Environmental Research and Consultancy Department
Civil Aviation Authority

ERCD REPORT 1302

Noise Exposure Contours for Gatwick Airport 2012

J Lee
G Cebrian
L Edmonds
J Patel
D Rhodes

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

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Summary

This report presents the year 2012 noise exposure contours for London Gatwick Airport. The 57 dBA Leq contour area for 2012 based on the actual runway modal split was calculated to be 41.2 km^2, a 2% increase from 2011. The population enclosed within the actual 57 dBA contour increased by 20% compared to 2011, to 3,650.

September 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 based on 2001 Census data (updated for 2012) 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.

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 generated by a single aircraft at the measurement point, measured in dBA. This noise metric accounts for the duration of the sound as well as its intensity.

SID Standard Instrument Departure.

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Executive Summary

This report presents noise exposure contours generated for London Gatwick Airport for the year 2012. The noise modelling used radar and noise data from Gatwick'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 2012 summer traffic data for Gatwick revealed that average daily movements (686.8) were virtually the same as in 2011 (687.0).

The area of the 2012 'actual' modal split (87% west / 13% east) 57 dBA Leq contour increased by 2% compared to 2011, to 41.2 km^2. The slight area increase can be attributed mainly to some changes in the fleet mix, which included a 35% higher number of movements by the ANCON aircraft type EA320C (i.e. Airbus A320 with CFM-56 engines). The population count within the 2012 actual 57 dBA contour increased significantly compared to 2011 (by 20%) to 3,650. This was due to the extension of the contour to the east over a densely populated area (Lingfield), primarily as a result of the 9% higher proportion of westerly movements in 2012.

The area of the 2012 'standard' modal split (74% west / 26% east) 57 dBA Leq contour increased, by 2% to 41.2 km^2. This was due mainly to changes in the fleet mix, in particular the higher proportion of EA320C aircraft. The population count within the standard 57 dBA contour was 16% higher than in 2011 at 3,200, a consequence of the contour to the east of the airport extending over populated areas of Lingfield.

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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 Gatwick 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 This report contains small-scale diagrams of the year 2012 Gatwick 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].

1.1.5 The objectives of this report are to explain the noise modelling methodology used to produce the year 2012 Leq contours for Gatwick Airport, to present the calculated noise contours and to assess the changes to the contours relative to the previous year (**Ref 2**).

[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 Gatwick Airport

1.2.1 Gatwick Airport is located approximately 28 miles (45 km) south of London and about 2 miles (3 km) north of Crawley. Aside from the nearby towns of Crawley and Horley it is situated in mostly lightly populated countryside (**Figure 1**).

1.2.2 Gatwick Airport has one main runway, designated 08R/26L, which is 3,316 m long. The Runway 26L landing threshold[3] is displaced by 424 m, and the Runway 08R landing threshold is displaced by 393 m. There is also one standby runway (08L/26R) that can be used if the main runway is out of operation, for example, due to maintenance work. There are two passenger terminals. The layout of the runways, taxiways and passenger terminals in 2012 is shown in **Figure 2**.[4]

1.2.3 In the 2012 calendar year there were 247,000[5] aircraft movements (2011: 251,000) at Gatwick Airport, handling approximately 34.2 million passengers (2011: 33.7 million).[6]

[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 (28 Jun 12) AD 2-EGKK-2-1

[5] To the nearest thousand.

[6] 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 3**). The ANCON model is also used for the production of annual contours for Heathrow 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 4**). 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 Gatwick 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 Gatwick 2012 summer radar data.

2.3 Flight tracks

2.3.1 Aircraft departing Gatwick 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 Gatwick 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 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 samples of radar data extracted from the Gatwick NTK system over the 92-day summer period, 16 June to 15 September 2012. **Figure 4** shows a sample of radar flight tracks from a day in August 2012. ERCD used in-house radar analysis software to calculate mean departure flight tracks and associated lateral dispersions for each NPR/SID. Arrival tracks for Runways 08R and 26L were modelled using evenly spaced 'spurs' about the extended runway centrelines. The majority of arriving aircraft joined the centrelines at distances between 12 and 24 km from threshold for Runway 08R and between 11 and 28 km from threshold for Runway 26L.

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 2012 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 The application of reverse thrust following touchdown was modelled for all ANCON types where applicable.

2.5 Noise emissions

2.5.1 At Gatwick, 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 Gatwick NTK system comprises five 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)[8]. Thirdly, only measurements obtained of aircraft operations

[7] Further information on the noise monitors can be found in ERCD Report 1004 (**Ref 5**).

[8] 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.

that pass through a 60-degree inverted cone, centred at the noise monitor, are retained in order to minimise the effects of lateral attenuation[9] and lateral directivity[10].

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 when, and where, 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) over the 92-day 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[11] and close agreement was found.

Traffic distribution by noise class

2.6.2 **Table 1** lists the average summer day movements[12] by eight noise classes of aircraft, ranked in ascending order of noise emission, i.e. from least to most noisy, in 2011 and 2012. As in 2011, the majority of movements (84%) were by short-haul 'Chapter 3' and 'Chapter 4'[13] jet aircraft (Noise Class 3), the numbers of which were up slightly, by 0.5%, in 2012. (Note: in 2012 an estimated 82% of the aircraft within Noise Class 3 were compliant with the Chapter 4 standard).

2.6.3 Movements by wide-body twin-engine aircraft (Noise Class 4) were effectively unchanged in 2012. However, wide-body 3/4-engine aircraft (Noise Class 5) numbers decreased by 3%, though they comprised just 1% of total movements. Around 7% of movements were by large propeller aircraft (Noise Class 2), the numbers of which dropped by 5%. The numbers of aircraft within Noise Classes 1 and 8 were insignificant, and there were no Noise Class 6 and 7 movements.

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

[10] 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.

[11] NATS is the provider of air traffic control services to Gatwick Airport.

[12] Includes departures and arrivals.

[13] Aircraft whose certificated noise levels are classified by the ICAO *Standards and Recommended Practices – Aircraft Noise: Annex 16 to the Convention on International Civil Aviation* into 'Chapter 3' and 'Chapter 4' types - these are typically characterised by modern, quieter, high-bypass turbofan aircraft.

2.6.4 The average number of daily movements at Gatwick over the 2012 summer period (686.8) was virtually the same as in 2011 (687.0).

2.6.5 **Figure 5** illustrates the changing distribution of traffic among the eight noise classes over the period from 1988 to 2012 inclusive. The shift over the years to increasingly higher proportions of short-haul Chapter 3 & 4 aircraft (Noise Class 3) can be clearly seen.

Traffic distribution by ANCON aircraft type

2.6.6 A more detailed breakdown of the 2012 average summer day movements, indicating the ANCON types that fall into each noise class, is provided in **Table 2**. The largest increase in movements was for the ANCON type EA320C (Noise Class 3), up by 29 movements per day (note: ANCON type descriptions can be found in **Table 2**). There were also notable increases in Noise Class 3 for the B738 (up by 13 movements) and the ERJ170 (up by 11 movements).

2.6.7 The largest reductions were for the following Noise Class 3 types: the ERJ190, which were down by 14 movements per day; the B757E, down by 13 movements; and the EA319C, also down by 13 movements.

2.6.8 **Figure 6** illustrates the numbers of movements by ANCON aircraft type for the average summer day. It can be seen that in 2012 the EA319C was the most frequent ANCON aircraft type at Gatwick with 190 daily movements (28% of total movements), followed by the EA320C with 112 movements (16% of total movements) and the B733 with 103 movements (15% of total movements).

2.6.9 The noise dominant ANCON types at Gatwick in 2012 included the B733, B738, B744G, EA319C and EA320C. They were responsible for the highest contributions of 'noise energy', which is a function of both aircraft noise level and movement numbers.

Traffic distribution by SID route

2.6.10 **Figure 7** shows the distribution of aircraft departures by SID route for 2012. The 'wraparound' route LAM/BIG/CLN/DVR from Runway 26L had the highest loading of departure traffic (38%), followed by the HAR/BOG route from Runway 26L with 25% of the traffic, and then 26L KEN/SAM (23%). The traffic increased by 4% on both the 26L LAM/BIG/CLN/DVR and 26L HAR/BOG routes. There were reductions in traffic of up to 3% on each of the Runway 08R SIDs.

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 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

westerly (Runway 26L) and easterly (Runway 08R) operations is referred to as the *runway modal split*.

2.7.2 To remove the effect of year-on-year weather fluctuations on aircraft operations and to clarify underlying trends, two sets of contours have been produced for the year 2012:

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

(ii) Contours assuming the 'standard' modal split over the Leq period, i.e. the long-term modal split calculated from the 20-year rolling average; for 2012, this is the 20-year period from 1993 to 2012. Use of the standard modal split enables year-on-year comparisons without the runway usage affecting the contour shape.

2.7.3 The actual and standard modal splits for 2012, together with the previous year, are summarised in the following table:

Gatwick runway modal splits for 2012 and 2011

Modal split scenario	**% west (Runway 26L)**	**% east (Runway 08R)**
Actual 2012	87%	13%
Actual 2011	78%	22%
Standard 2012	74%	26%
Standard 2011	73%	27%

2.7.4 The 2012 proportion of actual westerly operations (87%) was 9% higher than in 2011 and the highest recorded at Gatwick since 1998. The 2012 standard modal split was 1% higher than for 2011. Historical runway modal splits at Gatwick for the past 20 years are summarised in **Figure 8**.

2.8 Topography

2.8.1 The topography around Gatwick Airport was modelled by accounting for terrain height, and is of particular relevance on the western side of the airport around the high ground in the vicinity of Russ Hill (near Charlwood). 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[14] 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 Gatwick 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 2012 update of the 2001 Census supplied by CACI Limited[15]. 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 population data points for the area around Gatwick Airport are illustrated in **Figure 10**.

2.9.2 Estimates have also been made of the numbers of noise sensitive buildings situated within the contours, using the *InterestMap*™[16] 'Points of Interest' (2012) database. For the purposes of this study, the noise sensitive buildings that have been considered are schools, hospitals and places of worship.

[14] Meridian™ 2

[15] www.caci.co.uk

[16] InterestMap is distributed by Dotted Eyes Ltd and derived from Ordnance Survey 'Points of Interest' data.

