1
Large twin-turboprop	2	LTT	1.2
Boeing 737-300/400/500	3	B733	6.8
Boeing 737-600/700	3	B736	0.1
Boeing 737-800/900	3	B738	38.3
Boeing 757-200 (RB211-535C engines)	3	B757C	0.1
Boeing 757-200 (RB211-535E4/E4B engines)	3	B757E	0.6
Boeing 757-200 (PW2037/2040 engines)	3	B757P	< 0.1
BAe 146/Avro RJ	3	BA46	2.1
Airbus A318	3	EA318	< 0.1
Airbus A319 (CFM-56 engines)	3	EA319C	7.0
Airbus A319 (IAE-V2500 engines)	3	EA319V	0.2
Airbus A320 (CFM-56 engines)	3	EA320C	1.7
Airbus A320 (IAE-V2500 engines)	3	EA320V	< 0.1
Airbus A321 (CFM56 engines)	3	EA321C	0.7
Airbus A321 (IAE-V2500 engines)	3	EA321V	< 0.1
Executive Business Jet (Chapter 3)	3	EXE3	2.2
Bombardier Regional Jet 100/200	3	CRJ	< 0.1
Embraer 135/145	3	ERJ	0.2
Embraer 190	3	ERJ190	< 0.1
Boeing 767-200	4	B762	0.8
Boeing 767-300 (GE CF6-80 engines)	4	B763G	1.2
Boeing 777-200 (GE GE90 engines)	4	B772G	0.1
Airbus A300	4	EA30	1.4
Airbus A310	4	EA31	< 0.1
Airbus A330	4	EA33	0.1
Airbus A340-200/300	5	EA34	< 0.1
Airbus A340-500/600	5	EA346	< 0.1
Boeing 747-400 (GE CF6-80F engines)	5	B744G	< 0.1
Boeing 747-400 (PW PW4000 engines)	5	B744P	0.1
Boeing 747-400 (RR RB211 engines)	5	B744R	< 0.1
Boeing 747SP	5	B747SP	< 0.1
Boeing 747-8	5	B748	0.6
McDonnell Douglas MD-11	5	MD11	0.2
		TOTAL	**66.1**

