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

ERCD REPORT 1202

Noise Exposure Contours for Gatwick Airport 2011

J Lee
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Summary

This report presents the year 2011 noise exposure contours for London Gatwick Airport. The 57 dBA Leq contour area for 2011 based on the actual runway modal split was calculated to be 40.4 km^2, a 2% increase from 2010. The population enclosed within the actual 57 dBA contour increased by 7% compared to 2010.

September 2012

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 2011) 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 2011. The noise modelling used radar and noise data from Gatwick's Noise and Track Keeping System. Mean flight tracks and 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 2011 summer traffic data for Gatwick revealed that average daily movements increased by 3% compared to 2010.

The area of the 2011 'actual' modal split (78% west / 22% east) 57 dBA Leq contour increased by 2% relative to 2010, to 40.4 km^2. This can be attributed to the 3% increase in total movements, which resulted primarily from a significant increase in numbers of short-haul jet aircraft such as the Airbus A319 and A320. The population count within the 2011 actual 57 dBA contour also increased compared to 2010, by 7%.

The area of the 2011 'standard' modal split (73% west / 27% east) 57 dBA Leq contour increased, by 2% to 40.4 km^2. The population count within the standard 57 dBA contour was 12% higher than in 2010.

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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 2011 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 2011 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.defra.gov.uk* as well as ERCD Reports 0706, 0707 and 0708, which cover Heathrow, Gatwick and Stansted noise mapping respectively.

[2] www.dft.gov.uk

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, e.g. due to maintenance work. There are two passenger terminals. The layout of the runways, taxiways and passenger terminals in 2011 is shown in **Figure 2**.[4]

1.2.3 In the 2011 calendar year there were 251,000[5] aircraft movements (2010: 241,000) at Gatwick Airport, handling approximately 33.7 million passengers (2010: 31.4 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 (5 May 11) AD 2-EGKK

[5] To the nearest thousand.

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

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 ERCD Report 0606 (**Ref 3**). The ANCON model is also used for the production of annual contours for Heathrow and Stansted airports, and a number of regional airports in the UK.

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 2011 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 2011. **Figure 4** shows a sample of radar flight tracks from a day in June 2011. 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 2011 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. Further information on the validation of the ANCON noise model can be found on the CAA website[11].

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[12] and very close agreement was found.

Traffic distribution by noise class

2.6.2 **Table 1** lists the average summer day movements[13] by eight noise classes of aircraft, ranked in ascending order of noise emission, i.e. from least to most noisy, in 2010 and 2011. As in 2010, the majority of movements (84%) were by short-haul 'Chapter 3' and 'Chapter 4'[14] jet aircraft (Noise Class 3), the numbers of which were up by 6% in 2011. Movements by wide-body twin-engine aircraft (Noise Class 4) increased slightly by 1% to make up 7% of the total in 2011; likewise, wide-body three- and four-engine aircraft (Noise Class 5) numbers increased by 1%, though they comprised just 1% of total movements. Around 7% of movements were by large propeller aircraft (Noise Class 2), the movements of which dropped by 24%. The numbers of aircraft within Noise Classes 1 and 6 were not significant, and there were no aircraft in Noise Classes 7 and 8.

[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] http://www.caa.co.uk/docs/68/Valid_ANCON.pdf

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

[13] Includes departures and arrivals.

[14] 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.

2.6.3 The average number of daily movements at Gatwick over the 2011 summer period was 3% higher compared to 2010.

2.6.4 **Figure 5** illustrates the changing distribution of traffic among the eight noise classes over the period from 1988 to 2011 inclusive. The shift over the years to increasingly higher proportions of short-haul Chapter 3 and 4 aircraft (Noise Class 3) can be clearly seen.

Traffic distribution by ANCON aircraft type

2.6.5 A more detailed breakdown of the 2011 average summer day movements, indicating the ANCON types that fall into each noise class, is provided in **Table 2**. The largest increases in movements were for two ANCON types in Noise Class 3: the EA319C, up by 28 movements per day, and the EA320C, up by 27 movements (note: see **Table 2** for descriptions of ANCON types). The largest reduction in numbers was for the 'Large Twin Turboprop' (Noise Class 2), which dropped by 16 movements per day or 24%. Other significant reductions were found in Noise Class 3 for the EA321V (down by 10 movements per day), the EA320V (down by 8 movements) and the B757E (down by 7 movements).

2.6.6 **Figure 6** illustrates the numbers of movements by ANCON aircraft type for the average summer day. It can be seen that in 2011 the EA319C was the most frequent ANCON aircraft type at Gatwick with 202 daily movements (29% of total movements), followed by the B733 with 106 daily movements (15% of total movements).

2.6.7 The noise dominant ANCON types at Gatwick in 2011 were the B733, B738, EA319C, EA320C and (for departure noise only) the B744G. 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

2.6.8 **Figure 7** shows the distribution of aircraft departures by SID route for 2011. The percentage loadings on the SIDs were comparable to 2010. The 'wraparound' route LAM/BIG/CLN/DVR from Runway 26L had the highest loading of departure traffic (34%), followed by the KEN/SAM route from Runway 26L with 23% of the traffic.

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 2011:

(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 2011, this is the 20-year period from 1992 to 2011. 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 2011, together with the previous year, are summarised in the following table:

Gatwick runway modal splits for 2011 and 2010

Modal split scenario	**% west (Runway 26L)**	**% east (Runway 08R)**
Actual 2011	78%	22%
Actual 2010	81%	19%
Standard 2011	73%	27%
Standard 2010	73%	27%

2.7.4 It can be seen the 2011 actual modal split had a 3% higher proportion of easterly operations compared to 2010. The standard modal splits for 2011 and 2010 were the same. 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[15] 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

[15] Meridian™ 2

terrain heights in the vicinity of Gatwick Airport are depicted diagrammatically in **Figure 9**.

2.9 Population and 'Point 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 2011 update of the 2001 Census supplied by CACI Limited[16]. 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 been made of the numbers of noise sensitive buildings situated within the contours, using the *InterestMap*™[17] 'Points of Interest' (2011) database. For the purposes of this study, the noise sensitive buildings that have been considered are schools, hospitals and places of worship.

[16] www.caci.co.uk

[17] 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 2011 Leq noise contours generated with the actual 2011 summer period runway modal split (78% west / 22% 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 listed in the table below:

Gatwick 2011 actual modal split contours: area, population and household estimates

Leq contour level (dBA)	Area (km^2)	Population	Households
> 57	40.4	3,050	1,350
> 60	23.0	1,150	500
> 63	12.8	350	150
> 66	6.9	200	100
> 69	3.6	< 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 listed in the table below:

Gatwick 2011 actual modal split contours: noise sensitive building estimates

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

Note: All the schools identified within the contours were nursery schools.

3.2 Standard modal split contours

3.2.1 The Gatwick 2011 Leq noise contours generated with the standard 2011 summer period runway modal split (73% west / 27% 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 listed in the table below:

Gatwick 2011 standard modal split contours: area, population and household estimates

Leq contour level (dBA)	Area (km^2)	Population	Households
> 57	40.4	2,750	1,200
> 60	23.1	1,250	500
> 63	12.8	350	150
> 66	6.9	200	100
> 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 listed in the table below:

Gatwick 2011 standard modal split contours: noise sensitive building estimates

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

Note: All the schools identified within the contours were nursery schools.

4 Analysis of results

4.1 Actual modal split contours – comparison with 2010 contours

4.1.1 The Gatwick 2011 actual modal split Leq contours are compared against the 2010 actual Leq contours in **Figure 13**. The table below summarises the areas, populations and percentage changes from 2010 to 2011:

Gatwick actual modal split contours: areas and populations for 2010 and 2011

Leq (dBA)	2010 Area (km^2)	2011 Area (km^2)	Area change (%)	2010 Pop.	2011 Pop.	Pop. change (%)
> 57	39.6	40.4	+2%	2,850	3,050	+7%
> 60	22.5	23.0	+2%	1,150	1,150	0%
> 63	12.5	12.8	+2%	350	350	0%
> 66	6.8	6.9	+1%	100	200	+100%
> 69	3.6	3.6	0%	0	< 50	(n/a)
> 72	2.0	2.0	0%	0	0	(n/a)

Note: the 2010 and 2011 actual modal splits were 81% west / 19% east and 78% west / 22% east respectively.

4.1.2 It can be seen that most of the 2011 contour areas increased relative to 2010, by up to 2%. This was due to the 3% rise in movements (mainly for arrivals) in 2011, and in particular, to an overall 6% increase in movements of short-haul jet aircraft (e.g. EA319C and EA320C) within Noise Class 3.