3 Noise contour results

3.1 Actual modal split contours

3.1.1 The Gatwick 2012 Leq noise contours generated with the actual 2012 summer period runway modal split (87% west / 13% east) are shown in **Figure 11**. The contours are plotted from 57 to 72 dBA at 3 dB intervals.

3.1.2 The cumulative areas, populations and households within the contours are provided in the table below:

Gatwick 2012 actual modal split contours: area, population and household estimates

Leq contour level (dBA)	Area (km^2)	Population	Households
> 57	41.2	3,650	1,600
> 60	23.3	1,150	500
> 63	12.8	400	200
> 66	6.9	150	50
> 69	3.7	< 50	< 50
> 72	2.0	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 actual modal split contours are provided in the table below:

Gatwick 2012 actual modal split contours: noise sensitive building estimates

Leq contour level (dBA)	Schools	Hospitals	Places of worship
> 57	4	0	2
> 60	3	0	2
> 63	3	0	2
> 66	2	0	2
> 69	0	0	1
> 72	0	0	0

3.2 Standard modal split contours

3.2.1 The Gatwick 2012 Leq noise contours generated with the standard 2012 summer period runway modal split (74% west / 26% east) are shown in **Figure 12**. The contours are plotted from 57 to 72 dBA at 3 dB intervals.

3.2.2 The cumulative areas, populations and households within the contours are provided in the table below:

Gatwick 2012 standard modal split contours: area, population and household estimates

Leq contour level (dBA)	Area (km^2)	Population	Households
> 57	41.2	3,200	1,400
> 60	23.4	1,250	500
> 63	12.8	350	150
> 66	6.9	150	50
> 69	3.6	< 50	< 50
> 72	2.0	0	0

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

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

Gatwick 2012 standard modal split contours: noise sensitive building estimates

Leq contour level (dBA)	Schools	Hospitals	Places of worship
> 57	4	0	2
> 60	3	0	2
> 63	3	0	2
> 66	2	0	2
> 69	0	0	0
> 72	0	0	0

4 Analysis of results

4.1 Actual modal split contours – comparison with 2011 contours

4.1.1 The Gatwick 2012 actual modal split Leq contours are compared against the 2011 actual Leq contours in **Figure 13**. The table below summarises the areas, populations and percentage changes from 2011 to 2012:

Gatwick actual modal split contours: areas and populations for 2011 and 2012

Leq (dBA)	2011 Area (km^2)	2012 Area (km^2)	Area change (%)	2011 Pop.	2012 Pop.	Pop. change (%)
> 57	40.4	41.2	+2%	3,050	3,650	+20%
> 60	23.0	23.3	+1%	1,150	1,150	0%
> 63	12.8	12.8	0%	350	400	+14%
> 66	6.9	6.9	0%	200	150	-25%
> 69	3.6	3.7	+3%	< 50	< 50	(n/a)
> 72	2.0	2.0	0%	0	0	0%

Note: the 2011 and 2012 actual modal splits were 78% west / 22% east and 87% west / 13% east respectively.

4.1.2 There were area increases for some of the contour levels relative to 2011, in the order of 1-3%. These can be attributed primarily to changes in the fleet mix composition for 2012, the most significant being a 35% increase in EA320C aircraft movements compared to 2011.

4.1.3 A relatively large population increase was evident within the 57 dBA contour. This resulted from an extension of the contour over the village of Lingfield, caused principally by the higher proportion of westerly movements in 2012. 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.

4.2 Standard modal split contours – comparison with 2011 contours

4.2.1 The Gatwick 2012 standard modal split Leq contours are compared against the 2011 standard Leq contours in **Figure 14**. The following table summarises the areas, populations and percentage changes from 2011 to 2012:

Gatwick standard modal split contours: areas and populations for 2011 and 2012

Leq (dBA)	2011 Area (km^2)	2012 Area (km^2)	Area change (%)	2011 Pop.	2012 Pop.	Pop. change (%)
> 57	40.4	41.2	+2%	2,750	3,200	+16%
> 60	23.1	23.4	+1%	1,250	1,250	0%
> 63	12.8	12.8	0%	350	350	0%
> 66	6.9	6.9	0%	200	150	-25%
> 69	3.6	3.6	0%	< 50	< 50	(n/a)
> 72	2.0	2.0	0%	0	0	0%

Note: the standard modal split was 73% west / 27% east in 2011 and 74% west / 26% east in 2012.

4.2.2 The standard modal split 57 dBA contour area increased by 2% in 2012, which can be attributed largely to some changes in the fleet mix composition for 2012, such as the large increase in movements of EA320C aircraft mentioned earlier.

4.2.3 The population within the 57 dBA contour was 16% higher in 2012. This was caused by the slight extension of the contour to the east over a densely populated area (Lingfield), the result of a combination of the 1% higher westerly movements and change in fleet mix in 2012 described earlier.

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 westerly to easterly operations.

4.3 Noise contour historical trend

4.3.1 **Figure 15** shows how the 57 dBA Leq 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.)

Movements

4.3.2 Aircraft movements reached a low in 1991 (the year of the First Gulf War) and did not return to 1990 levels until 1995. From 1995 to 2000 they increased steadily. From 2000 to 2002 movements decreased, possibly as a consequence of the terrorist attacks on 11 September 2001. There was little change in the total annual number of movements from 2002 to 2003, but annual movements rose steadily from 2004 to 2007. However, the annual movement figure for 2008 fell by 1% from 2007 - this may be attributed to the fluctuating oil price and economic downturn. The annual movements fell even further in 2009, by 4%, as the global recession continued to impact upon the aviation industry.

4.3.3 Movements dropped for the third year in a row in 2010, by a further 5%. This was due in part to the volcanic ash crisis in April and adverse winter weather

conditions. However, there was a recovery in 2011 from the adverse events of the previous year as traffic levels rose by 4%. In 2012 traffic levels fell by about 2% following a significant drop in charter flights at Gatwick.

Areas and populations

4.3.4 From 1988 to 1993, the area within the 57 dBA Leq contour diminished markedly and then increased slightly until 1996. From 1996 onwards the area decreased slightly each year but levelled off between 1999 and 2000. In 2001 the area decreased by 22% relative to the previous year and in 2002 the contour area decreased by 19% relative to 2001. From 2002 to 2008 the contour area fluctuated within a narrow range from 45 to 49 km^2. However, the area fell below this range to 41 km^2 in 2009, and dropped further in 2010 to 39.6 km^2, the smallest ever area calculated for Gatwick. The contour area increased slightly in 2011 to 40.4 km^2 as movements recovered. In 2012 the area was again slightly higher, this time mainly due to some changes in the fleet mix.

4.3.5 The population numbers within the contours have generally moved in line with the areas, dropping to the lowest ever level in 2010, but increasing again in 2011. The marked rise in population for 2012 was largely the result of the contour extending over a densely populated area (Lingfield).

5 Conclusions

5.1 Year 2012 average summer 16-hour day Leq noise exposure contours have been generated for Gatwick Airport using the ANCON noise model.

5.2 The results show that the actual modal split 57 dBA Leq contour area increased from 40.4 km^2 in 2011 to 41.2 km^2 in 2012, a 2% rise. The growth in area can be attributed primarily to changes in the fleet mix, which included a higher proportion of EA320C aircraft in 2012. The population within the actual 57 dBA Leq contour increased markedly by 20% compared to 2011 - this was due to the extension of the contour over the village of Lingfield which resulted primarily from the significantly higher proportion of westerly movements in 2012.

5.3 The standard 57 dBA Leq contour area increased from 40.4 km^2 in 2011 to 41.2 km^2 in 2012, also a 2% rise. This growth in area may also be attributed mainly to the higher proportion of EA320C aircraft in the 2012 fleet mix. The population enclosed within the 2012 standard 57 dBA Leq contour was 16% higher than in 2011 at 3,250. This resulted from an extension of the contour to the east of the airport over densely populated areas of Lingfield.

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Table 1 Gatwick 2011 and 2012 average summer day movements by noise class

Noise Class	Description	2011	2012	Percentage of total 2012 movements	Change
PROPELLER AIRCRAFT					
1	Small propeller aircraft	0.2	0.1	0%	-0.1 (*)
2	Large propeller aircraft	49.2	46.5	7%	-2.7 (-5%)
CHAPTER 3/4 JETS **					
3	Short-haul aircraft	577.1	579.7	84%	+2.6 (+0.5%)
4	Wide-body twin-engine aircraft	50.5	50.8	7%	+0.3 (0%)
5	2nd generation wide-body 3,4-engine aircraft	9.9	9.6	1%	-0.3 (-3%)
LARGE CHAPTER 2/3 JETS					
6	1st generation wide-body 3,4-engine aircraft	< 0.1	0.0	0%	0.0 (*)
2nd GENERATION TWIN JETS					
7	Narrow-body twin-engine aircraft *(including Ch.2 and hushkitted versions)*	0.0	0.0	0%	0.0 (*)
1st GENERATION JETS					
8	Narrow-body 3,4-engine aircraft	0.0	< 0.1	0%	0.0 (*)
	TOTAL	**687.0**	**686.8**	**100%**	**-0.1 (0%)**

* Percentage changes not shown due to low numbers and limited data resolution.
** An estimated 82% of *Noise Class 3* aircraft in 2012 meet the 'Chapter 4' noise standard (2011: 77%)

Note: Totals may not sum exactly due to rounding.