Figure 1 Stansted Airport and surrounding area

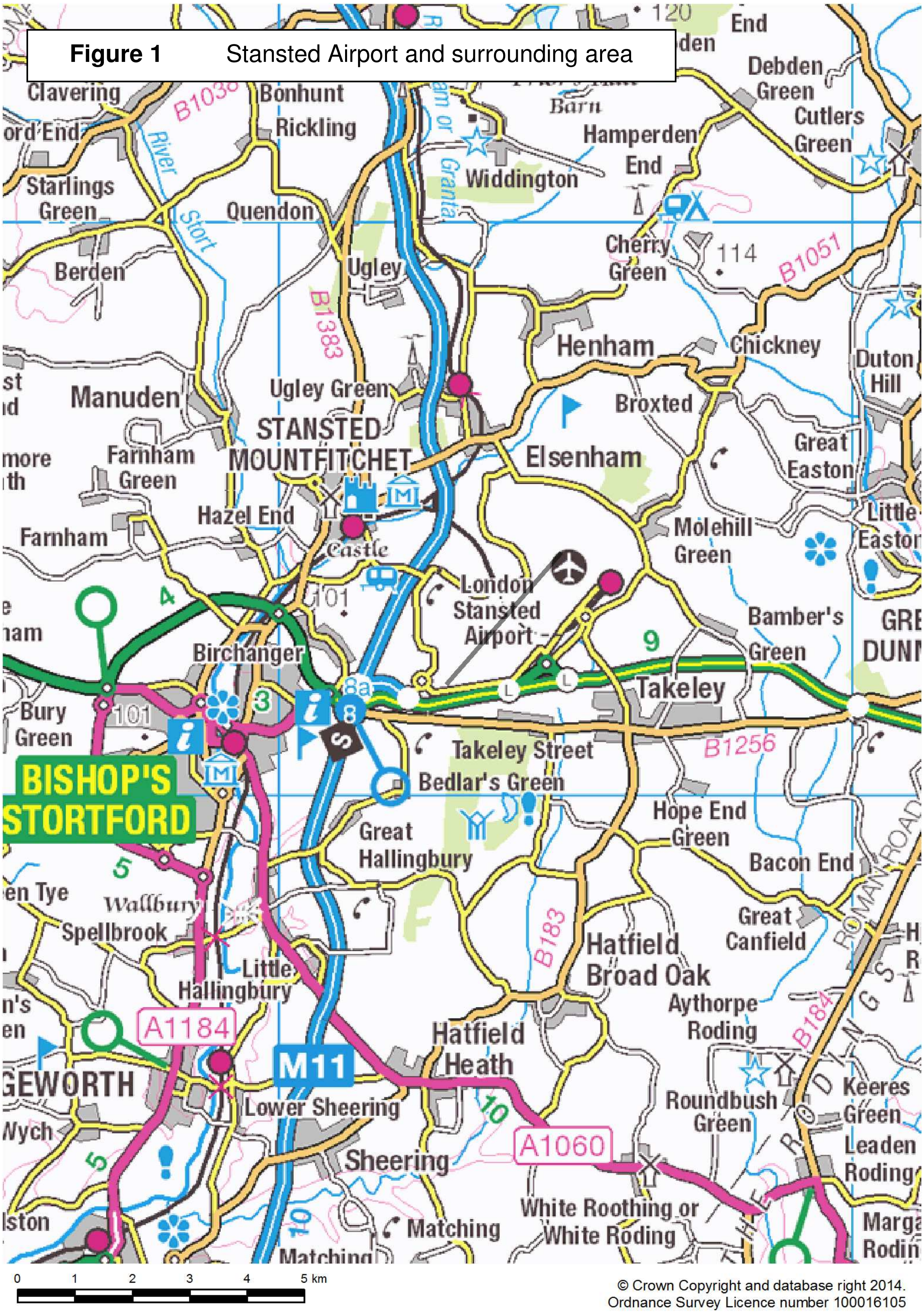


Figure 2 Stansted Airport layout in 2013

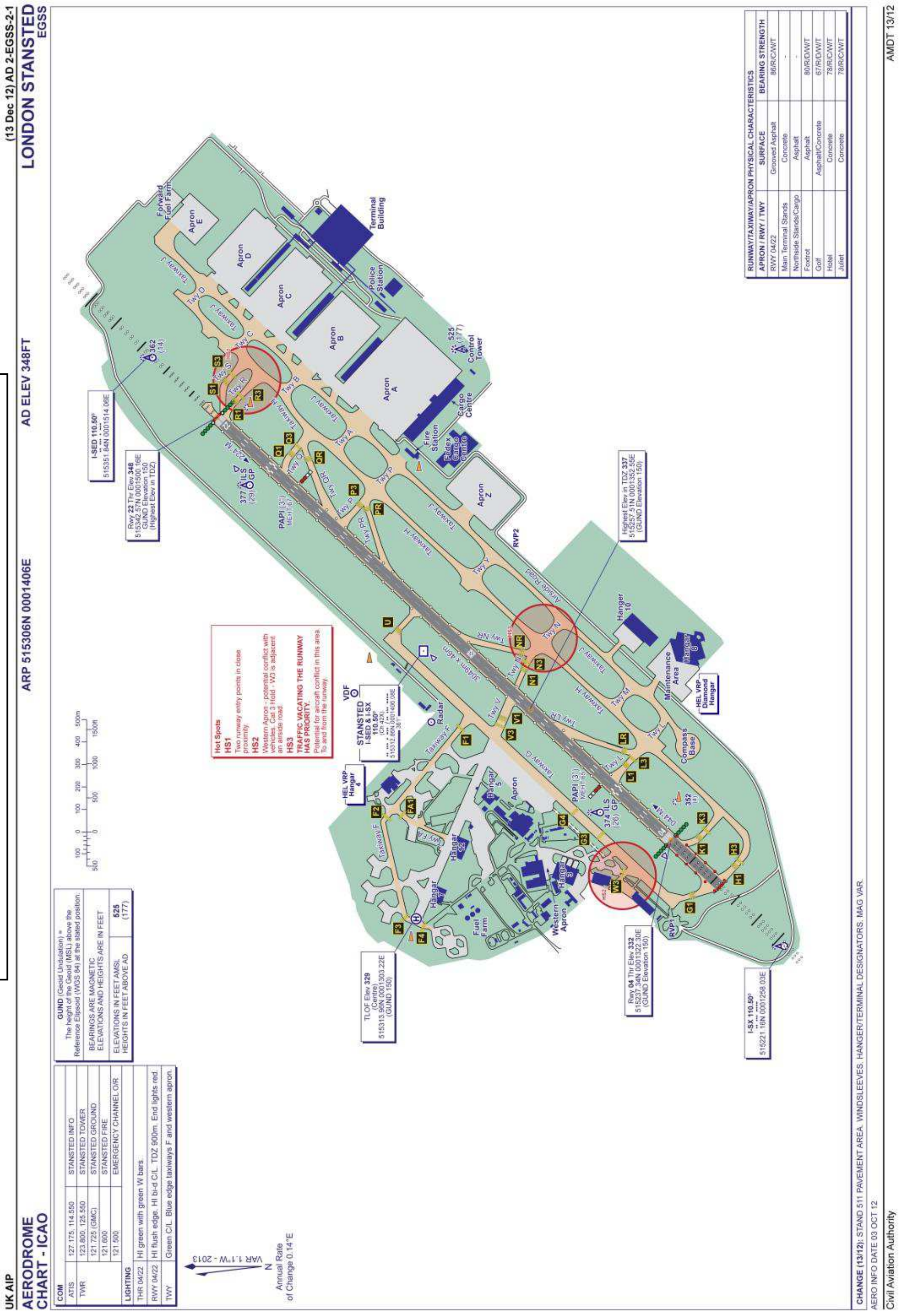