4.1.3 Populations also increased in 2011 at the 57 and 66 dBA contour levels. 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 2010 contours

4.2.1 The Gatwick 2011 standard modal split Leq contours are compared against the 2010 standard Leq contours in **Figure 14**. The following table summarises the areas, populations and percentage changes from 2010 to 2011:

Gatwick standard modal split contours: areas and populations for 2010 and 2011

Leq (dBA)	2010 Area (km^2)	2011 Area (km^2)	Area change (%)	2010 Pop.	2011 Pop.	Pop. change (%)
> 57	39.6	40.4	+2%	2,450	2,750	+12%
> 60	22.6	23.1	+2%	1,200	1,250	+4%
> 63	12.5	12.8	+2%	300	350	+17%
> 66	6.8	6.9	+1%	100	200	+100%
> 69	3.6	3.6	0%	0	< 50	(n/a)
> 72	2.0	2.0	0%	0	0	(n/a)

Note: the standard modal split was 73% west / 27% east in both 2010 and 2011.

4.2.2 As with the actual modal split contours, the standard modal split contour areas increased by up to 2% in 2011 as a result of the overall 3% rise in movements, which included significant increases of aircraft numbers within Noise Class 3. Populations also increased in 2011 at contour levels 57 through to 69 dBA.

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%.

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.

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.

5 Conclusions

5.1 Year 2011 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 39.6 km^2 in 2010 to 40.4 km^2 in 2011, a 2% rise. The increase in area can be attributed primarily to a 3% rise in movements, especially of short-haul jet aircraft such as the Airbus A319 and A320, which increased by 6%. The population within the actual 57 dBA Leq contour also increased compared to 2010, by 7%.

5.3 The standard 57 dBA Leq contour area increased from 39.6 km^2 in 2010 to 40.4 km^2 in 2011, a 2% rise. The population enclosed within the standard 57 dBA Leq contour was 12% higher.

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Table 1 Gatwick 2010 and 2011 average summer day movements by noise class

Noise Class	**Description**	**2010**	**2011**	**Percentage of total 2011 movements**	**Change**
	<PROPELLER AIRCRAFT>				
1	Small propeller aircraft	0.1	**0.2**	0.0%	+0.1 (*)
2	Large propeller aircraft	64.8	**49.2**	7.2%	-15.6 (-24%)
	<CHAPTER 3/4 JETS>				
3	Short-haul aircraft	544.0	**577.1**	84.0%	+33.1 (+6%)
4	Wide-body twin-engine aircraft	50.2	**50.5**	7.4%	+0.3 (+1%)
5	2nd generation wide-body 3,4-engine aircraft	9.8	**9.9**	1.4%	+0.1 (+1%)
	<LARGE CHAPTER 2/3 JETS>				
6	1st generation wide-body 3,4-engine aircraft	0.0	**< 0.1**	0.0%	0.0 (*)
	<2nd GENERATION TWIN JETS>				
7	Narrow-body twin-engine aircraft *(including Ch.2 and hushkitted versions)*	< 0.1	**0.0**	0.0%	0.0 (*)
	<1st GENERATION JETS>				
8	Narrow-body 3,4-engine aircraft	< 0.1	**0.0**	0.0%	0.0 (*)
	TOTAL	669.0	**687.0**	100%	+18.0 (+3%)

* Percentage changes not shown due to low numbers and limited data resolution.

Note: Totals may not sum exactly due to rounding.

Table 2 Gatwick 2010 and 2011 average summer day movements by ANCON aircraft type

Aircraft type	Noise class	ANCON type	2010	2011	Change
Single piston propeller	1	SP	0.0	**0.1**	+0.1
Small twin-piston propeller	1	STP	< 0.1	**< 0.1**	0.0
Small twin-turboprop	1	STT	0.1	**0.1**	0.0
Large twin-turboprop	2	LTT	64.8	**49.1**	-15.7
Large four-engine propeller	2	L4P	0.0	**< 0.1**	0.0
Boeing 737-300/400/500	3	B733	109.8	**106.2**	-3.6
Boeing 737-600/700	3	B736	8.8	**6.9**	-1.9
Boeing 737-800/900	3	B738	48.2	**54.8**	+6.6
Boeing 757-200 (RB211-535E4/E4B engines)	3	B757E	49.2	**41.9**	-7.3
Boeing 757-200 (PW2037/2040 engines)	3	B757P	< 0.1	**0.1**	+0.1
Boeing 757-300	3	B753	3.0	**2.8**	-0.2
BAe 146/Avro RJ	3	BA46	0.1	**0.3**	+0.2
Airbus A318	3	EA318	0.1	**0.1**	0.0
Airbus A319 (CFM-56 engines)	3	EA319C	174.4	**202.3**	+27.9
Airbus A319 (IAE-V2500 engines)	3	EA319V	15.3	**18.1**	+2.8
Airbus A320 (CFM-56 engines)	3	EA320C	56.6	**83.1**	+26.5
Airbus A320 (IAE-V2500 engines)	3	EA320V	11.1	**2.7**	-8.4
Airbus A321 (CFM-56 engines)	3	EA321C	4.5	**4.1**	-0.4
Airbus A321 (IAE-V2500 engines)	3	EA321V	23.1	**13.4**	-9.7
Executive Business Jet (Chapter 3)	3	EXE3	4.3	**3.5**	-0.8
Bombardier Regional Jet 100/200	3	CRJ	3.8	**4.4**	+0.6
Bombardier Regional Jet 900	3	CRJ900	0.4	**0.4**	0.0
Embraer ERJ 135/145	3	ERJ	0.2	**0.2**	0.0
Embraer ERJ 170	3	ERJ170	0.0	**< 0.1**	0.0
Embraer ERJ 190	3	ERJ190	29.4	**29.7**	+0.3
Fokker 100	3	FK10	1.2	**1.5**	+0.3
McDonnell Douglas MD80 series	3	MD80	0.4	**0.9**	+0.5
Boeing 767-200	4	B762	1.4	**0.9**	-0.5
Boeing 767-300 (GE CF6-80 engines)	4	B763G	7.4	**8.5**	+1.1
Boeing 767-300 (PW4000 engines)	4	B763P	0.2	**1.8**	+1.6
Boeing 767-300 (RR RB211 engines)	4	B763R	0.0	**< 0.1**	0.0
Boeing 767-400	4	B764	1.1	**0.0**	-1.1
Boeing 777-200 (GE GE90 engines)	4	B772G	8.8	**10.0**	+1.2
Boeing 777-200 (RR Trent 800 engines)	4	B772R	3.8	**3.4**	-0.4
Boeing 777-300 (GE GE90 engines)	4	B773G	4.6	**4.5**	-0.1
Boeing 777-300 (RR Trent 800 engines)	4	B773R	0.5	**0.7**	+0.2
Airbus A300	4	EA30	6.0	**6.2**	+0.2
Airbus A310	4	EA31	2.6	**0.8**	-1.8
Airbus A330	4	EA33	13.9	**13.9**	0.0
Airbus A340-200/300	5	EA34	0.2	**0.5**	+0.3
Airbus A340-600	5	EA346	0.0	**< 0.1**	0.0
Boeing 747-400 (GE CF6-80F engines)	5	B744G	9.5	**9.3**	-0.2
Boeing 747-400 (PW4000 engines)	5	B744P	0.1	**< 0.1**	-0.1
McDonnell Douglas MD-11	5	MD11	0.0	**< 0.1**	0.0
McDonnell Douglas DC-10	6	DC10	0.0	**< 0.1**	0.0
Executive Business Jet (Chapter 2)	7	EXE2	< 0.1	**0.0**	0.0

Aircraft type	Noise class	ANCON type	2010	2011	Change
Boeing 707	8	B707	< 0.1	**0.0**	0.0
		TOTAL	669.0	**687.0**	+18.0 (+2.7%)

Note: Totals may not sum exactly due to rounding.