Table 2 Gatwick 2011 and 2012 average summer day movements by ANCON aircraft type

Aircraft type	Noise class	ANCON type	2011	2012	Change
Single piston propeller	1	SP	0.1	< 0.1	-0.1
Small twin-piston propeller	1	STP	< 0.1	0.0	0.0
Small twin-turboprop	1	STT	0.1	0.1	0.0
Large twin-turboprop	2	LTT	49.1	46.5	-2.6
Large four-engine propeller	2	L4P	< 0.1	0.0	0.0
Boeing 737-300/400/500	3	B733	106.2	102.6	-3.6
Boeing 737-600/700	3	B736	6.9	3.6	-3.3
Boeing 737-800/900	3	B738	54.8	67.5	+12.7
Boeing 757-200 (RB211-535E4/E4B engines)	3	B757E	41.9	29.2	-12.7
Boeing 757-200 (PW2037/2040 engines)	3	B757P	0.1	0.1	0.0
Boeing 757-300	3	B753	2.8	2.9	+0.1
BAe 146/Avro RJ	3	BA46	0.3	1.0	+0.7
Airbus A318	3	EA318	0.1	0.1	0.0
Airbus A319 (CFM-56 engines)	3	EA319C	202.3	189.8	-12.5
Airbus A319 (IAE-V2500 engines)	3	EA319V	18.1	16.3	-1.8
Airbus A320 (CFM-56 engines)	3	EA320C	83.1	112.1	+29.0
Airbus A320 (IAE-V2500 engines)	3	EA320V	2.7	2.4	-0.3
Airbus A321 (CFM-56 engines)	3	EA321C	4.1	3.4	-0.7
Airbus A321 (IAE-V2500 engines)	3	EA321V	13.4	16.5	+3.1
Executive Business Jet (Chapter 3)	3	EXE3	3.5	3.7	+0.2
Bombardier Regional Jet 100/200	3	CRJ	4.4	0.1	-4.3
Bombardier Regional Jet 700	3	CRJ700	0.0	0.1	+0.1
Bombardier Regional Jet 900	3	CRJ900	0.4	0.2	-0.2
Embraer ERJ 135/145	3	ERJ	0.2	0.2	0.0
Embraer ERJ 170	3	ERJ170	< 0.1	11.1	+11.1
Embraer ERJ 190	3	ERJ190	29.7	15.8	-13.9
Fokker 100	3	FK10	1.5	0.8	-0.7
McDonnell Douglas MD80 series	3	MD80	0.9	0.1	-0.8
Boeing 767-200	4	B762	0.9	0.1	-0.8
Boeing 767-300 (GE CF6-80 engines)	4	B763G	8.5	7.3	-1.2
Boeing 767-300 (PW4000 engines)	4	B763P	1.8	1.7	-0.1
Boeing 767-300 (RR RB211 engines)	4	B763R	< 0.1	< 0.1	0.0
Boeing 777-200 (GE GE90 engines)	4	B772G	10.0	11.5	+1.5
Boeing 777-200 (PW400 engines)	4	B772P	0.0	0.9	+0.9
Boeing 777-200 (RR Trent 800 engines)	4	B772R	3.4	3.7	+0.3
Boeing 777-200LR/300ER (GE GE90 engines)	4	B773G	4.5	4.5	0.0
Boeing 777-300 (RR Trent 800 engines)	4	B773R	0.7	0.1	-0.6
Airbus A300	4	EA30	6.2	5.2	-1.0
Airbus A310	4	EA31	0.8	1.2	+0.4
Airbus A330	4	EA33	13.9	14.6	+0.7
Airbus A340-200/300	5	EA34	0.5	0.3	-0.2
Airbus A340-500/600	5	EA346	< 0.1	< 0.1	0.0
Airbus A380 (Engine Alliance GP7000)	5	EA38GP	0.0	< 0.1	0.0
Boeing 747-400 (GE CF6-80F engines)	5	B744G	9.3	9.3	0.0
Boeing 747-400 (PW4000 engines)	5	B744P	< 0.1	0.0	0.0
McDonnell Douglas MD-11	5	MD11	< 0.1	0.0	0.0

Aircraft type	Noise class	ANCON type	2011	2012	Change
McDonnell Douglas DC-10	6	DC10	< 0.1	0.0	0.0
Ilyushin Il-62	8	IL62	0.0	< 0.1	0.0
		TOTAL	**687.0**	**686.8**	**-0.2 (0%)**

Note: Totals may not sum exactly due to rounding.

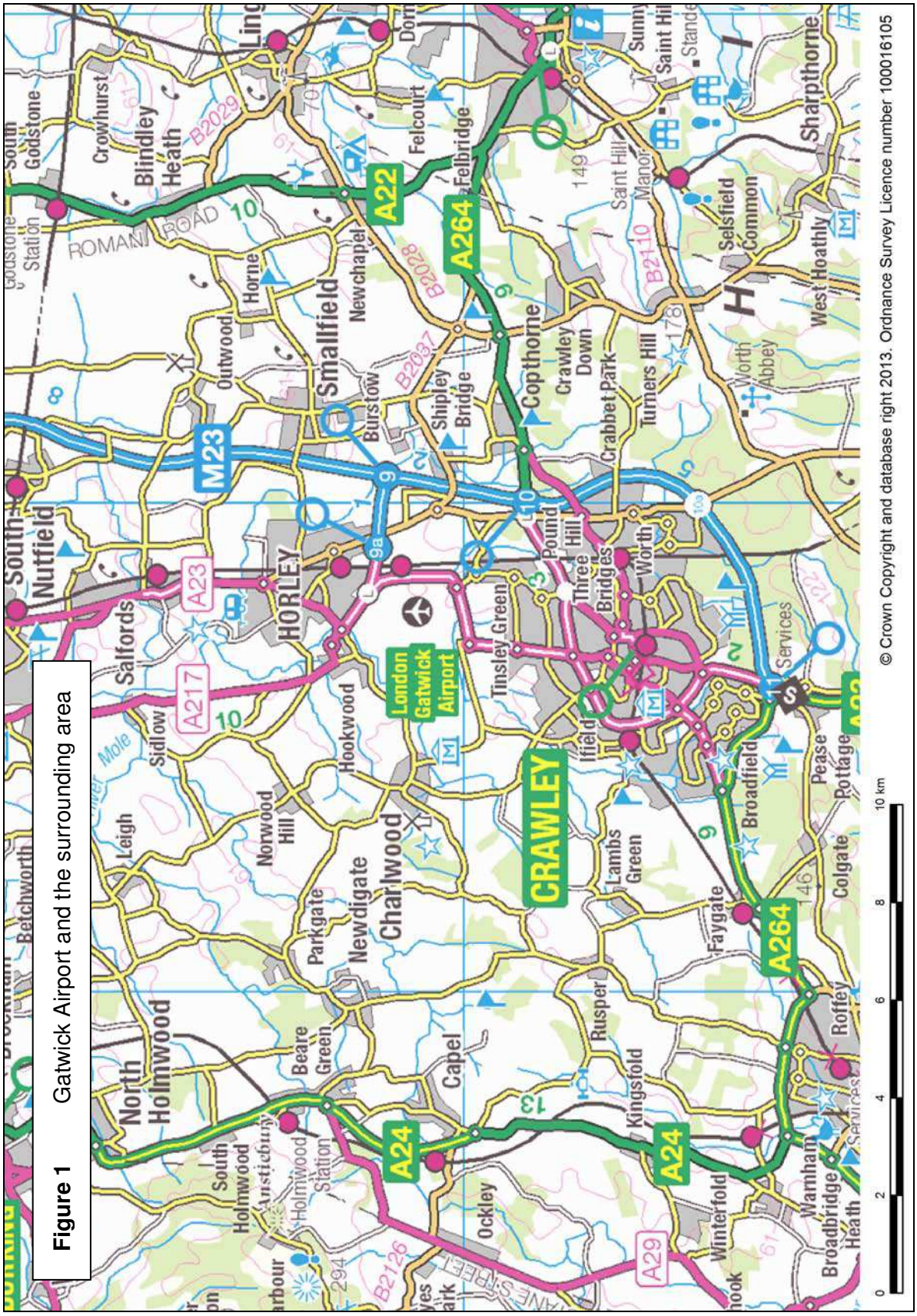
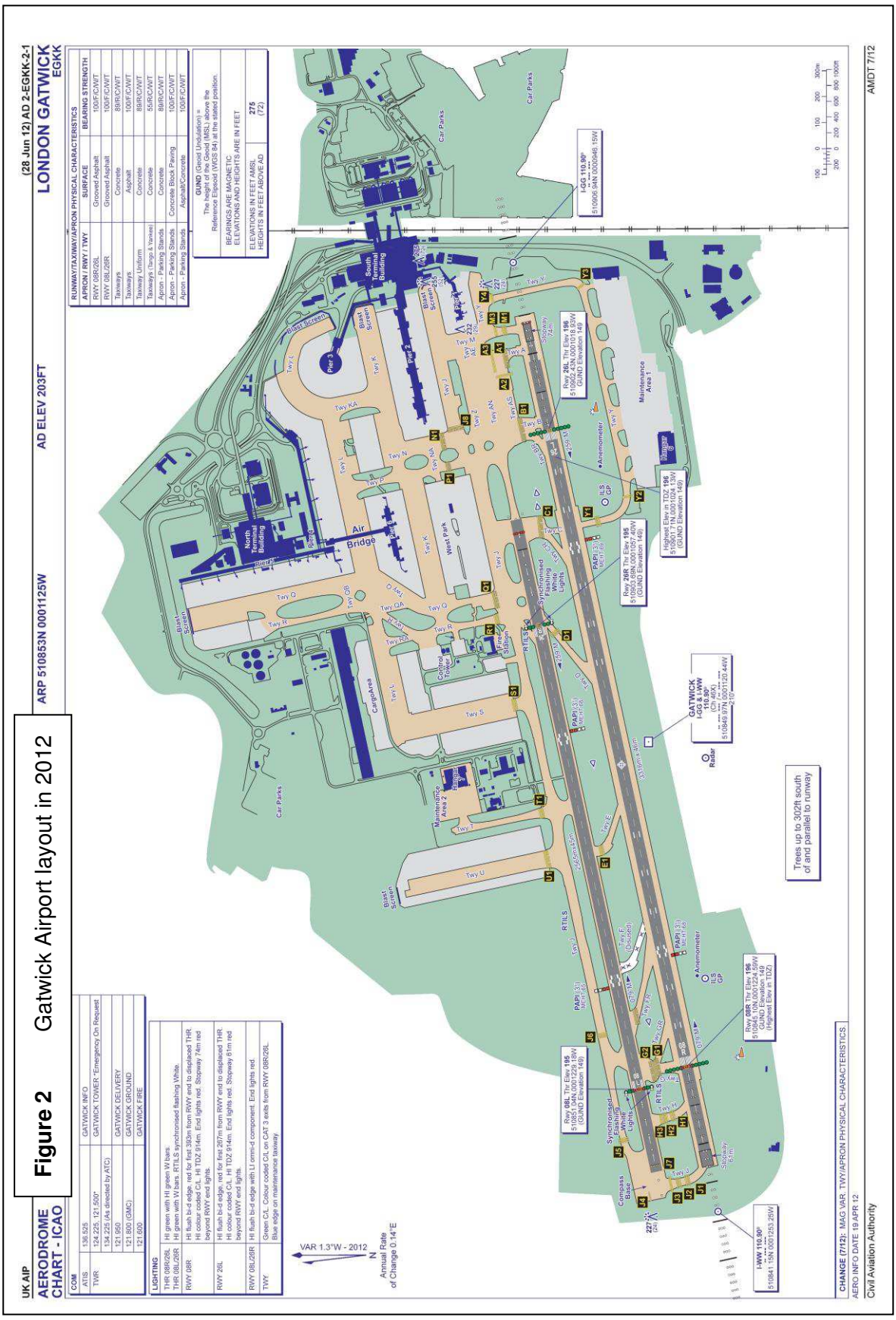