Figure 3 Stansted Standard Instrument Departure (SID) routes

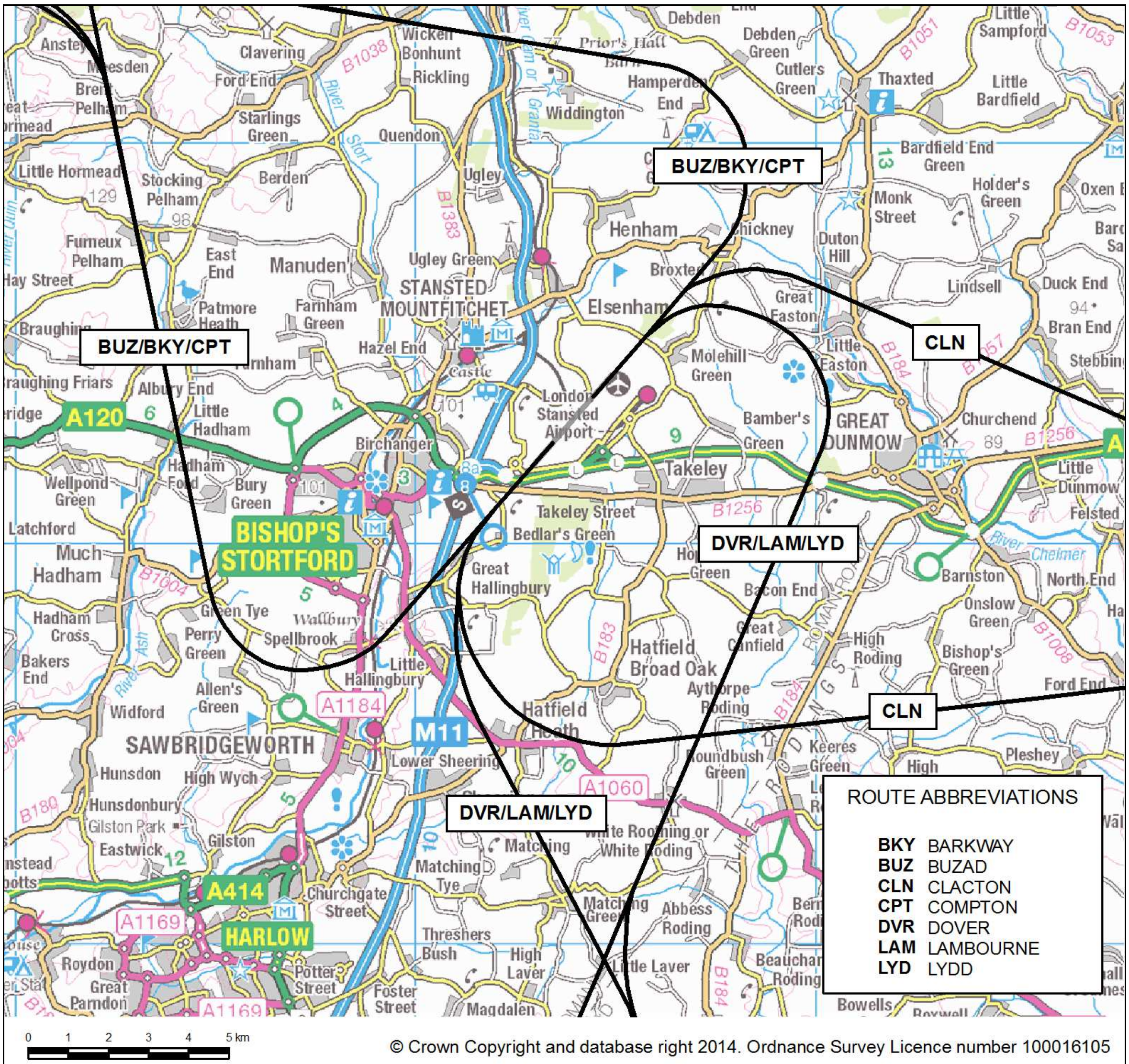


Figure 4 Typical Stansted radar flight tracks

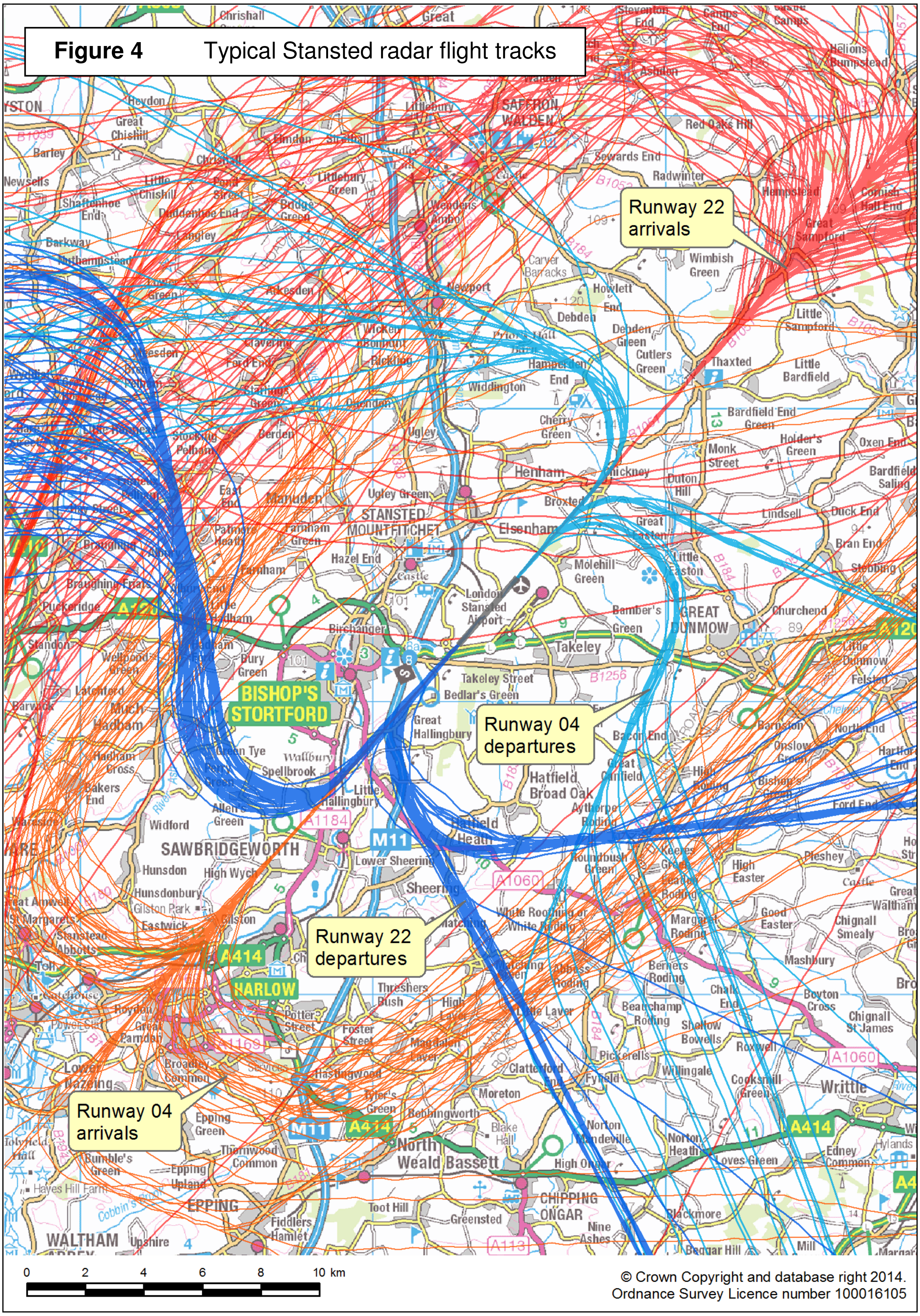
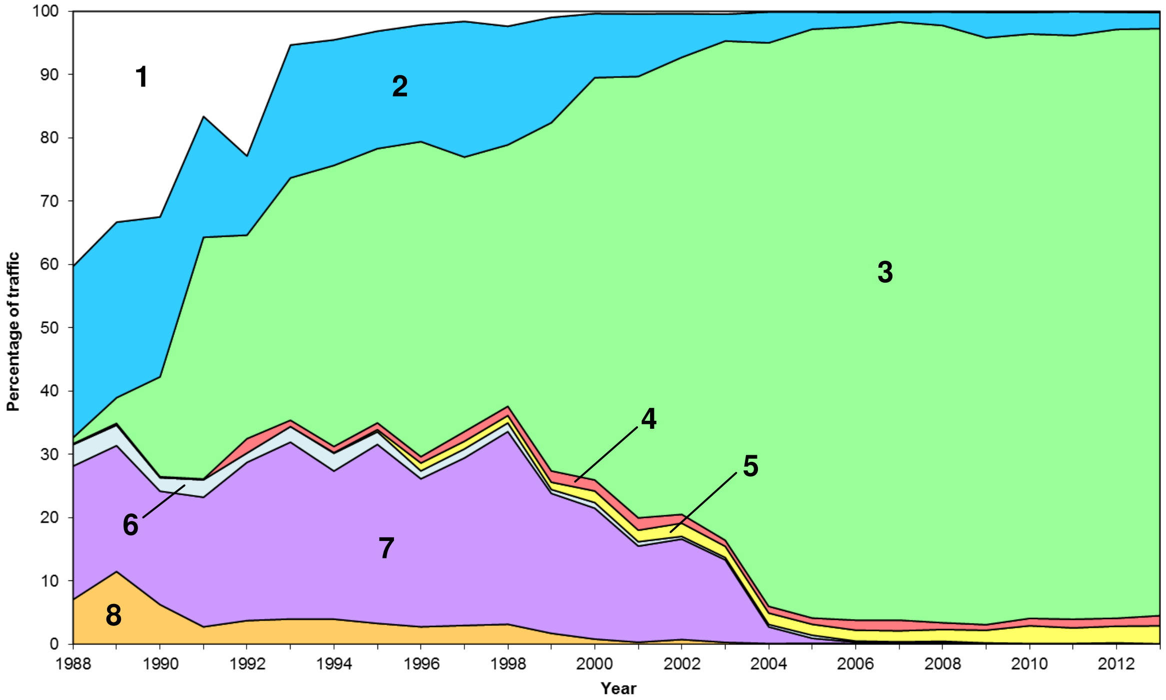