Figure 1 Gatwick Airport and the surrounding area

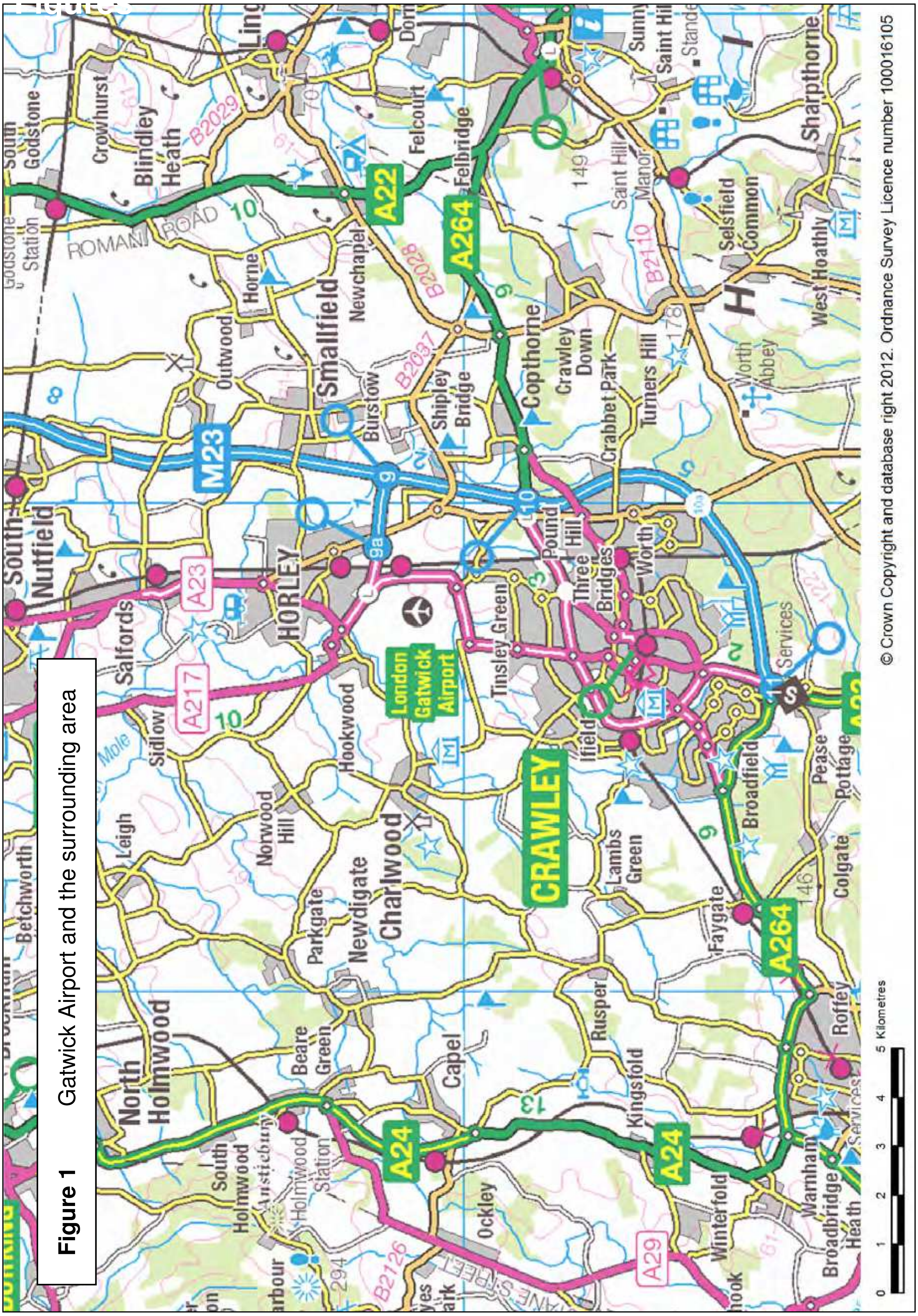


Figure 2 Gatwick Airport layout in 2011

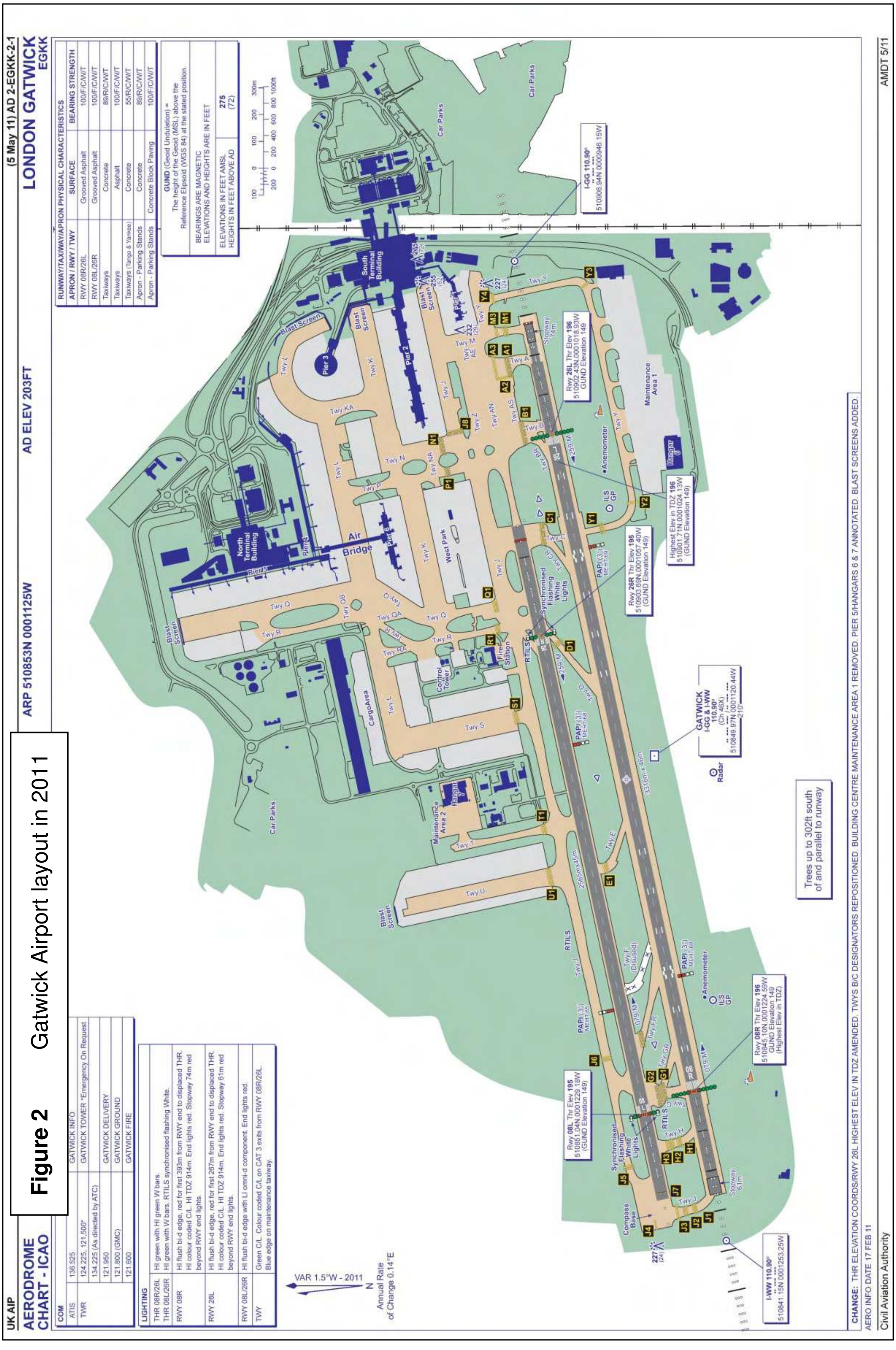


Figure 3 Gatwick Standard Instrument Departure (SID) routes

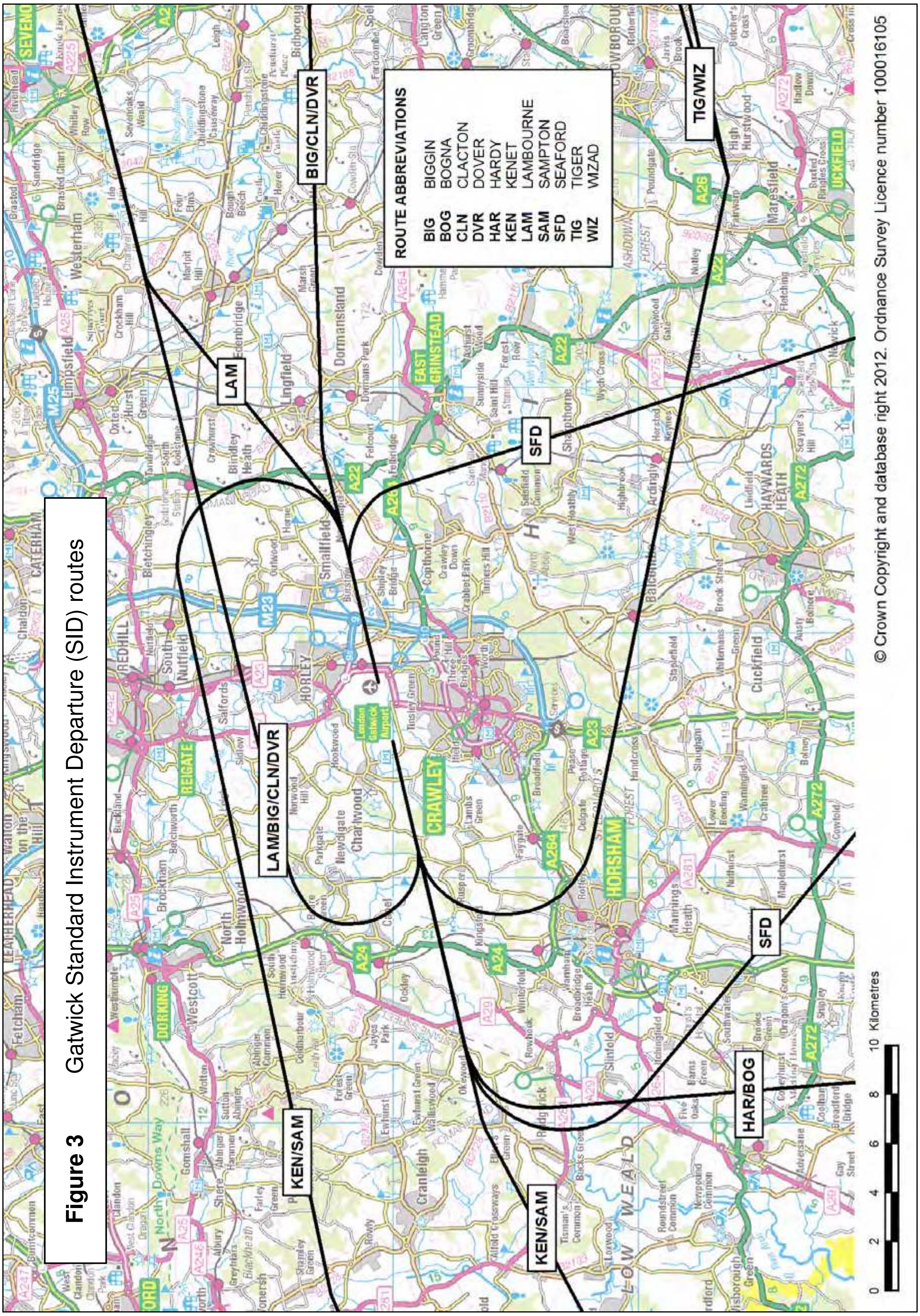