Figure 1 Gatwick Airport and the surrounding area



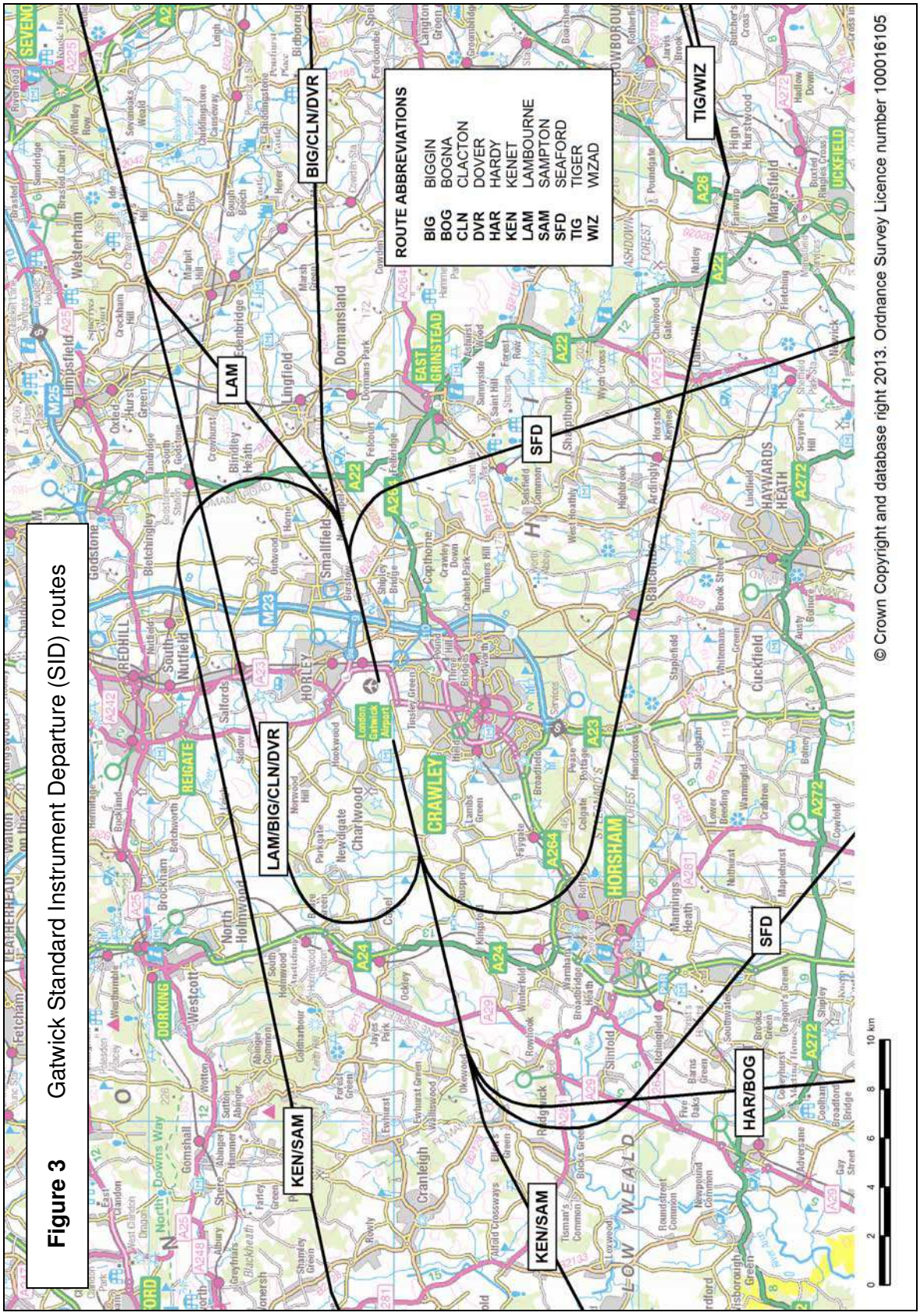


Figure 3 Gatwick Standard Instrument Departure (SID) routes

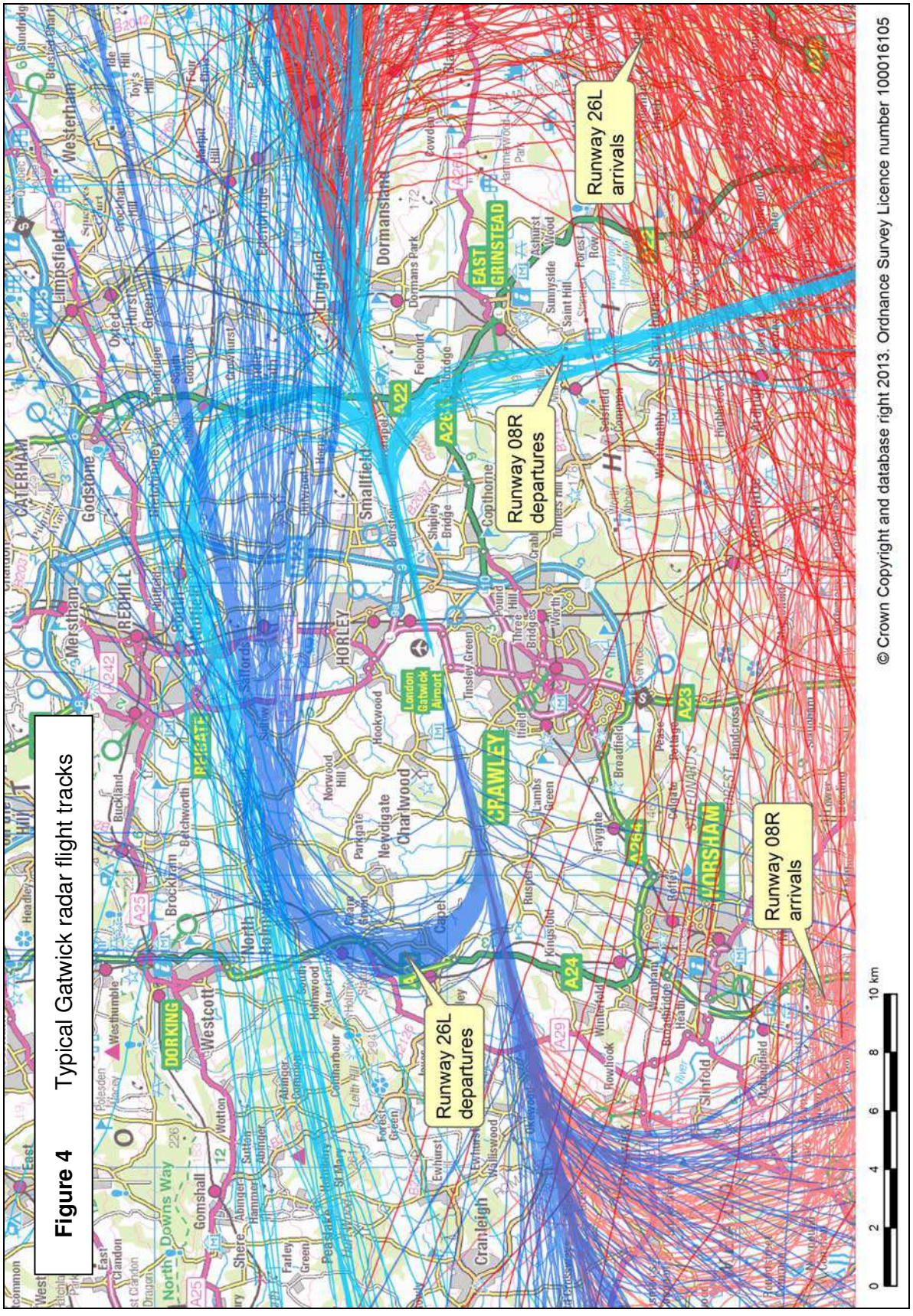
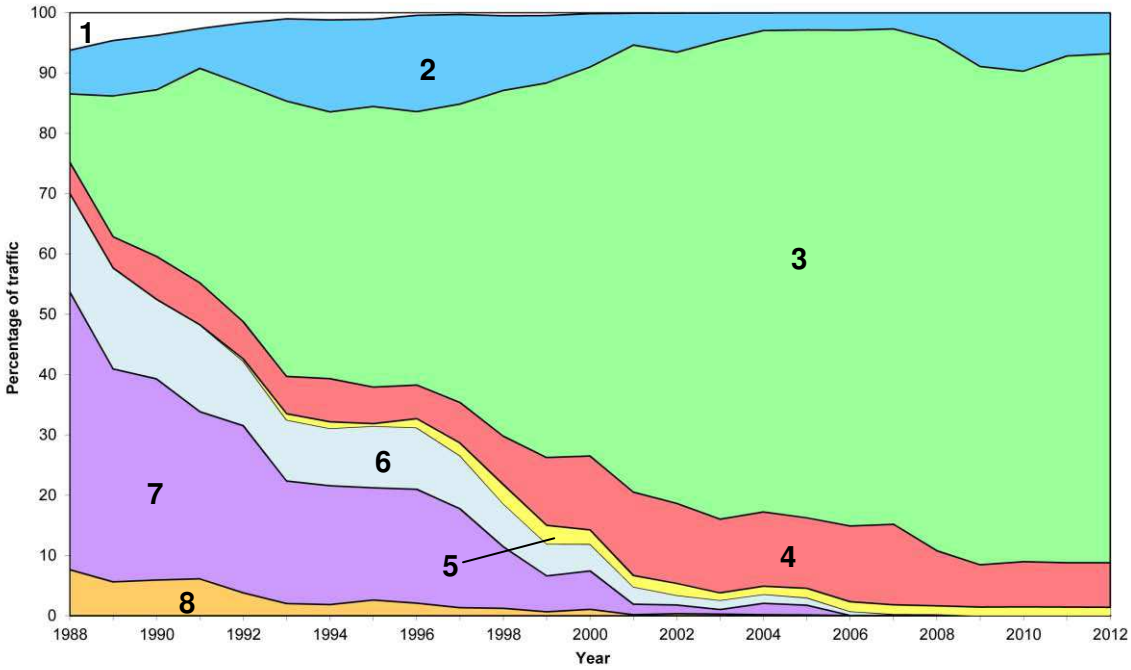