Figure 5 Stansted noise class trend 1988-2013



Note: The percentages from 1990 onwards 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.

Key to noise classes

Propeller aircraft
1 Small props, e.g. single/twin piston and turboprop light aircraft
2 Large props, e.g. 2- and 4-propeller transports, e.g. ATR-42, BAe ATP

Chapter 3/4 jets
3 Short-haul, e.g. Airbus A319, Boeing 737-800
4 Wide-body twins, e.g. Airbus A300, Boeing 767
5 2nd generation wide-body 3/4-engine aircraft, e.g. Boeing 747-400, MD-11

Large Chapter 2/3 jets
6 1st generation wide-body 3/4-engine aircraft, e.g. Boeing 747-200

2nd generation twin jets
7 Narrow body twins (including hushkitted versions), e.g. Boeing 737-200

1st generation jets
8 Narrow body 3/4-engine aircraft (including hushkitted versions), e.g. Boeing 727

Figure 6a Stansted 2013 average summer day movements by ANCON type

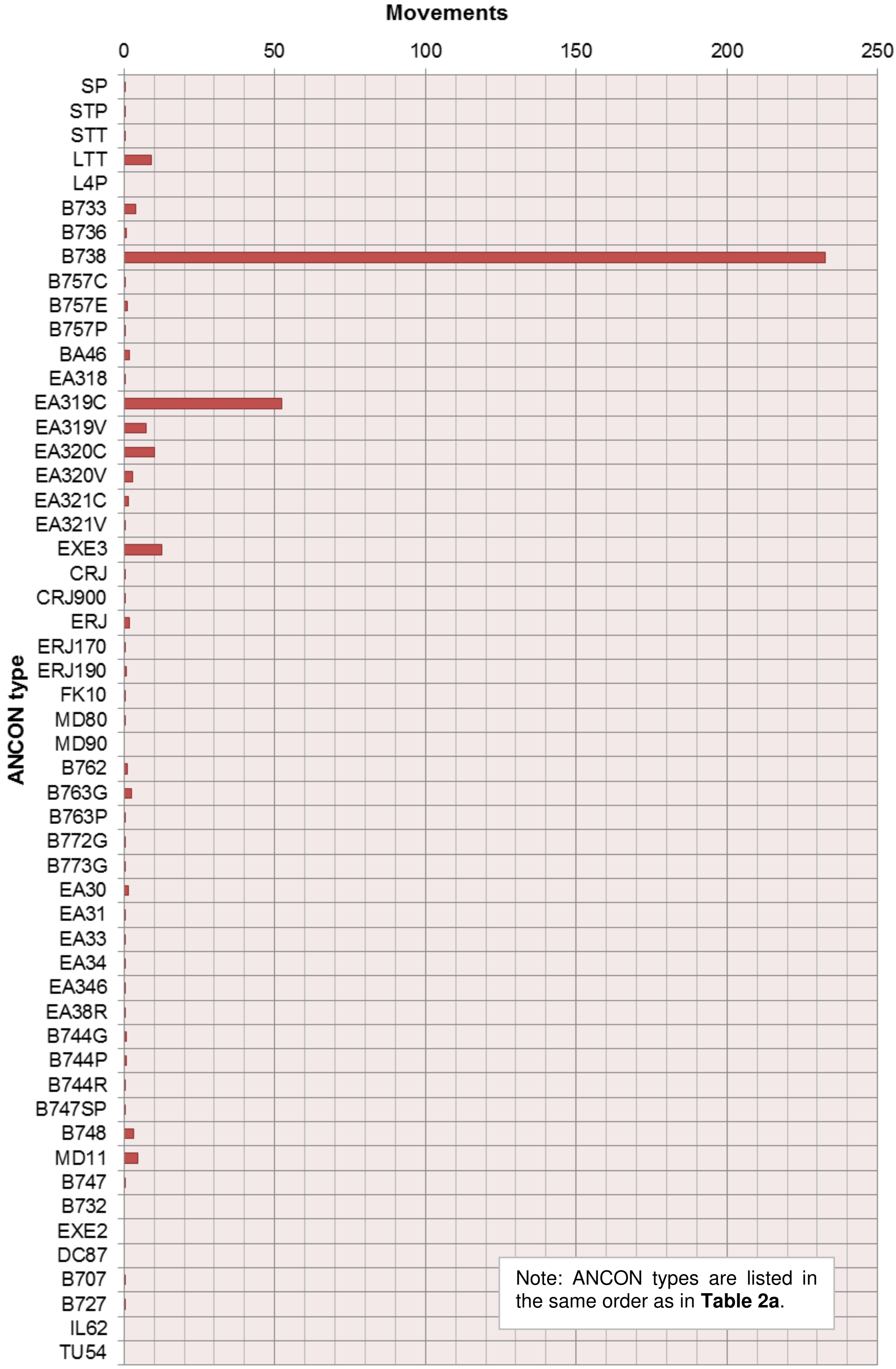