Figure 4 Typical Gatwick radar flight tracks

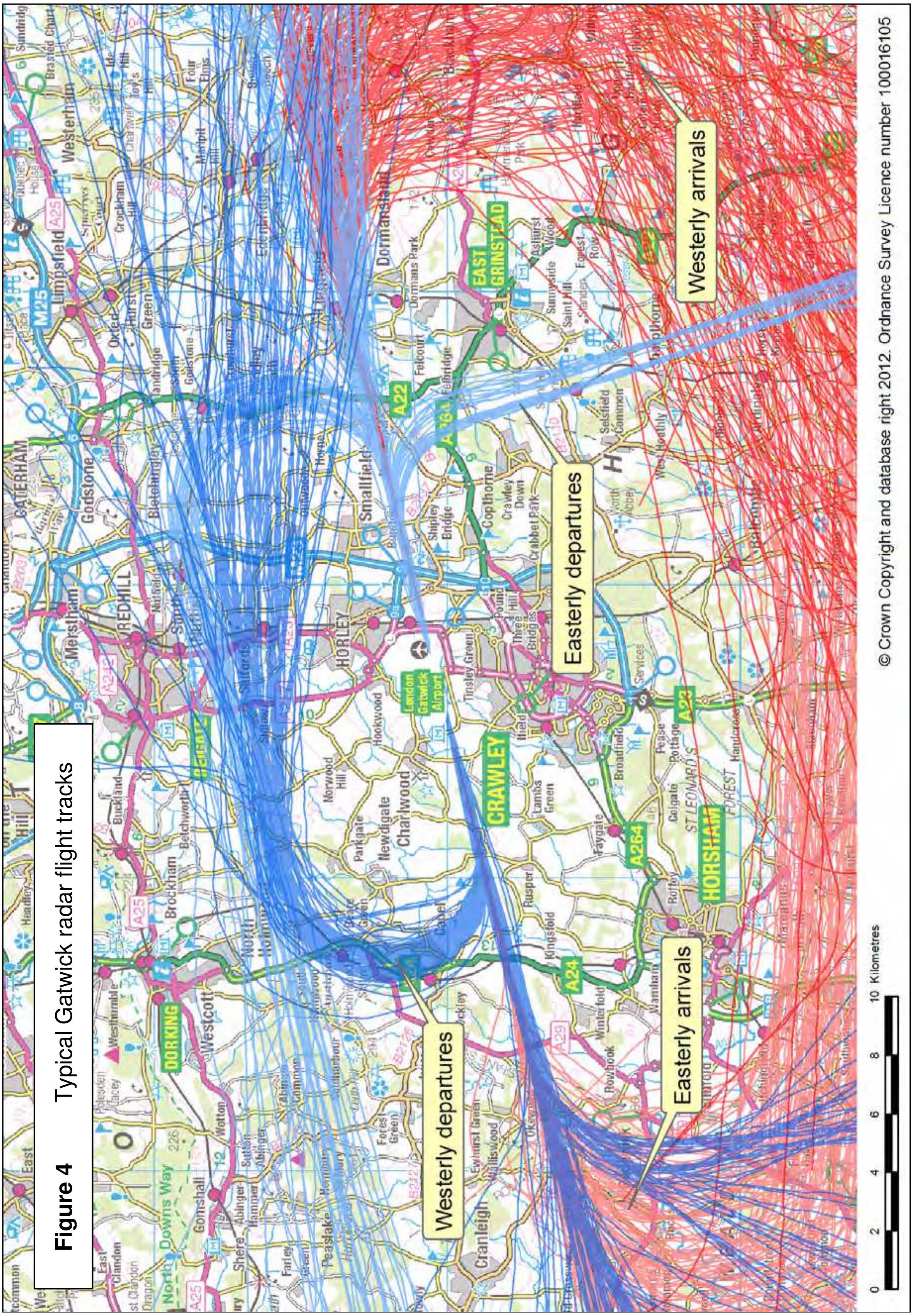
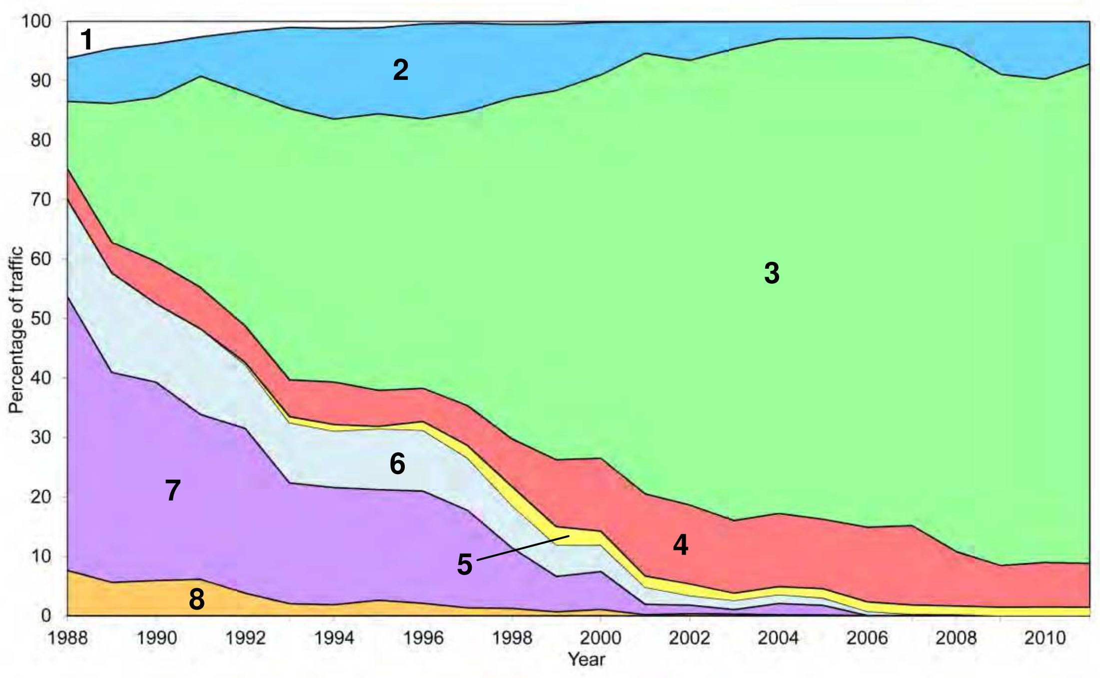


Figure 5 Gatwick noise class trend 1988-2011



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 2011 average summer day movements by ANCON type