Figure 4 Typical Gatwick radar flight tracks

Figure 5 Gatwick noise class trend 1988-2012



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

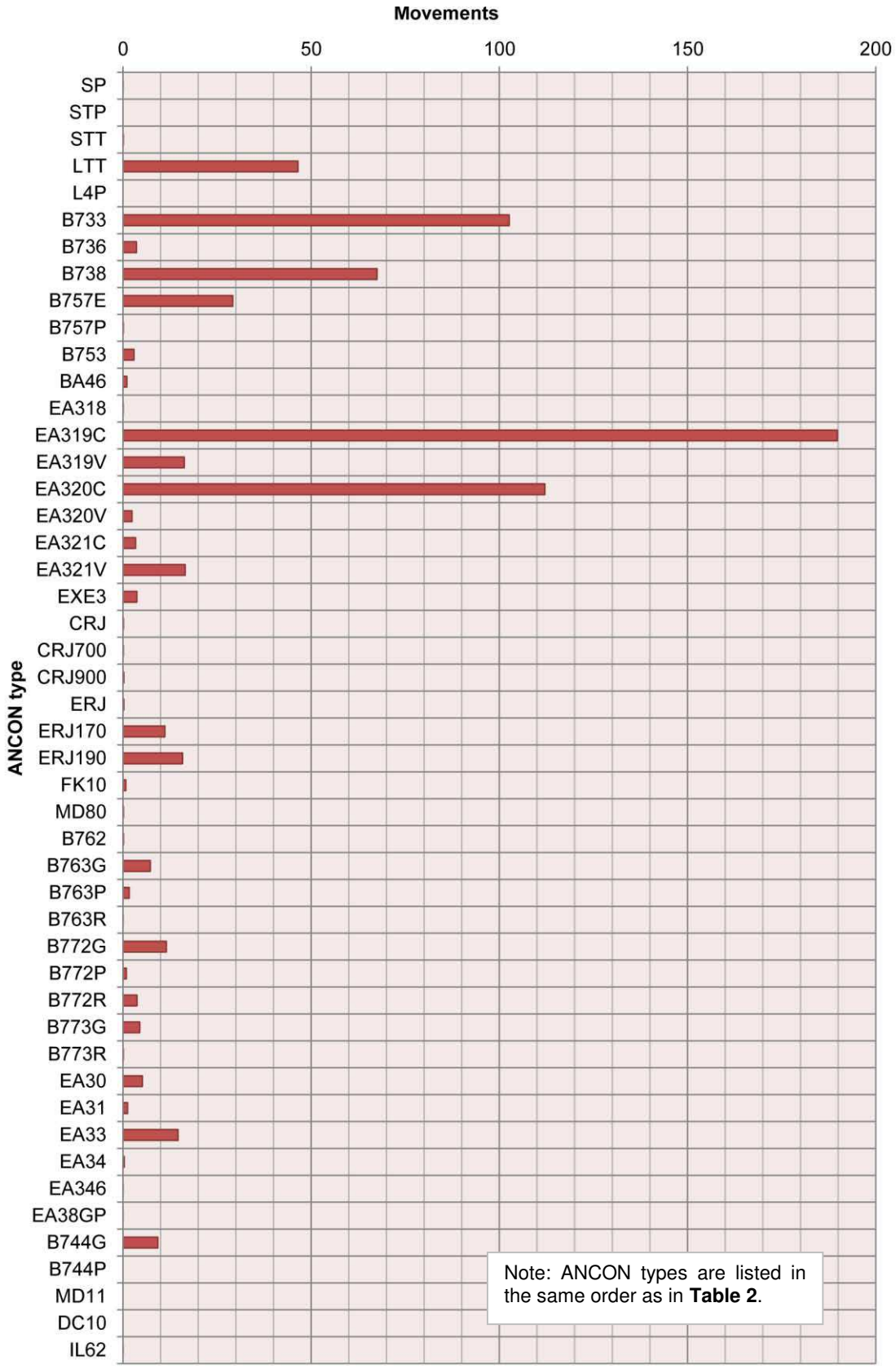
Chapter 3/4 jets
3 Short-haul, e.g. Airbus A319, Boeing 737-300
4 Wide-body twins, e.g. Airbus A330, Boeing 767
5 2nd generation wide-body 3/4-engine aircraft, e.g. Airbus A340, Boeing 747-400

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 707

Figure 6 Gatwick 2012 average summer day movements by ANCON type



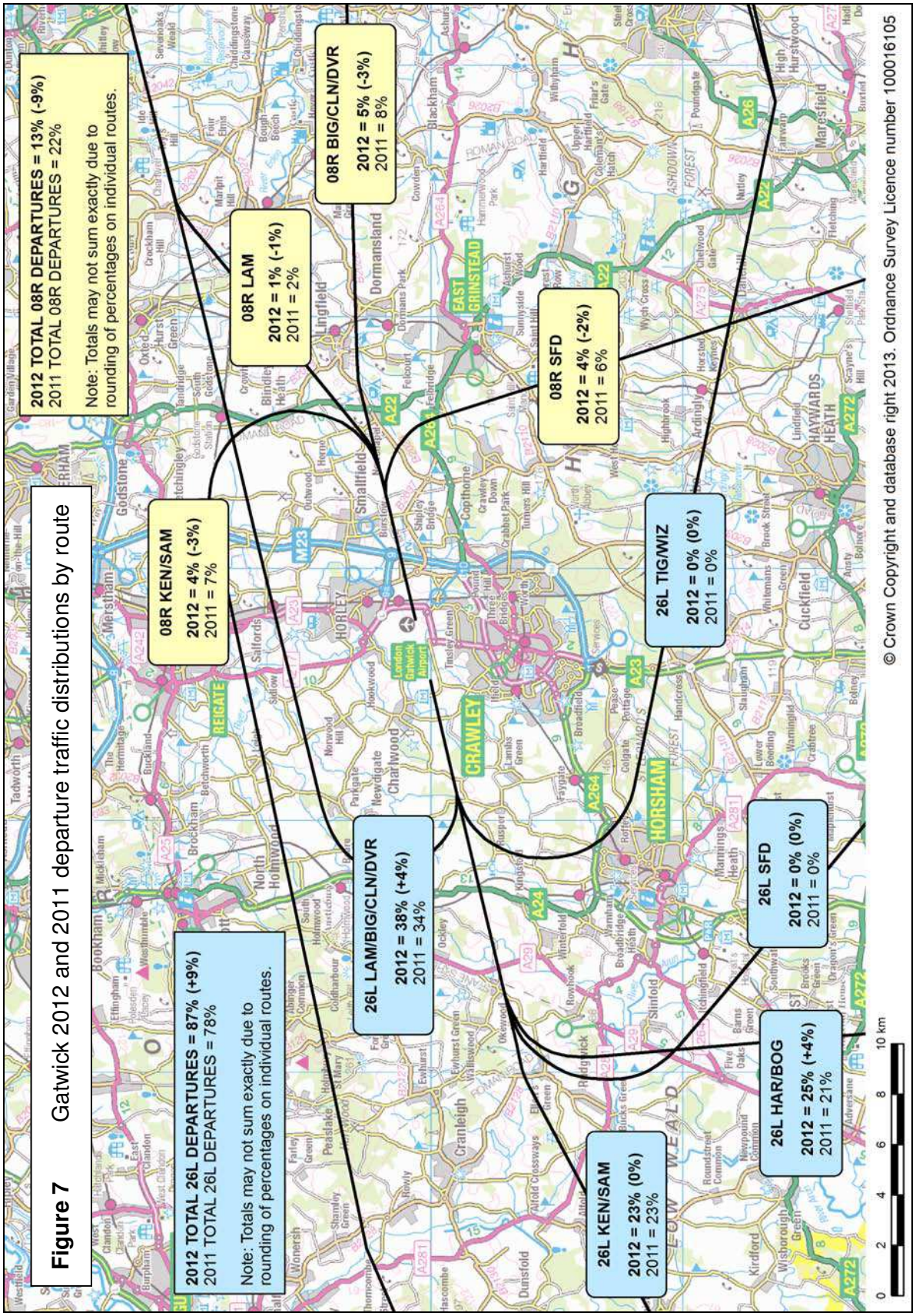
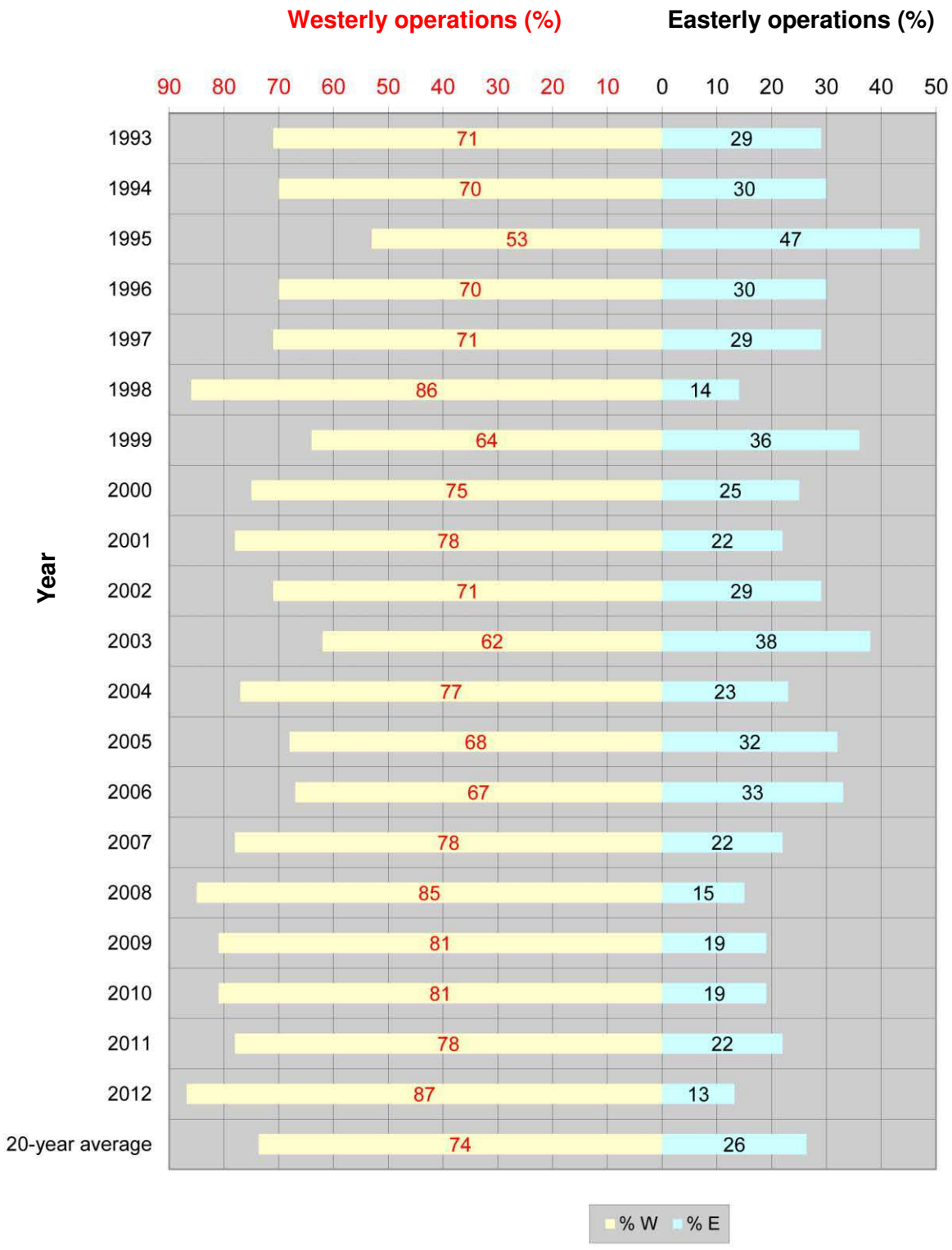