Figure 6b Stansted 2013 average summer night movements by ANCON type

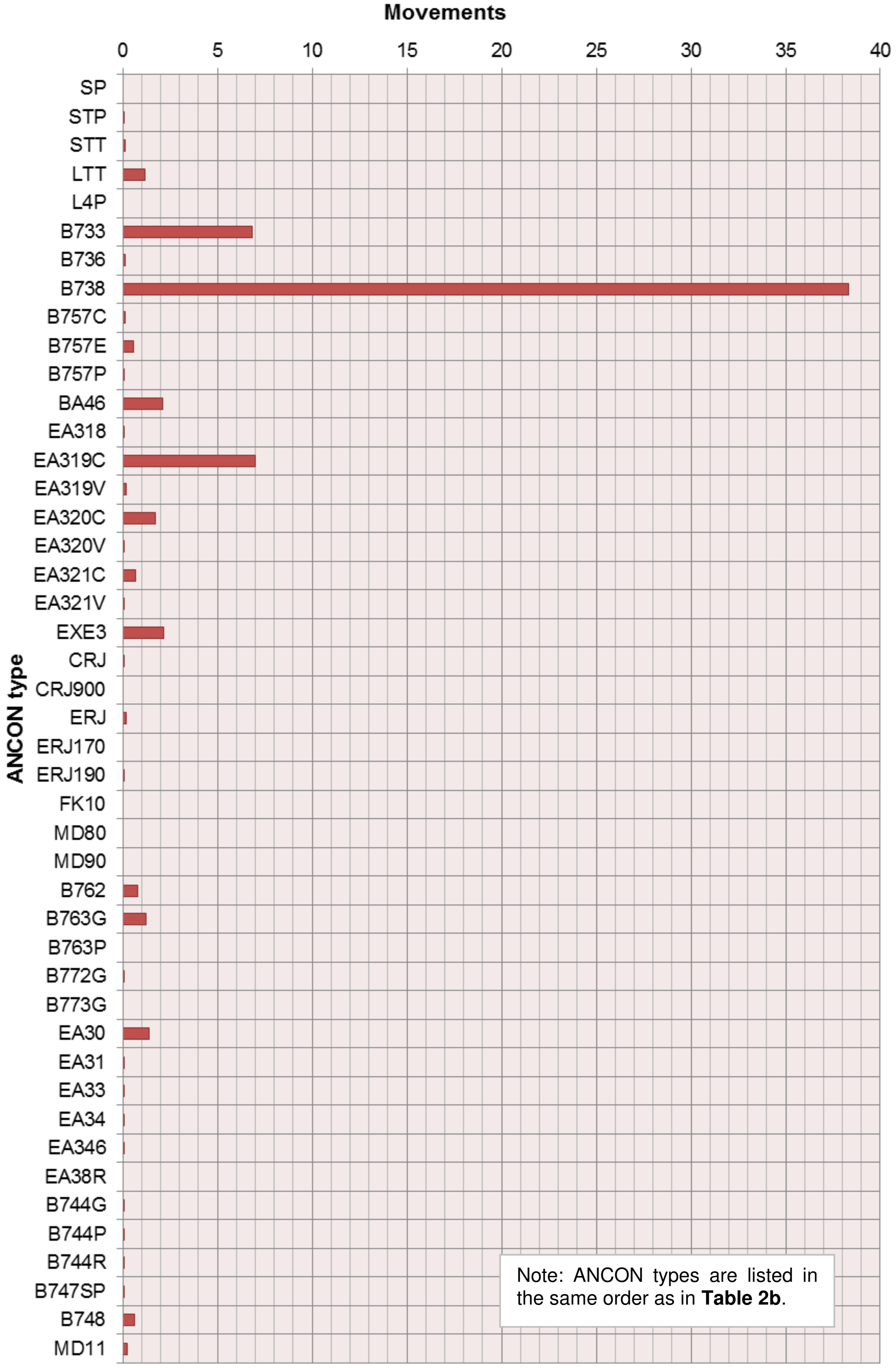


Figure 7a Stansted 2013 and 2012 summer day SID traffic distributions

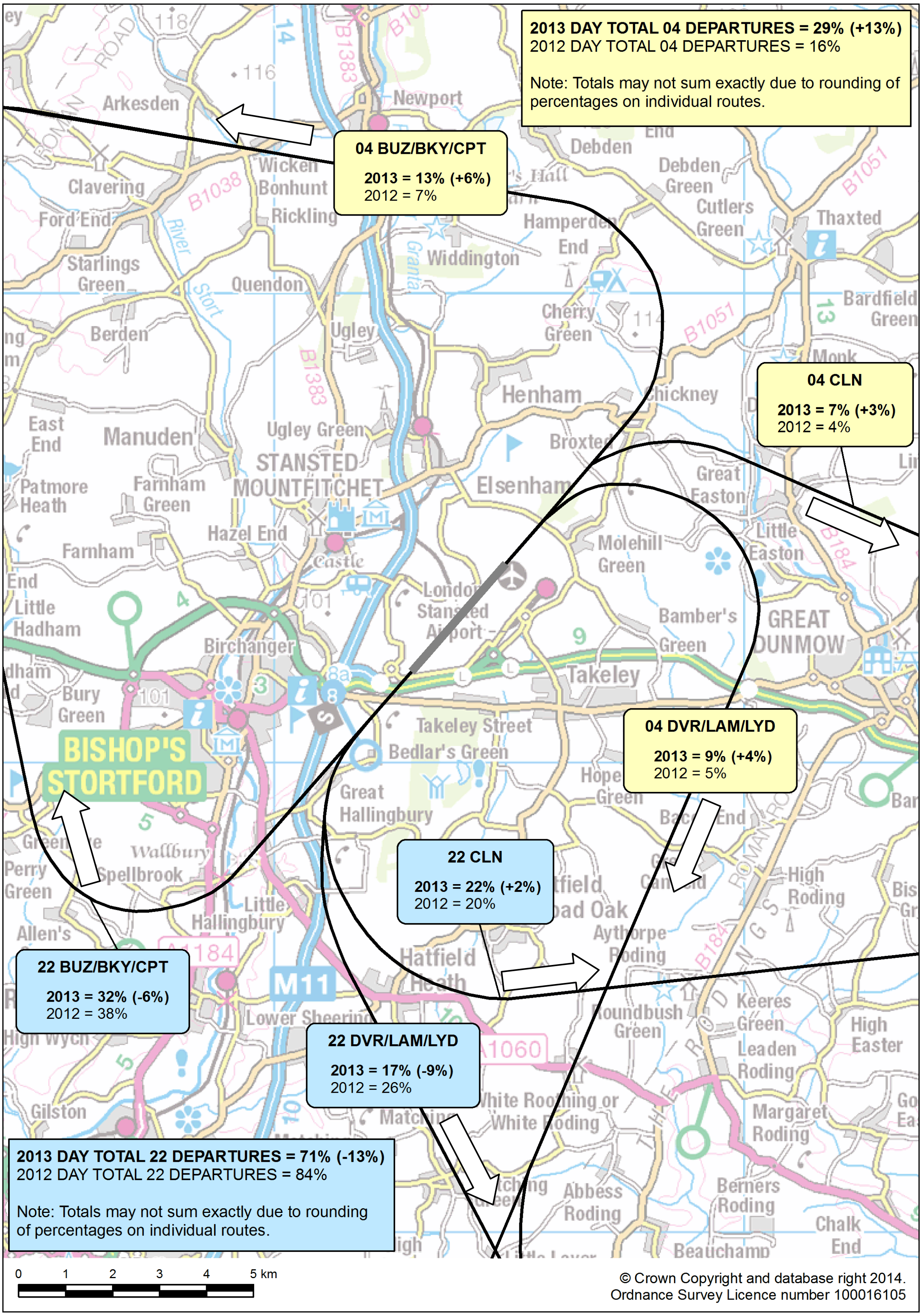


Figure 7b Stansted 2013 summer night SID traffic distributions

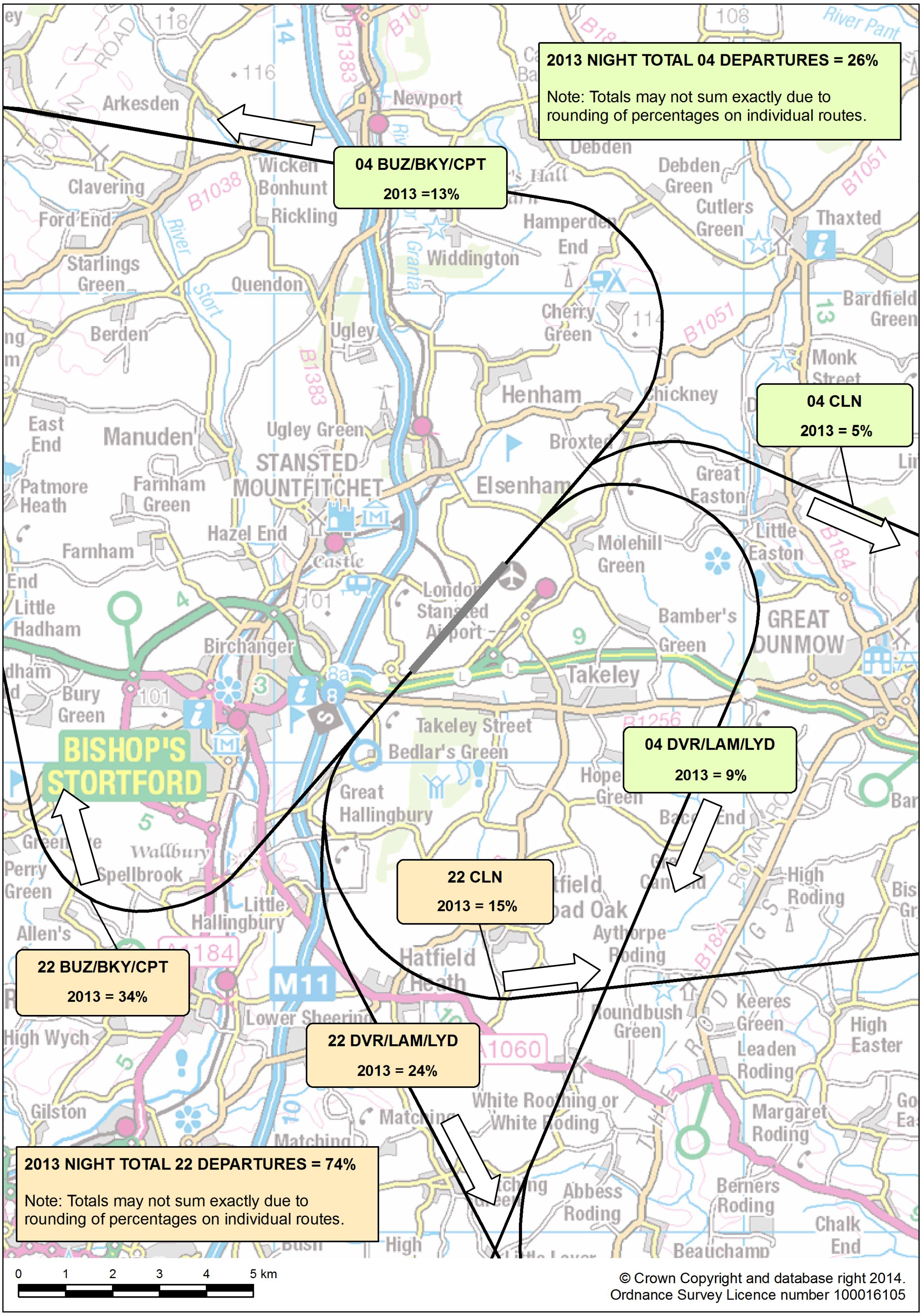


Figure 8 Stansted average summer day runway modal splits 1994-2013

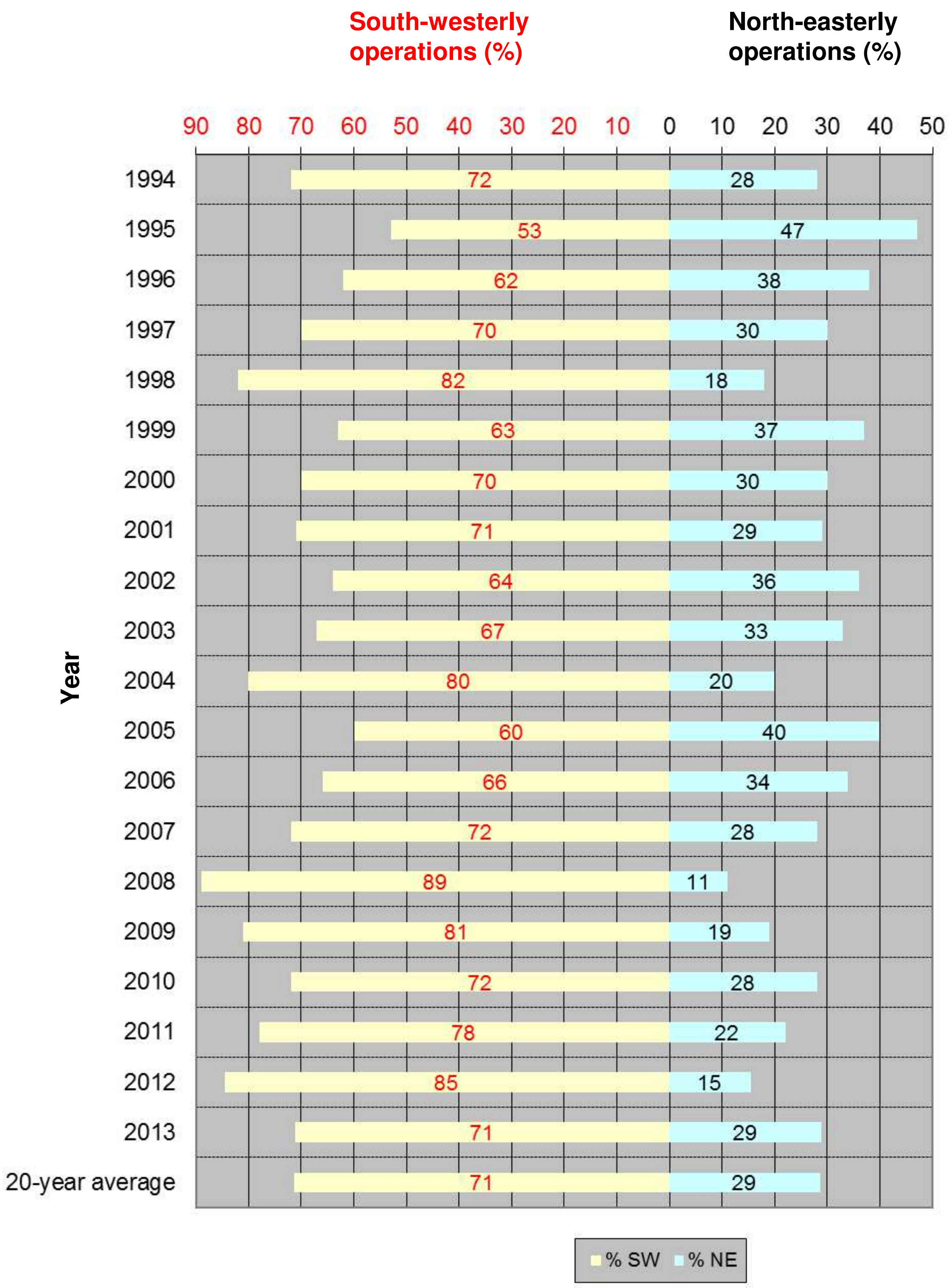