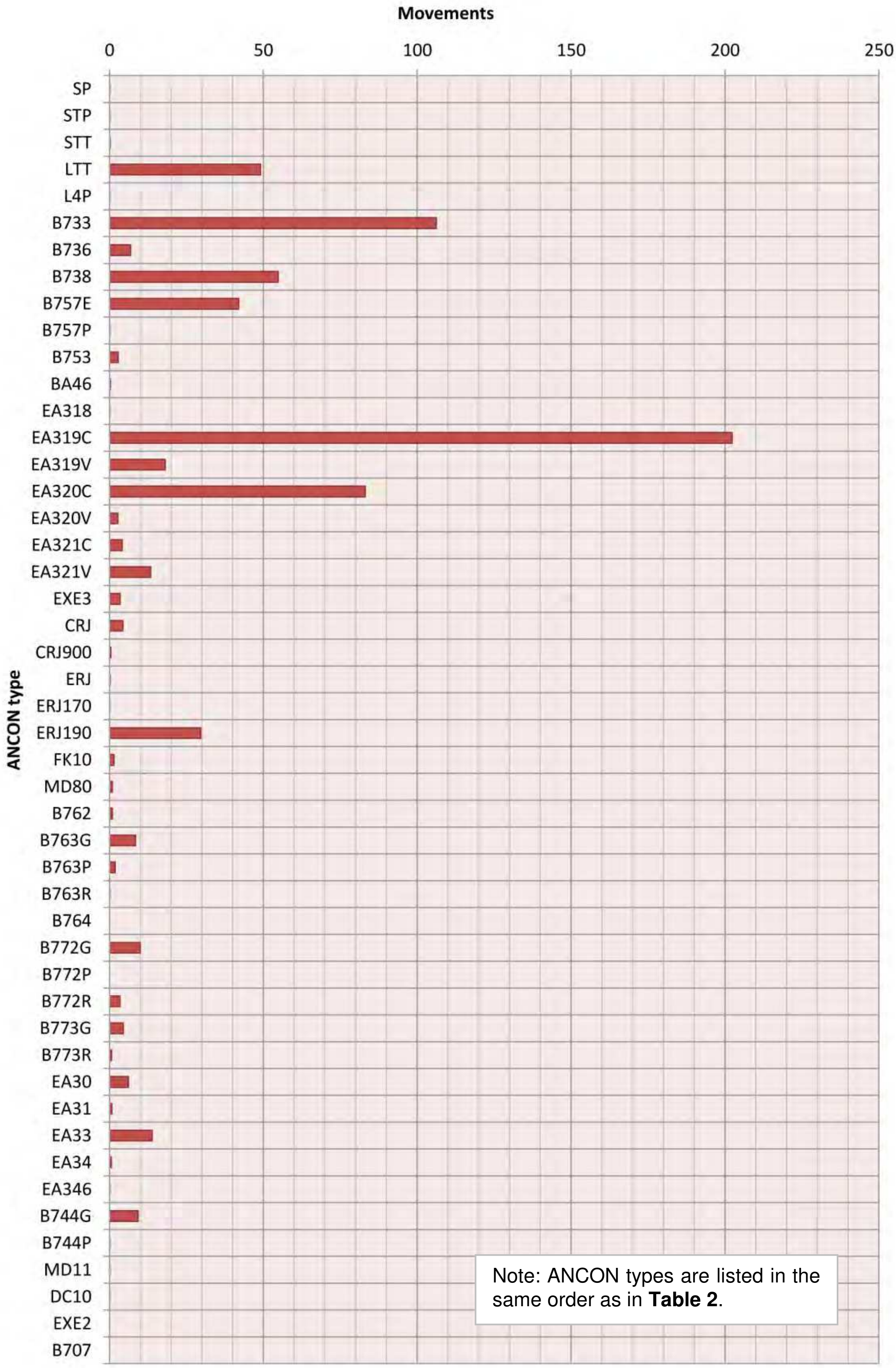


Figure 7 Gatwick 2010 and 2011 departure traffic distributions by route

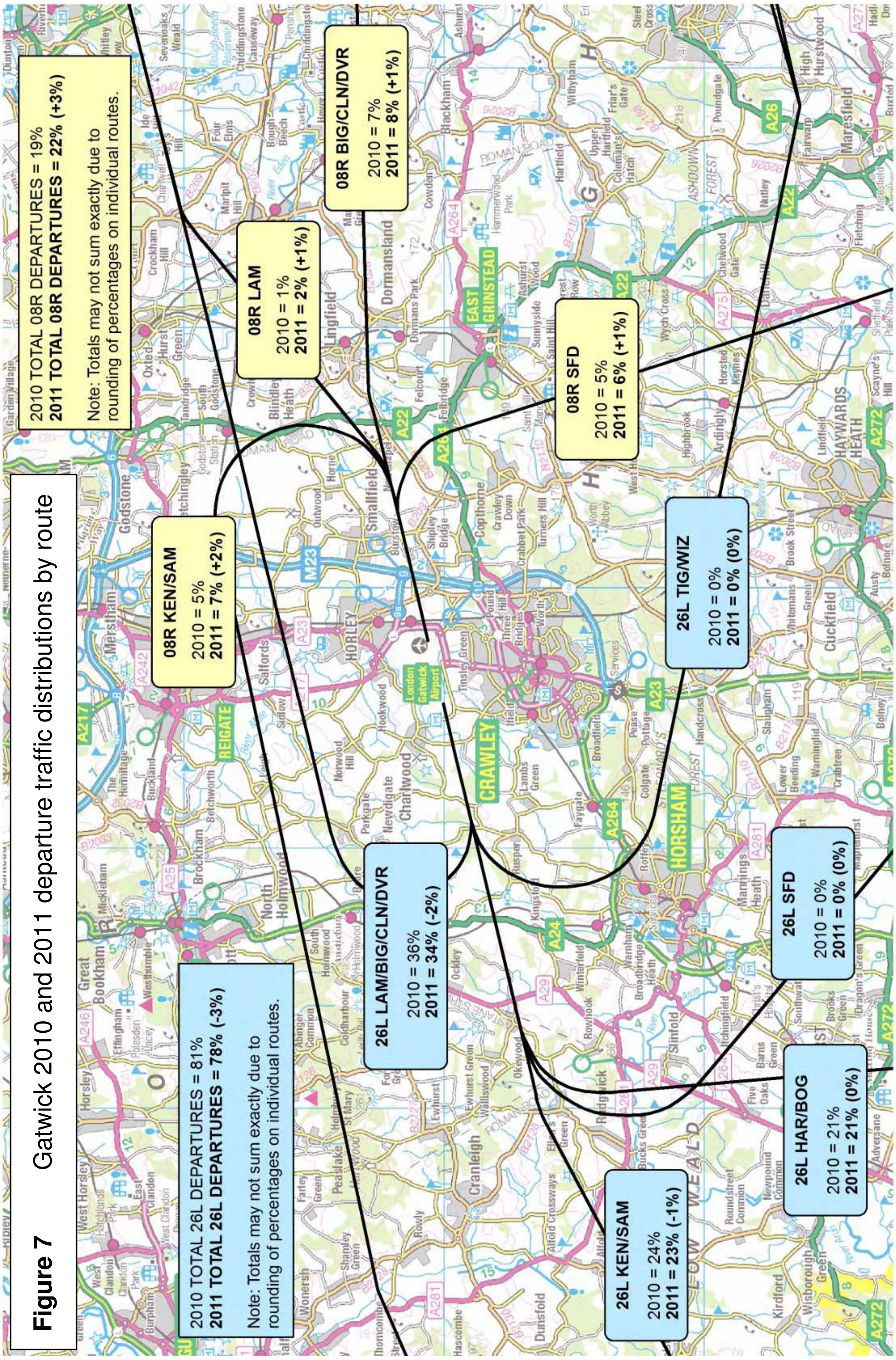