Figure 7 Gatwick 2012 and 2011 departure traffic distributions by route

Figure 8 Gatwick average summer day runway modal splits 1993-2012



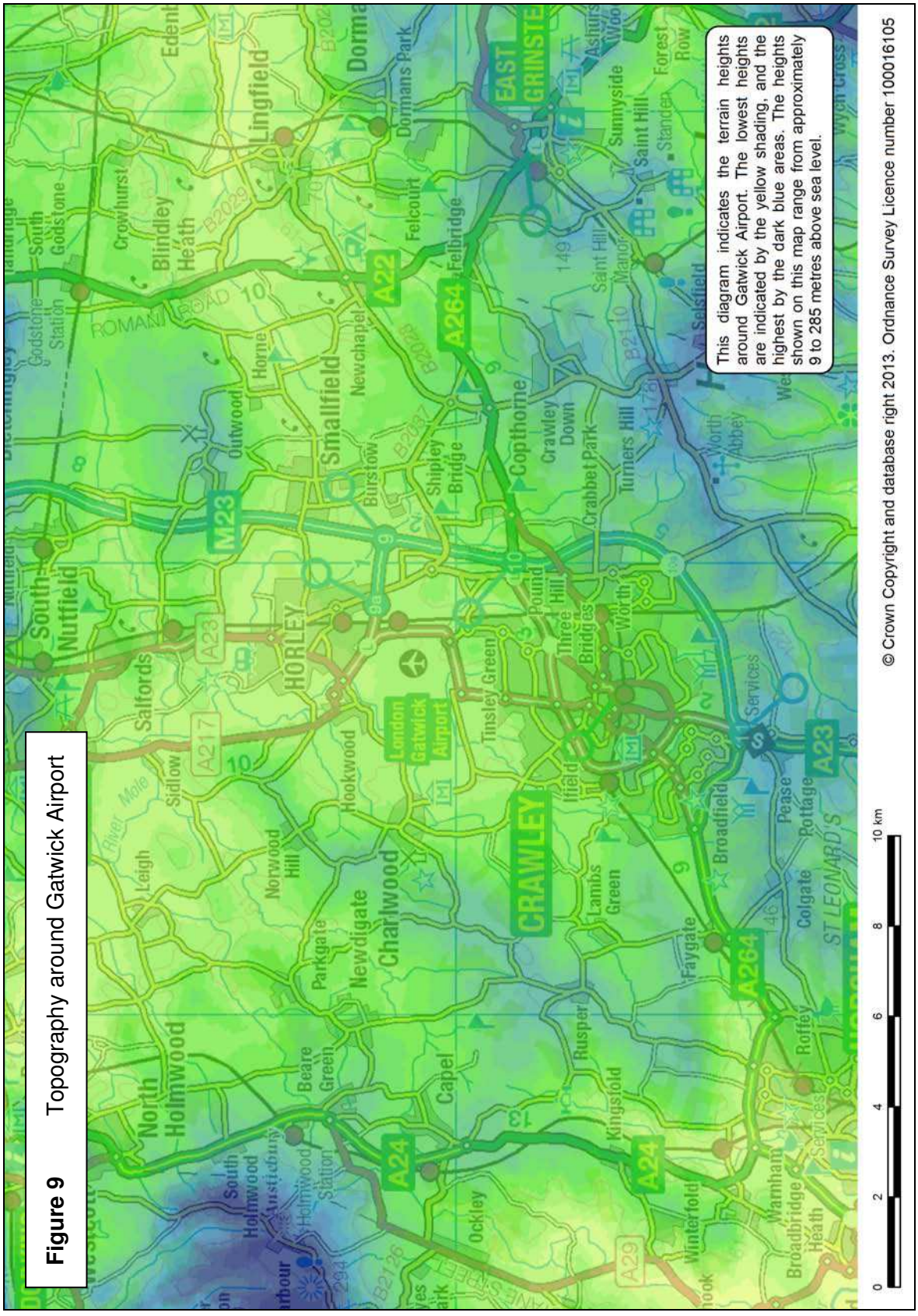


Figure 9 Topography around Gatwick Airport

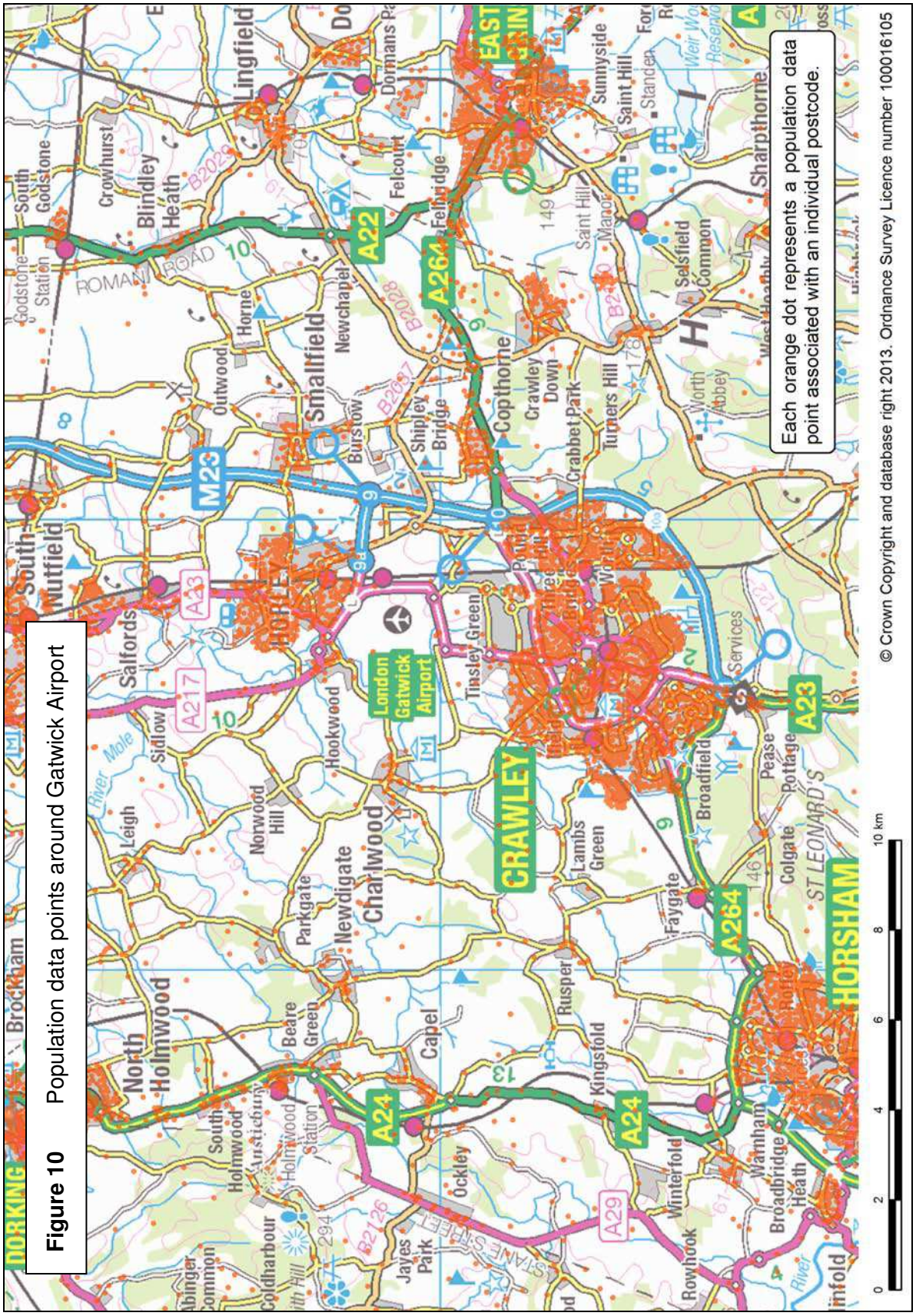


Figure 10 Population data points around Gatwick Airport