Figure 9 Topography around Stansted Airport

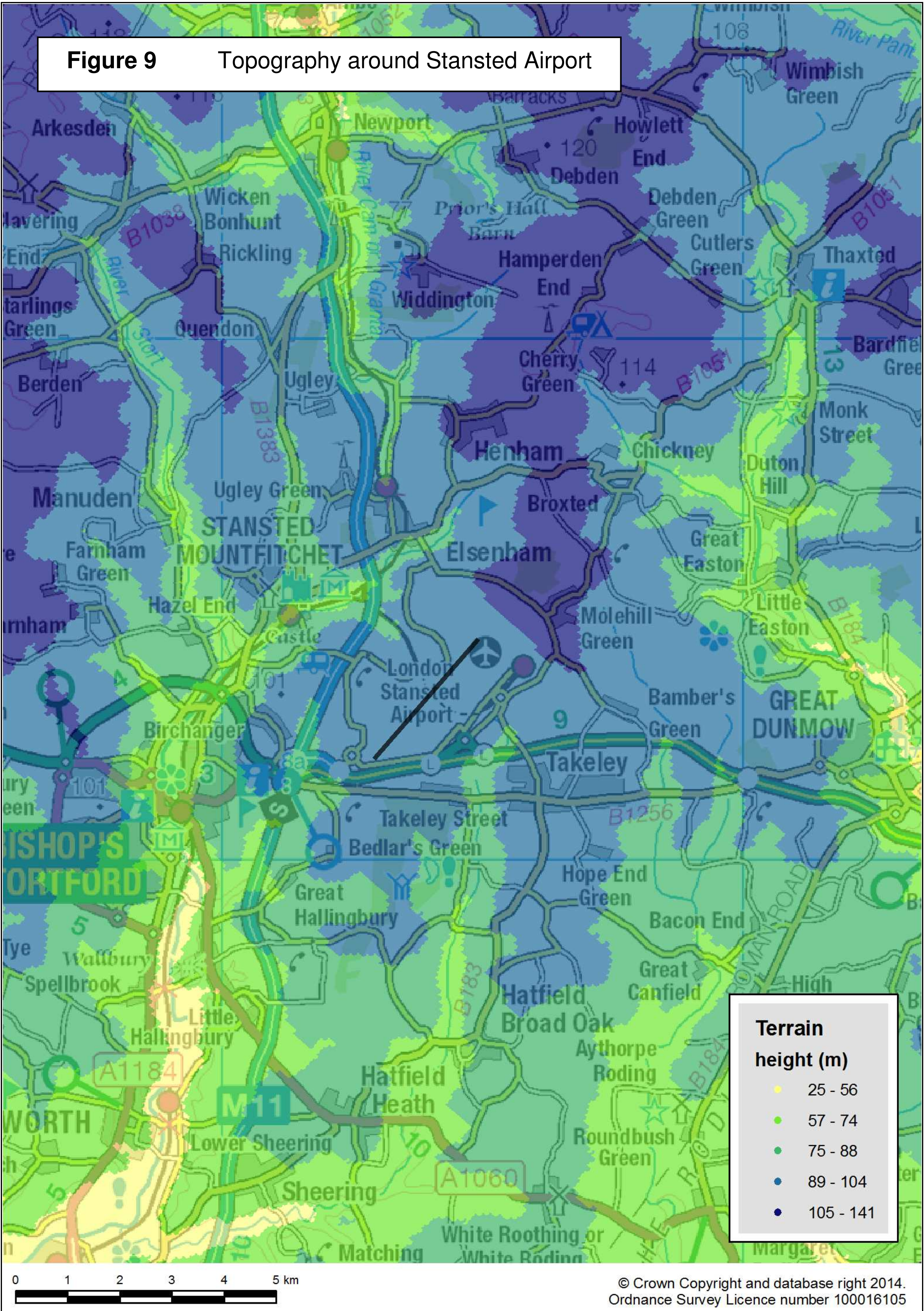


Figure 10 Population data points around Stansted Airport

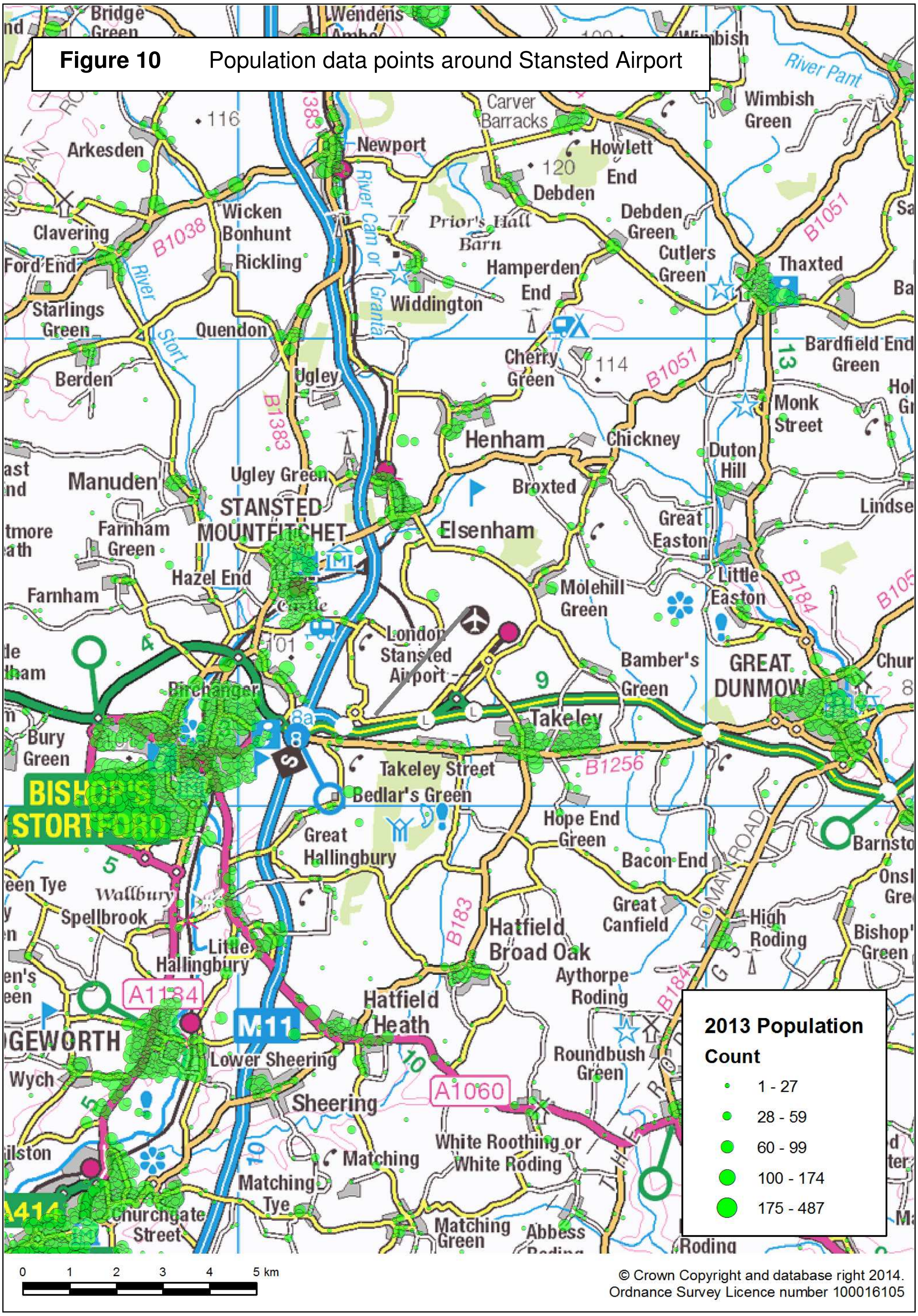


Figure 11a Stansted 2013 day actual (71% SW / 29% NE) Leq contours

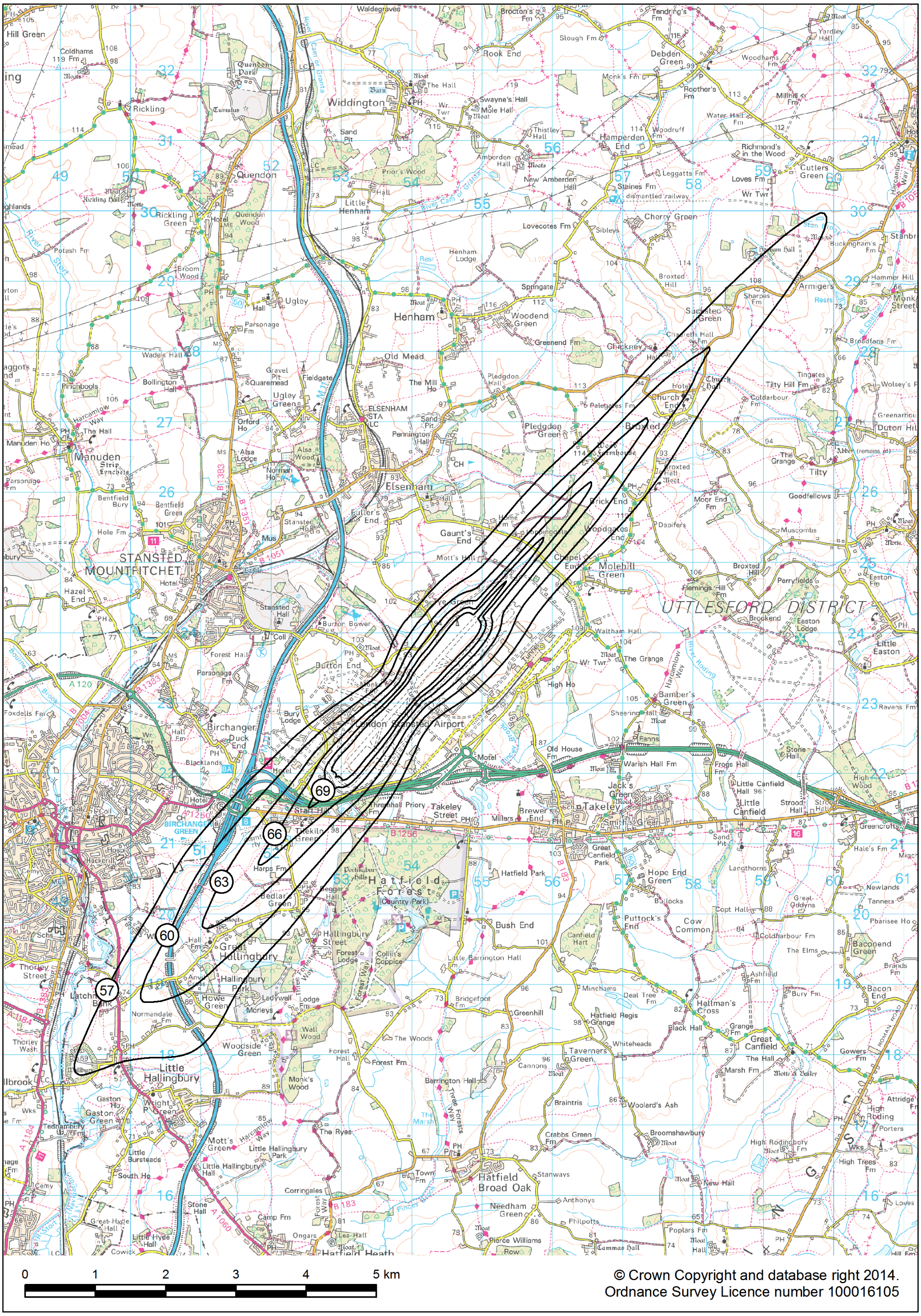


Figure 11b Stansted 2013 night actual (70% SW / 30% NE) Leq contours

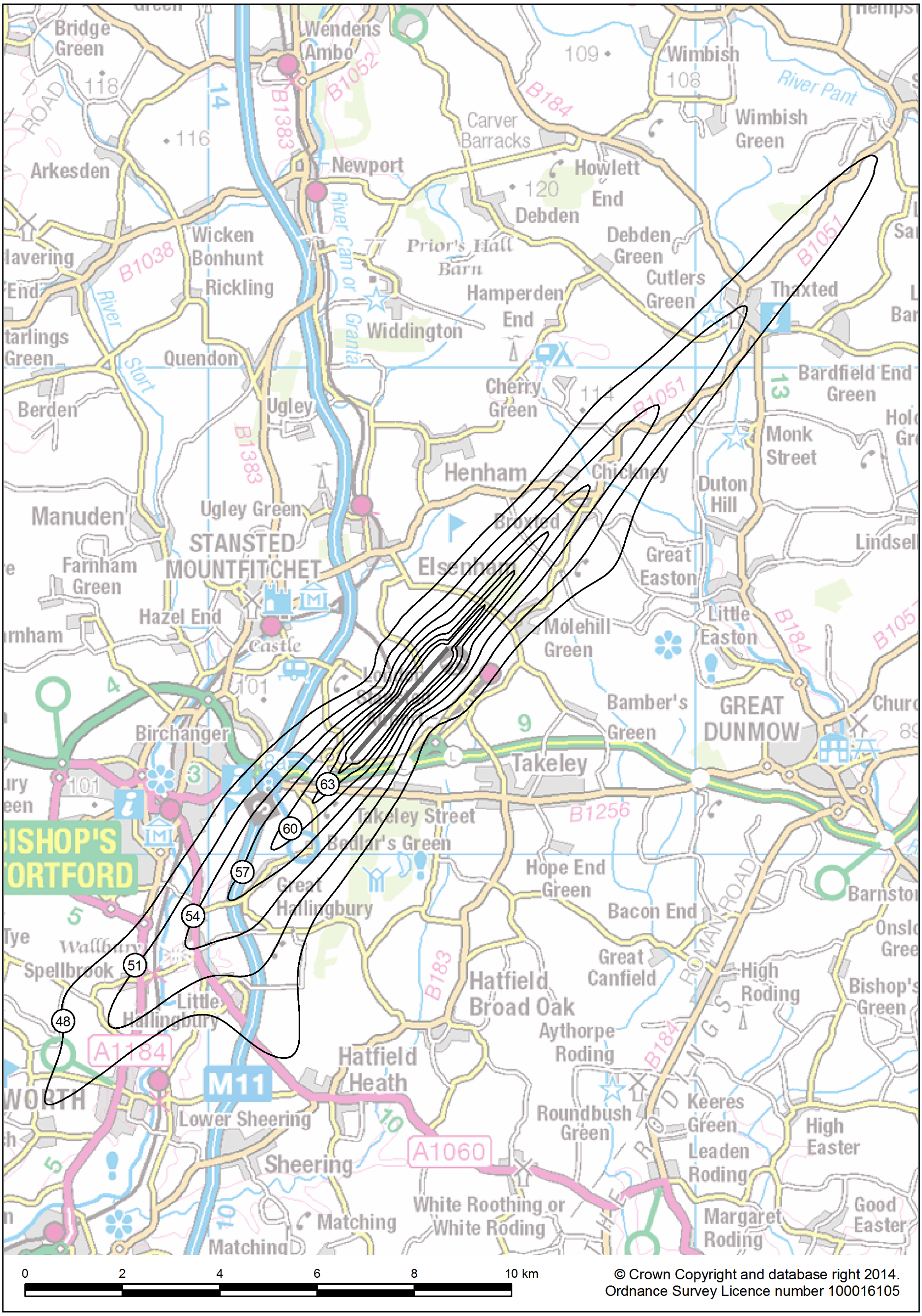


Figure 12 Stansted 2013 day standard (71% SW / 29% NE) Leq contours