Figure 8 Gatwick average summer day runway modal splits 1992-2011

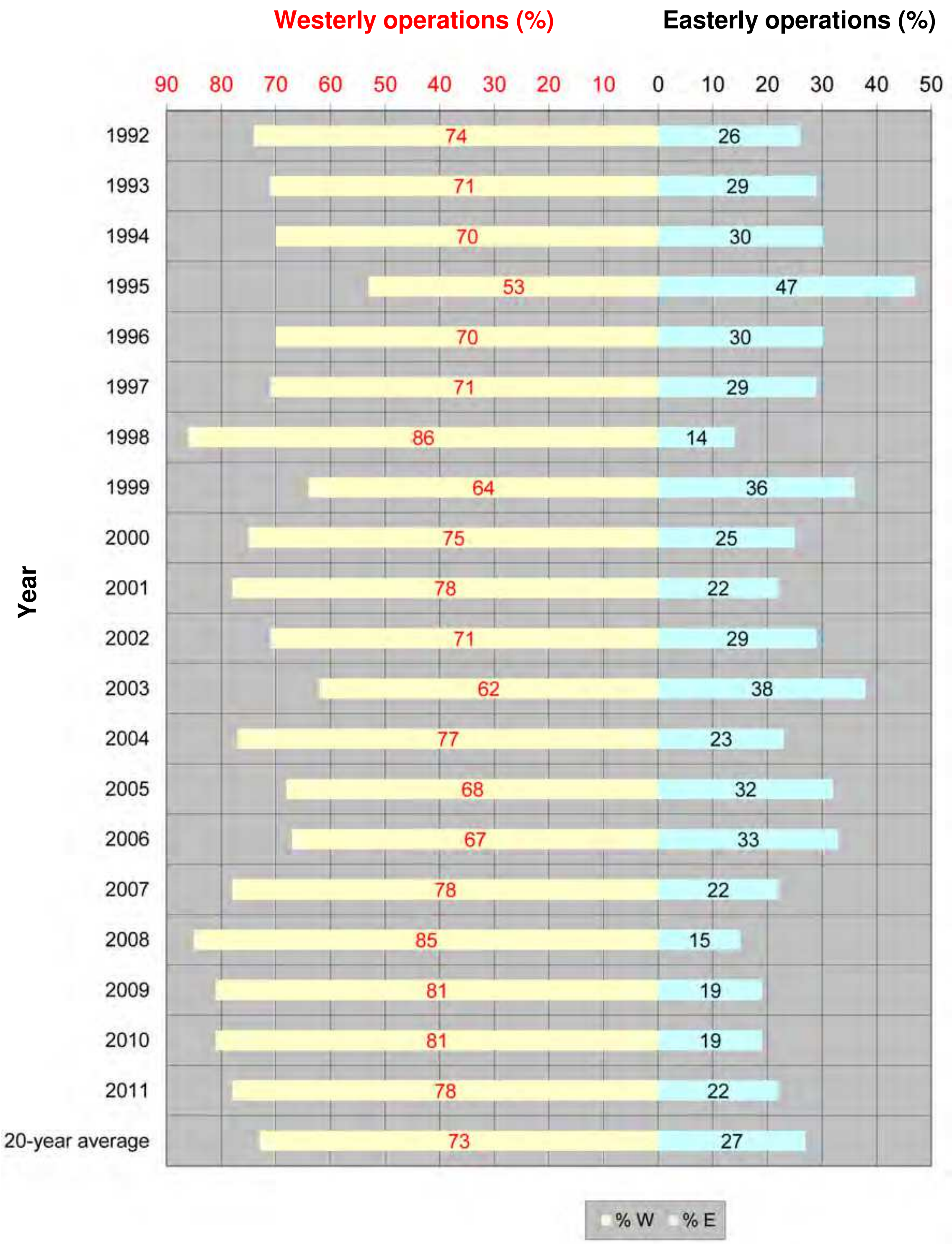
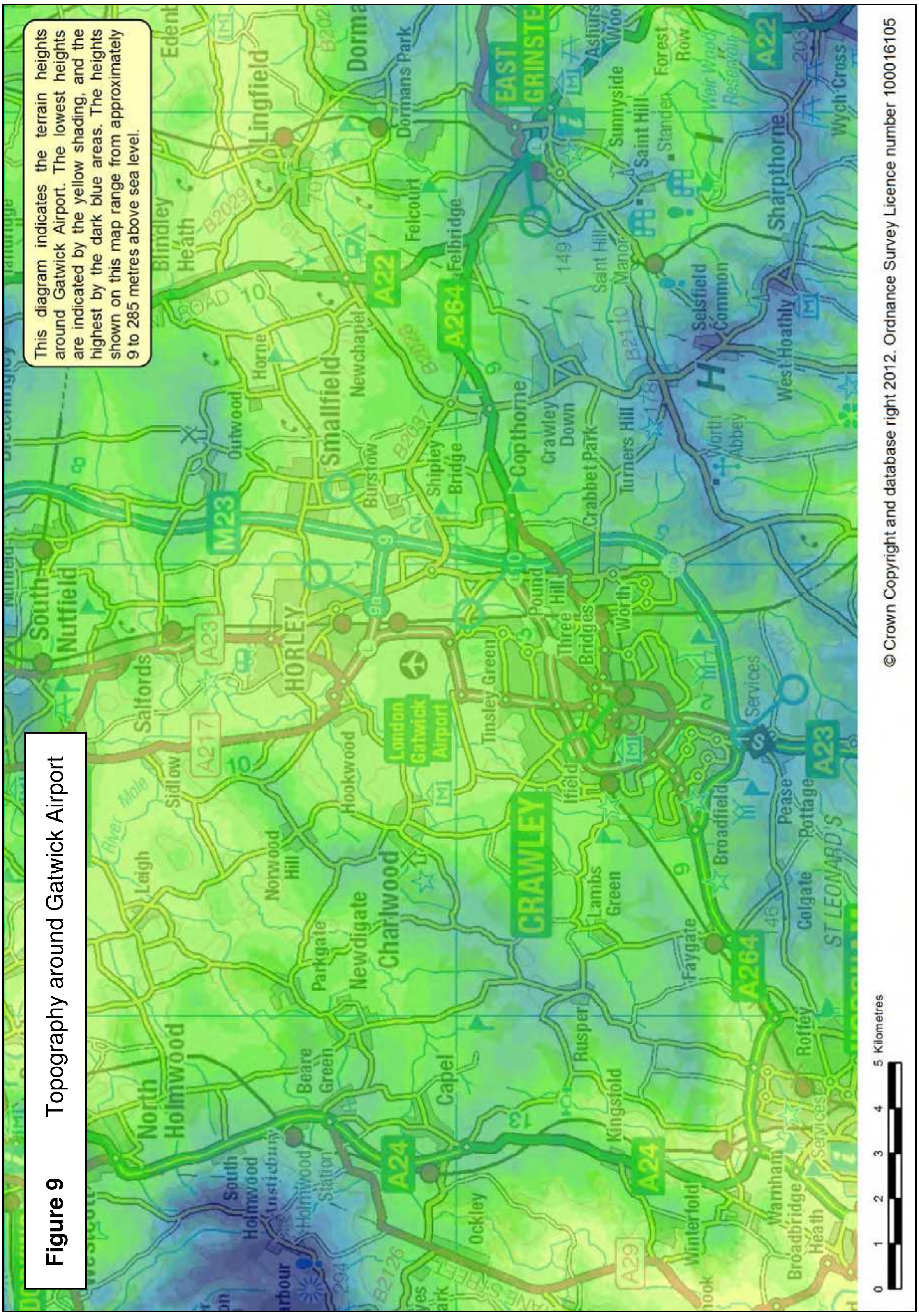