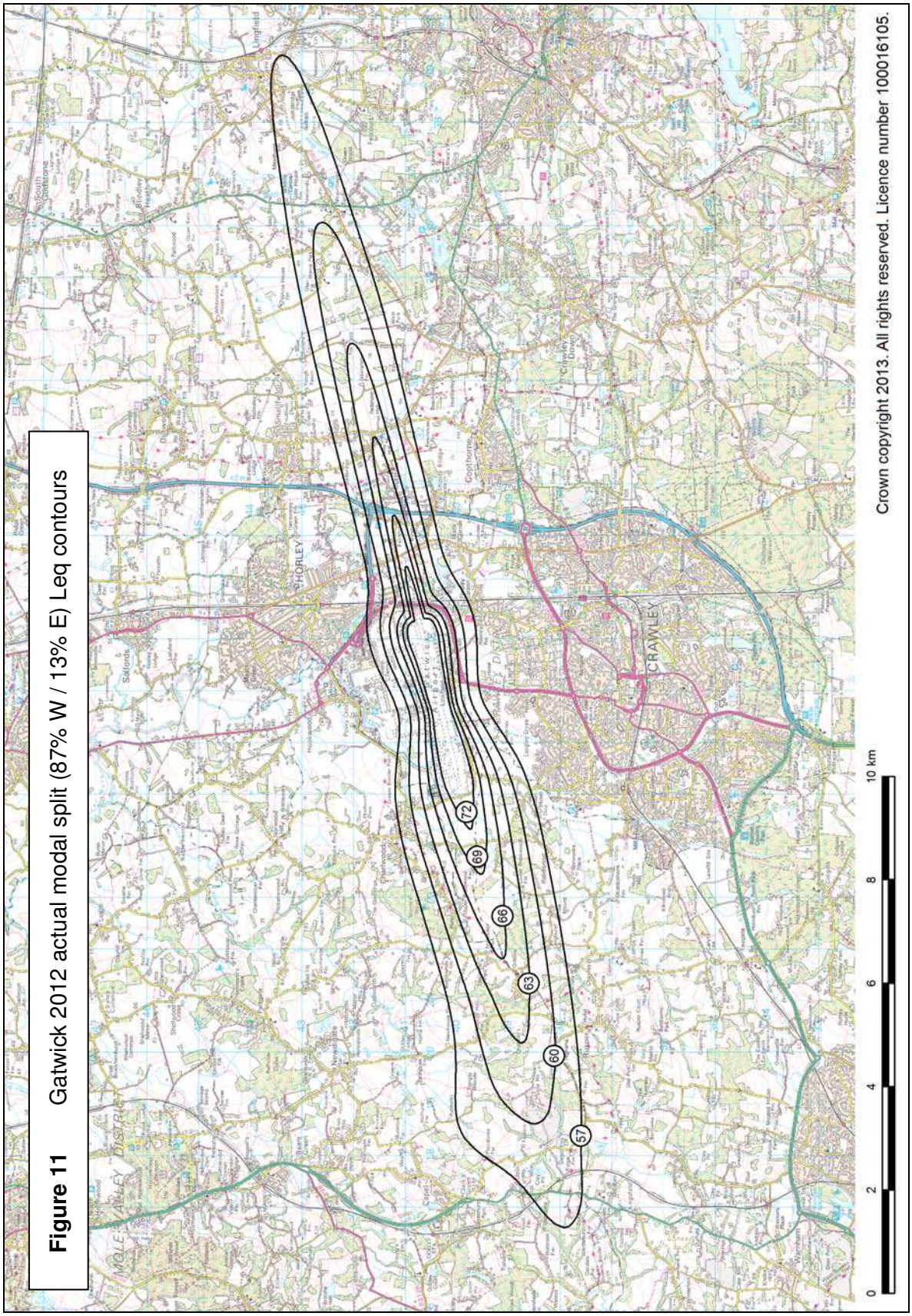


Figure 11 Gatwick 2012 actual modal split (87% W / 13% E) Leq contours

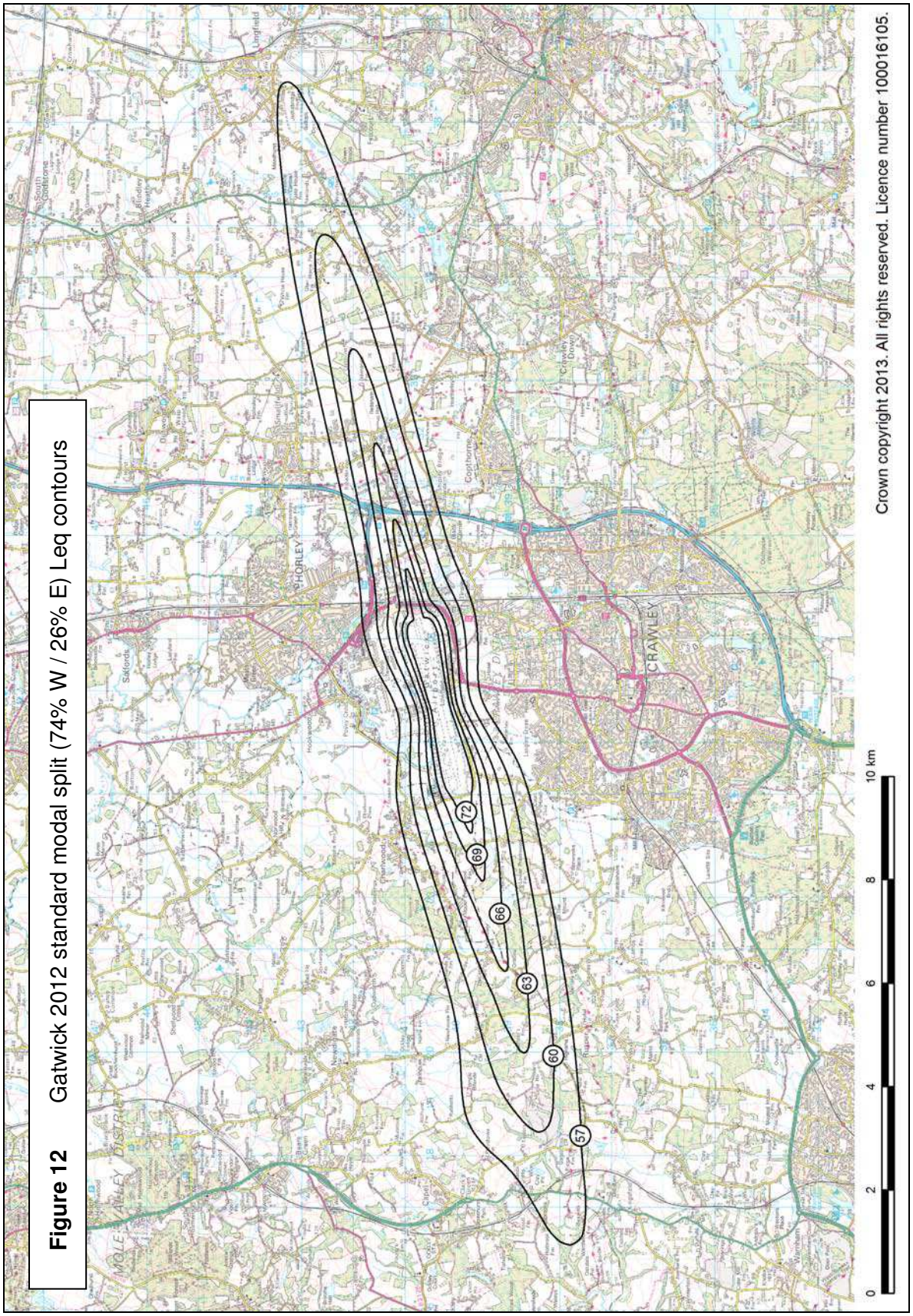


Figure 12 Gatwick 2012 standard modal split (74% W / 26% E) Leq contours

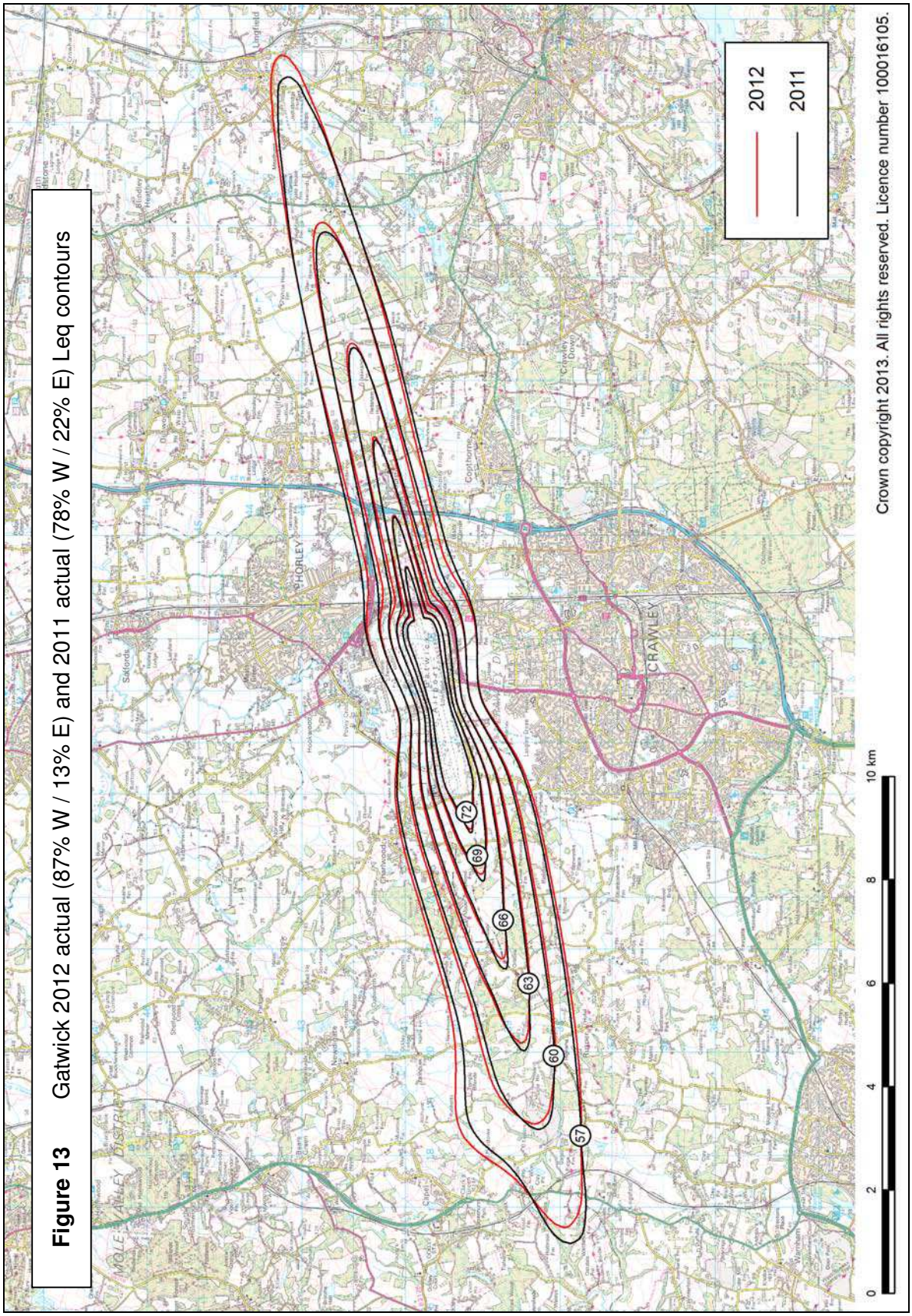