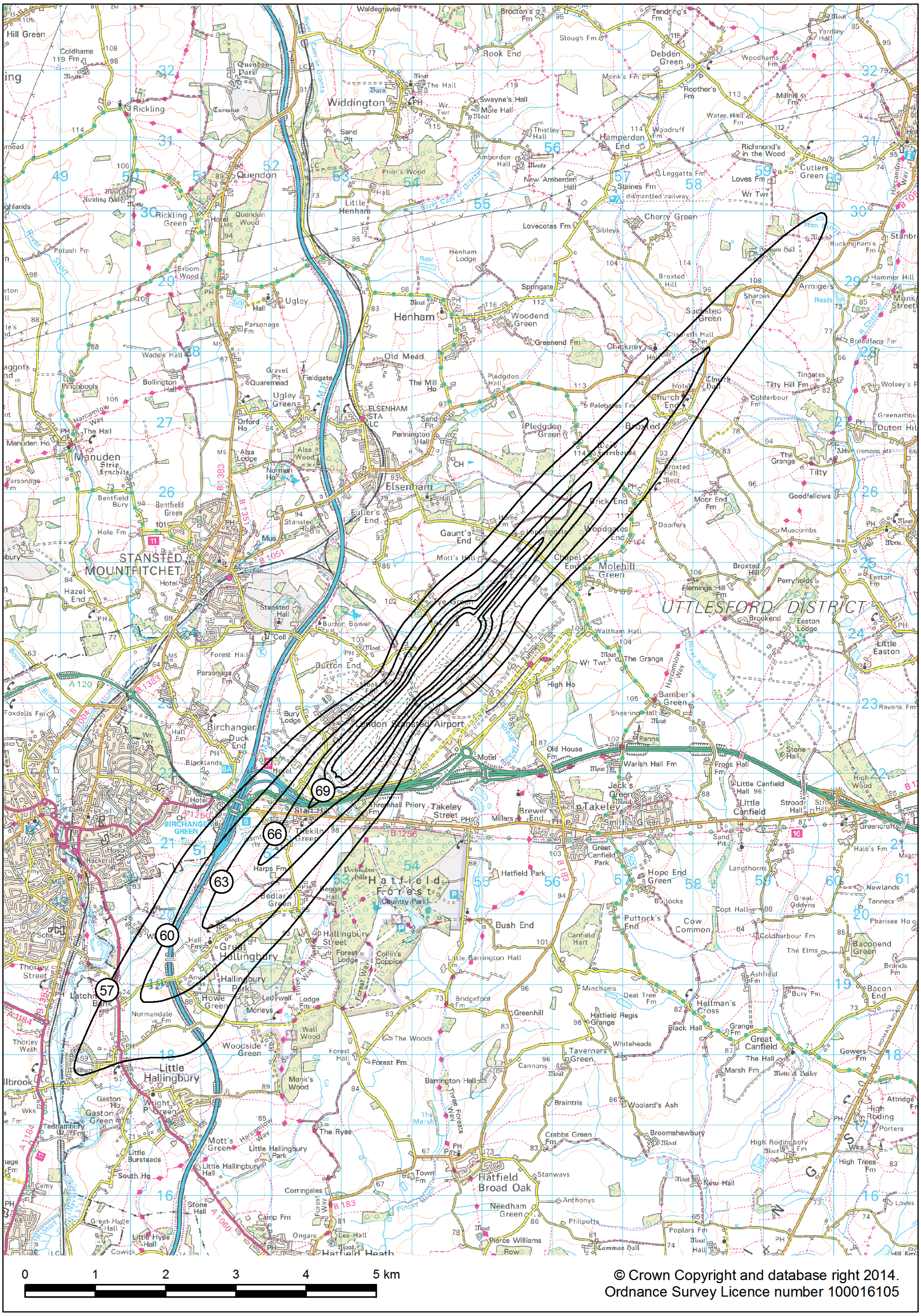
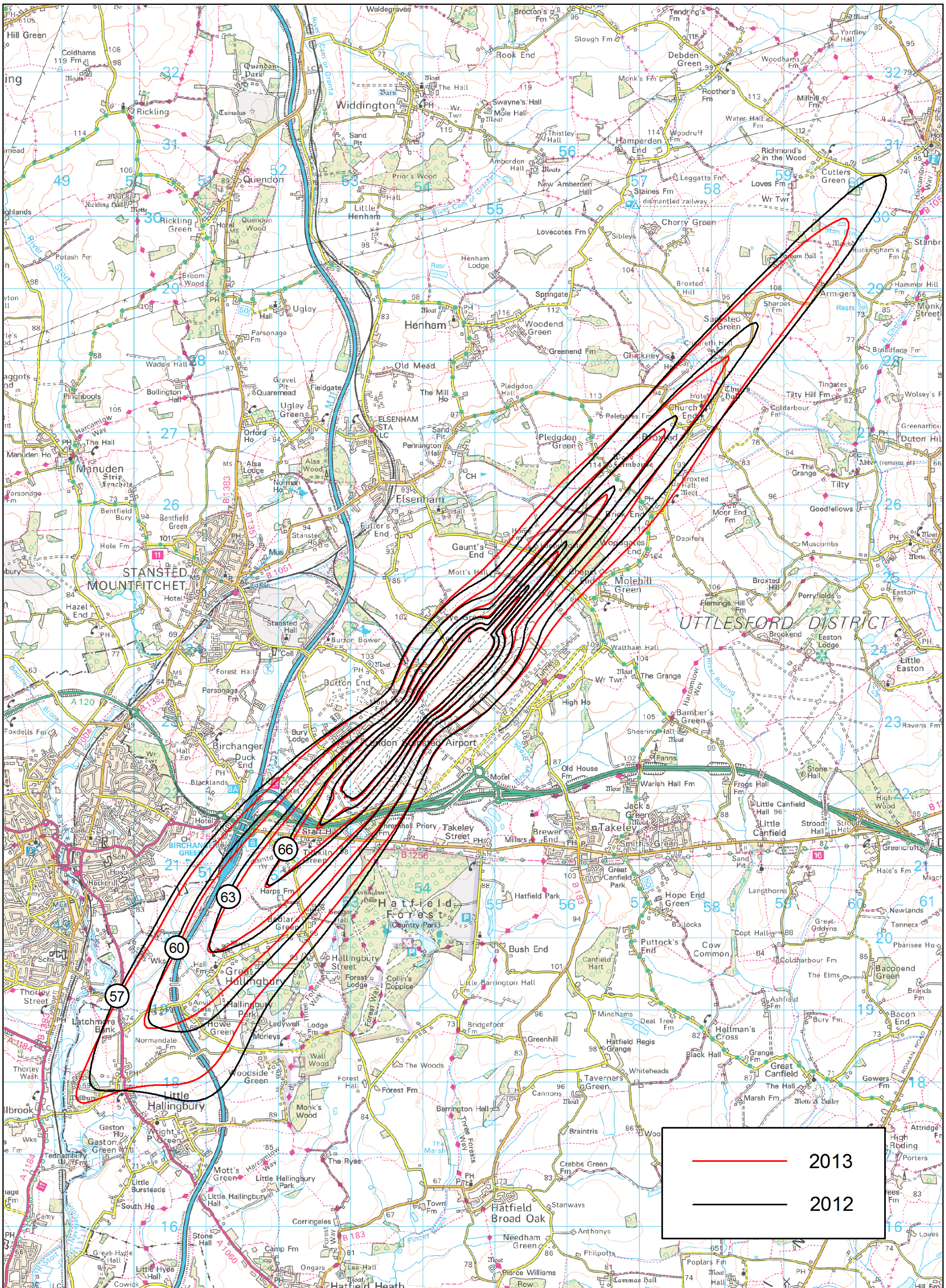


Figure 13 Stansted day actual 2013 (71% SW / 29% NE) and 2012 (85% SW / 15% NE) Leq contours



0 1 2 3 4 5 km

Figure 14 Stansted day standard 2013 (71% SW / 29% NE) and 2012 (71% SW / 29% NE) Leq contours

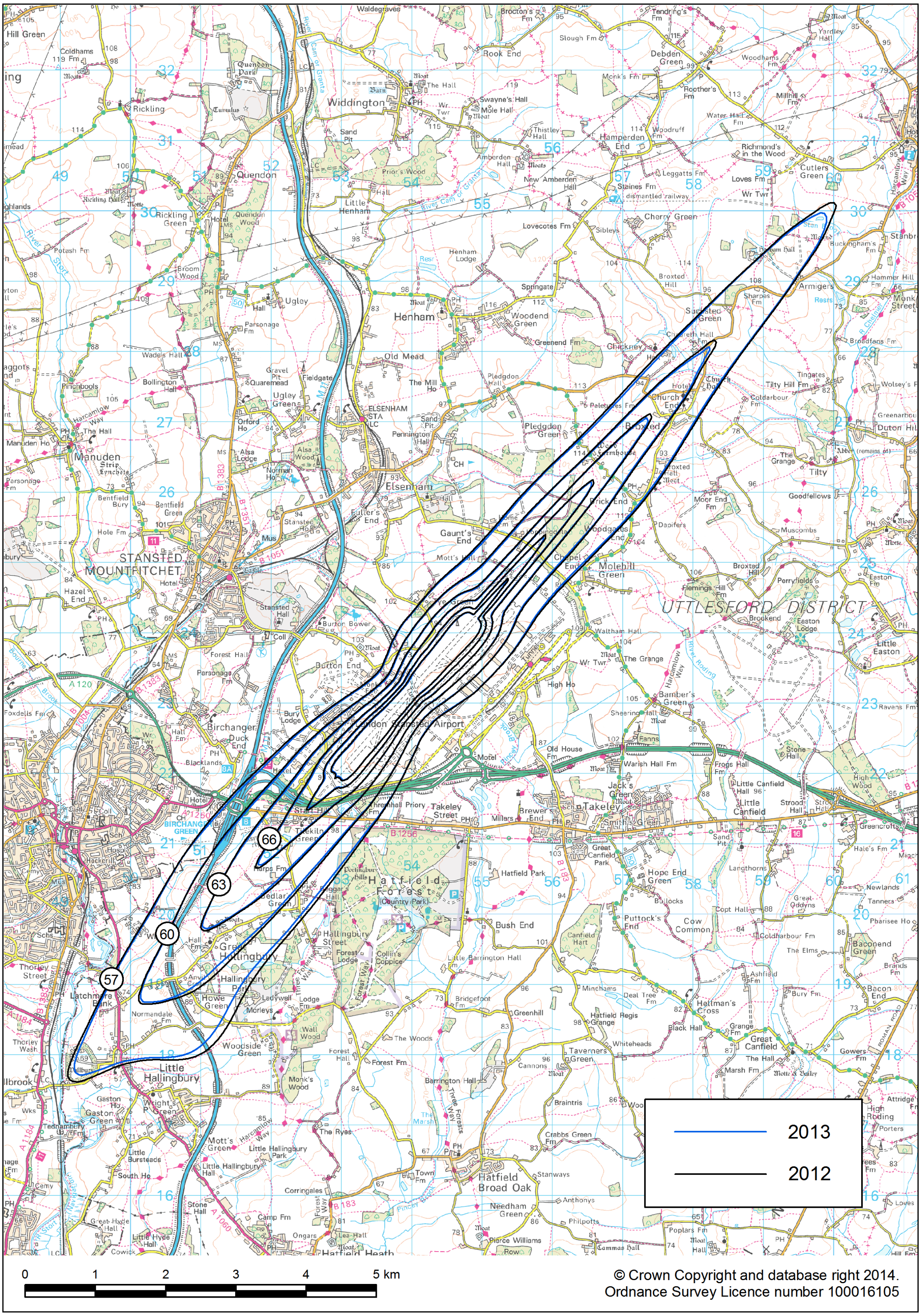


Figure 15 Stansted annual traffic and summer day Leq noise contour area/population trend 1988-2013