Figure 9 Topography around Gatwick Airport



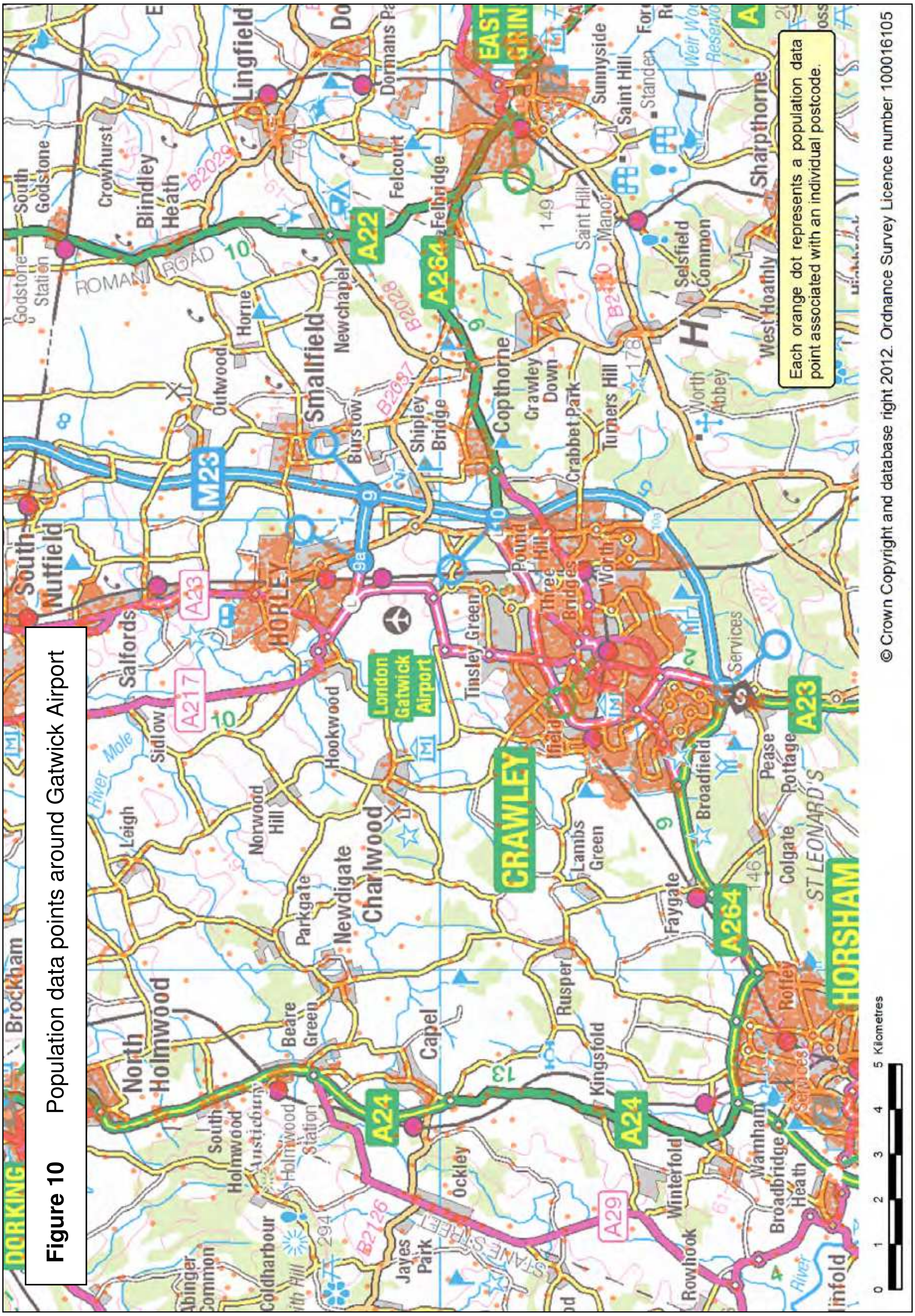


Figure 10 Population data points around Gatwick Airport

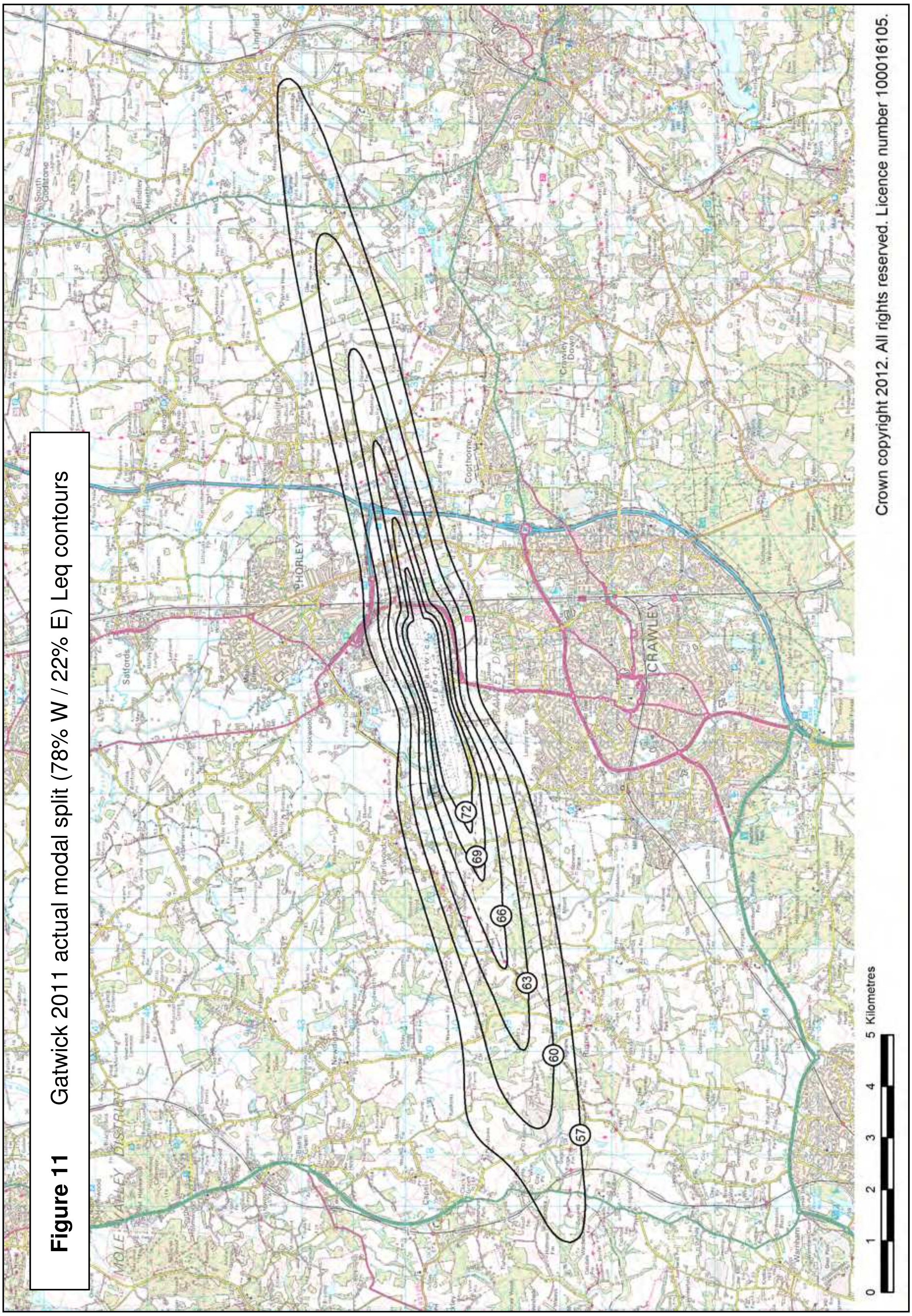


Figure 11 Gatwick 2011 actual modal split (78% W / 22% E) Leq contours

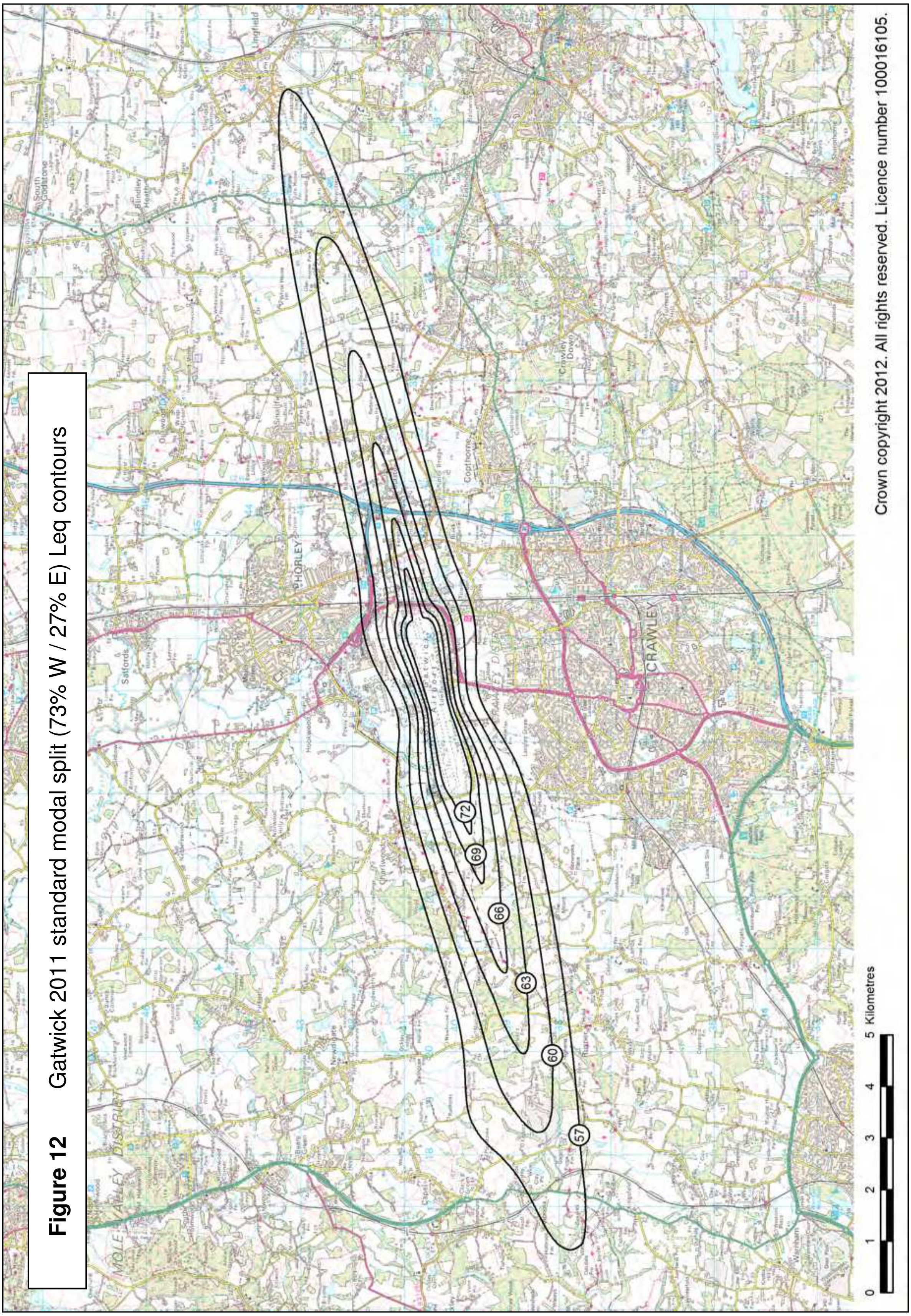


Figure 12 Gatwick 2011 standard modal split (73% W / 27% E) Leq contours