Figure 13 Gatwick 2012 actual (87% W / 13% E) and 2011 actual (78% W / 22% E) Leq contours

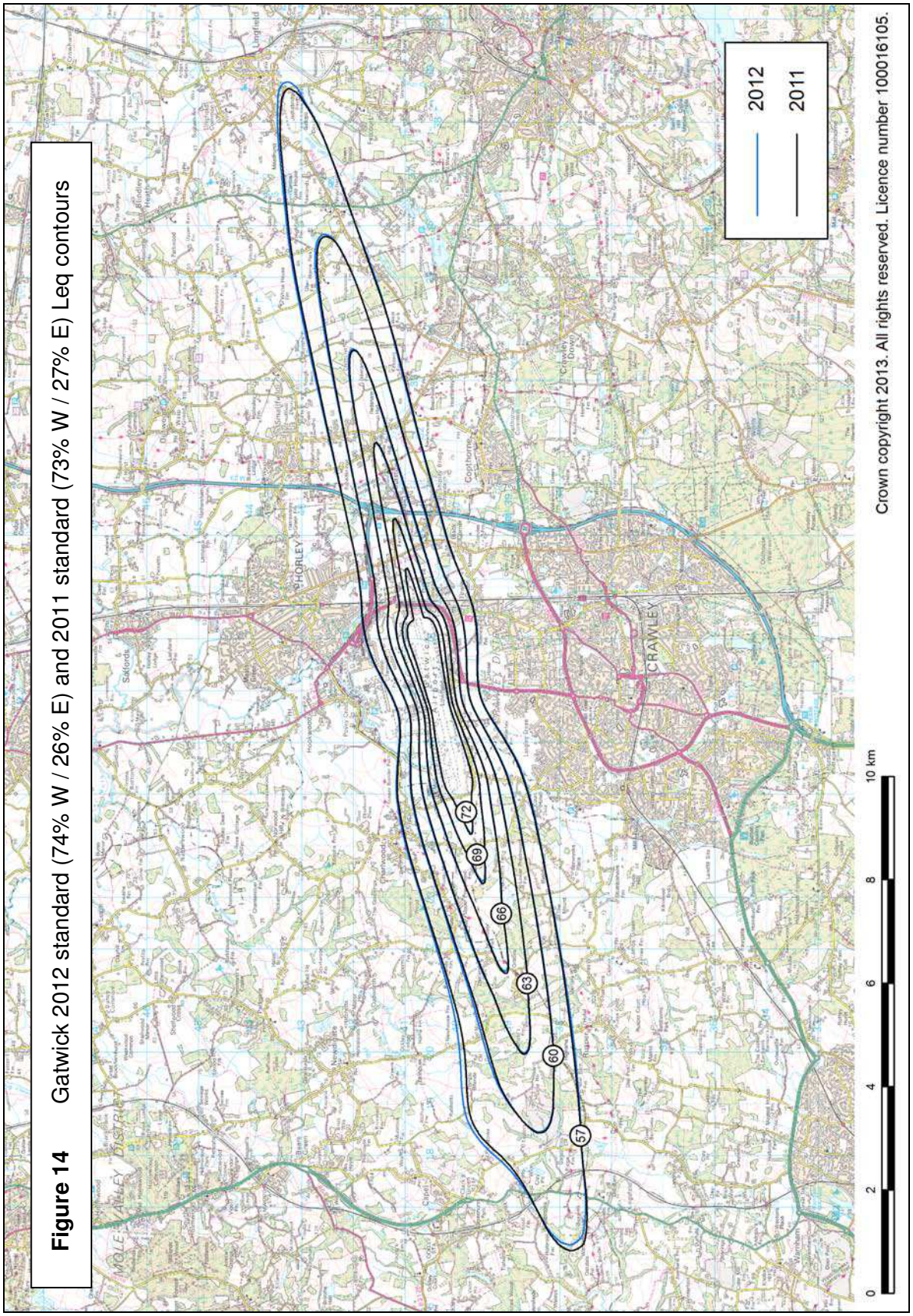


Figure 14 Gatwick 2012 standard (74% W / 26% E) and 2011 standard (73% W / 27% E) Leq contours

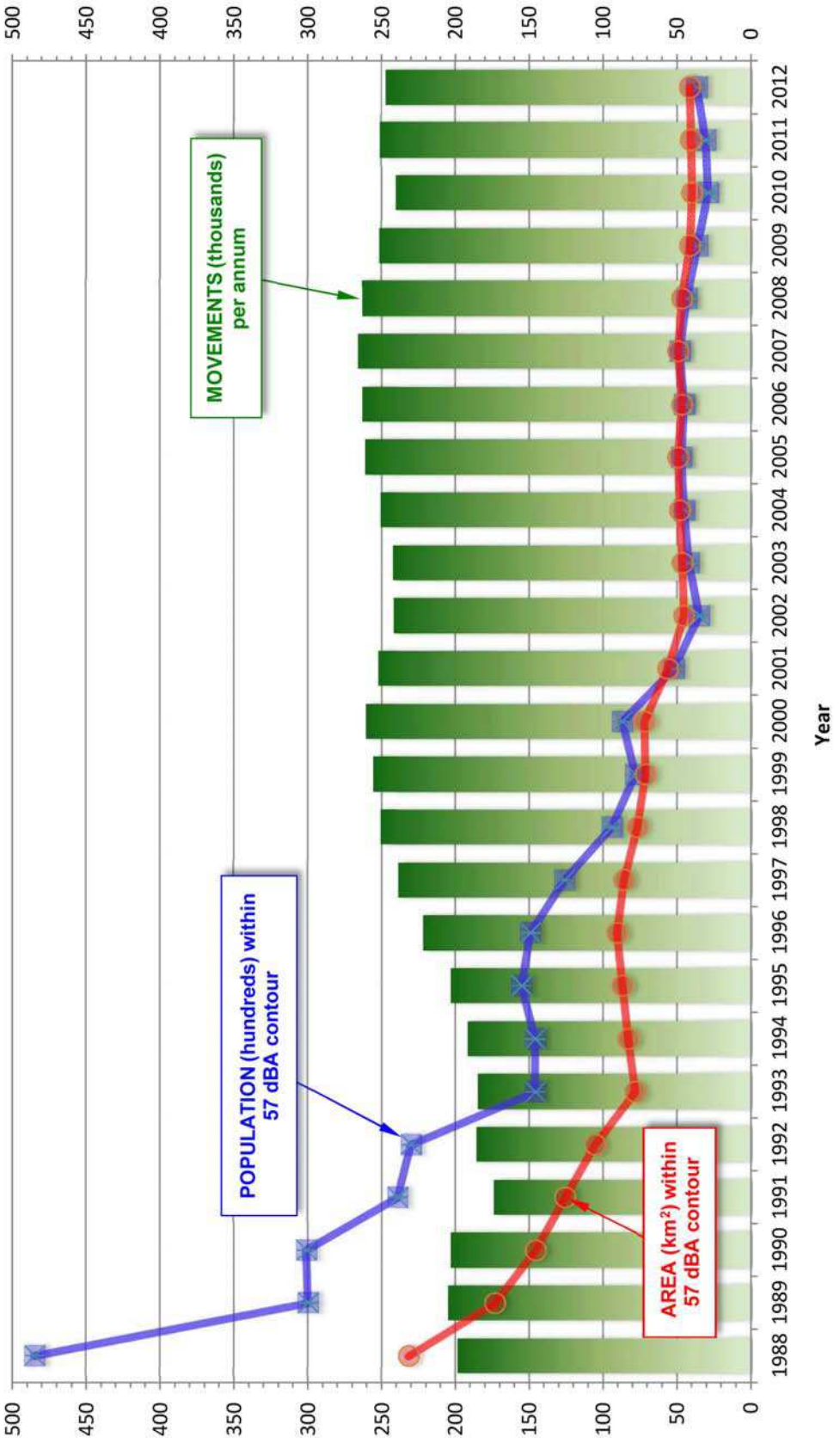


Figure 15 Gatwick annual traffic and Leq noise contour area/population trend 1988-2012