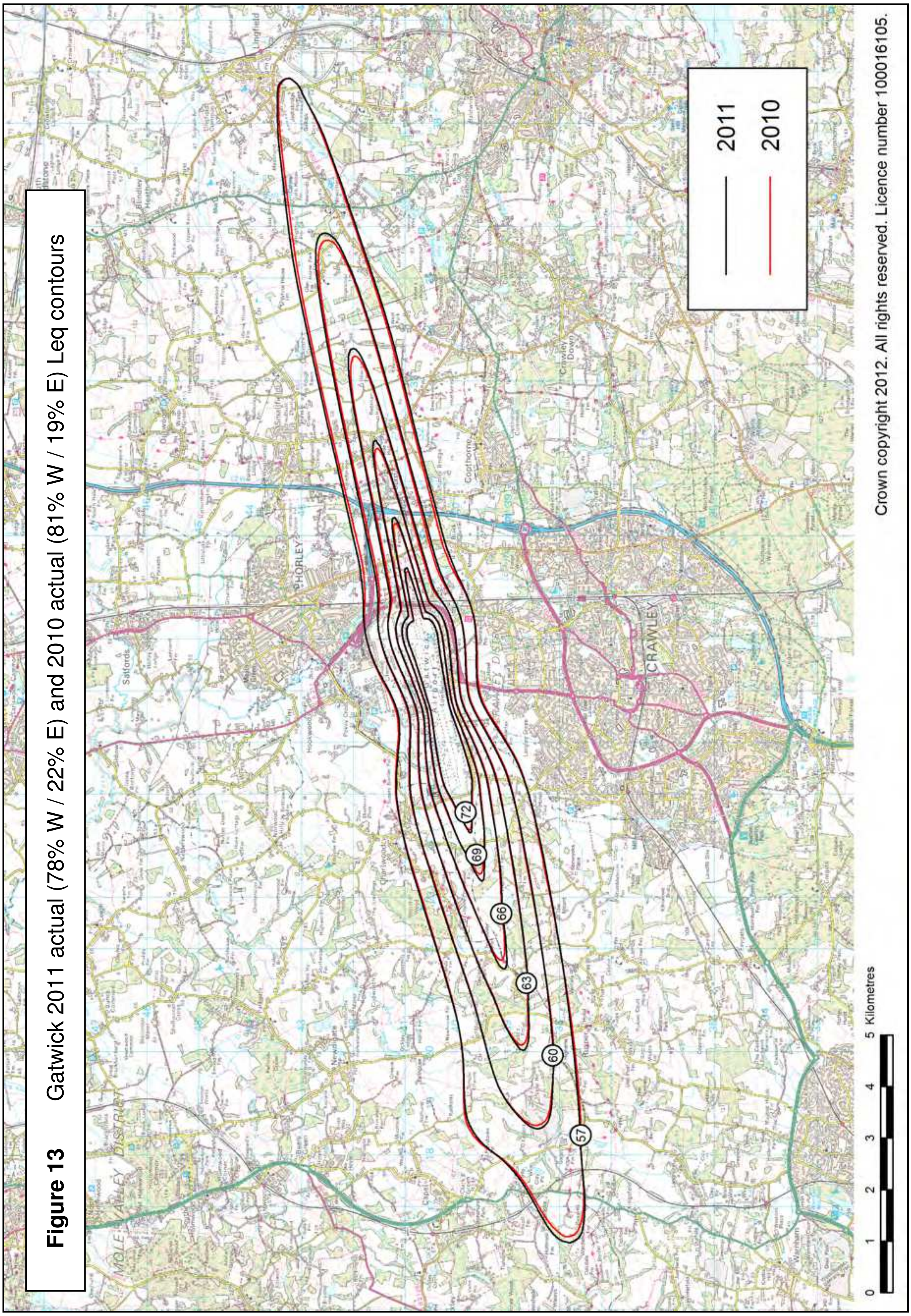


Figure 13 Gatwick 2011 actual (78% W / 22% E) and 2010 actual (81% W / 19% E) Leq contours

Figure 14 Gatwick 2011 standard (73% W / 27% E) and 2010 standard (73% W / 27% E) Leq contours

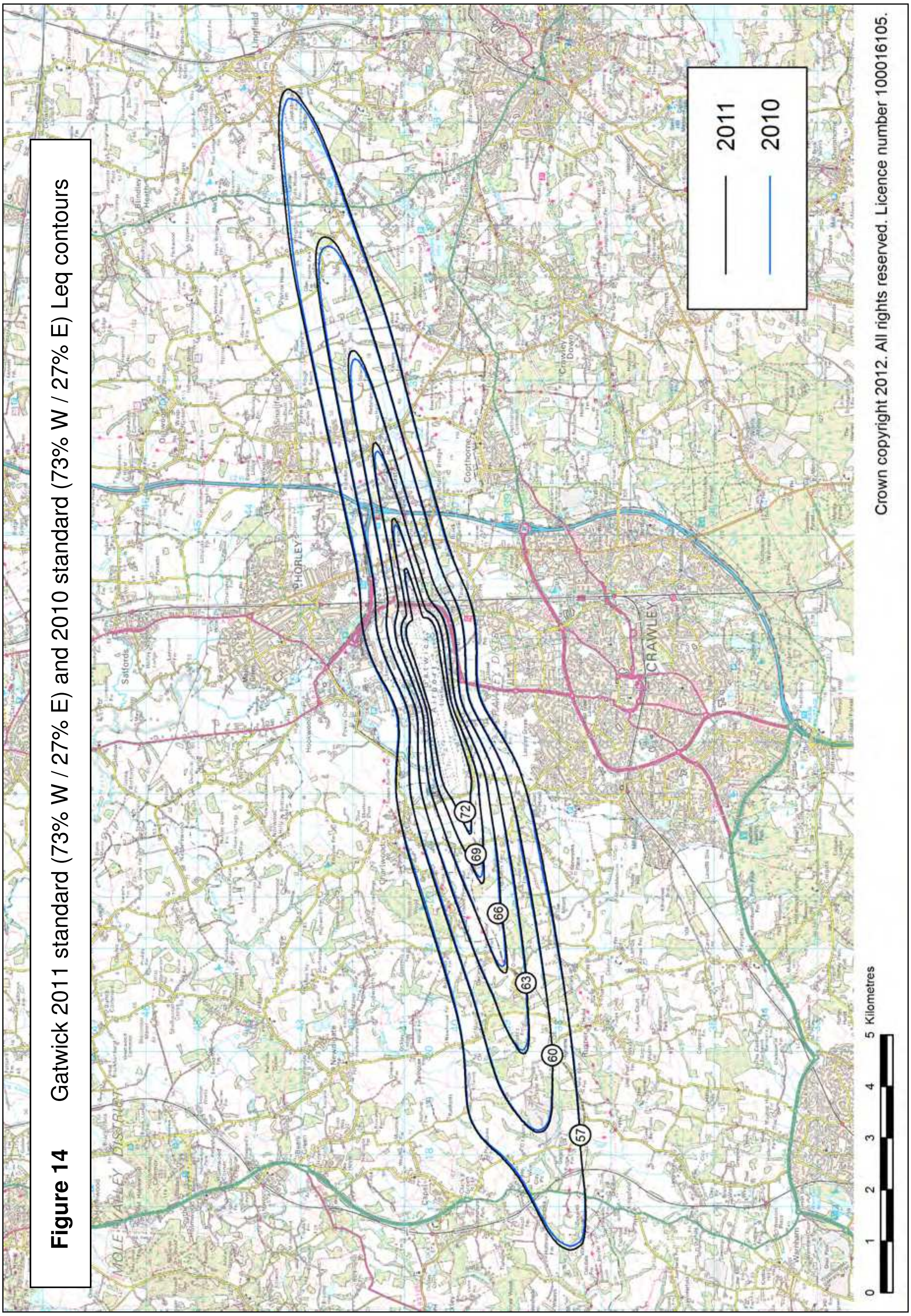


Figure 15 Gatwick traffic and noise contour area/population trend 1988-2011