Environmental Research and Consultancy Department
Civil Aviation Authority

ERCD REPORT 1502

Noise Exposure Contours for Gatwick Airport 2014

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Prepared by the Civil Aviation Authority on behalf of the Department for Transport, August 2015

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Summary

This report presents the year 2014 average summer day and night noise exposure contours for London Gatwick Airport.

The 57 dBA Leq day contour area for 2014 based on the actual runway modal split (64% west / 36% east) was calculated to be 42.2 km^2, 3% higher than in 2013 (2013: 40.9 km^2). The population enclosed within the 2014 actual 57 dBA Leq day contour increased by 2% to 3,300 (2013: 3,250). The 48 dBA Leq night actual modal split (60% west / 40% east) contour area for 2014 was 103.5 km^2, a 13% increase from 2013 (2013: 91.8 km^2), enclosing a population of 12,850 (2013: 11,200), a rise of 15%.

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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 2014) supplied by CACI Information Services.

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Glossary

AIP Aeronautical Information Publication

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

ATC Air Traffic Control

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

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 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 2014 average summer day and night noise exposure contours generated for London Gatwick Airport.

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 2014 summer traffic data for Gatwick revealed that average daily movements for the 16-hour daytime period (715.6) were 1% higher than in the previous year (2013: 706.7). There were on average 123.1 movements per 8-hour night over the 2014 summer period (2013: 107.7), an increase of 14% from 2013.

The area of the 2014 day actual modal split (64% west / 36% east) 57 dBA Leq contour increased by 3% to 42.2 km^2 (2013: 40.9 km^2). This resulted from the slightly higher number of movements in 2014 coupled with the replacement of large-twin turboprops by short-haul jet aircraft. The population count within the 2014 day actual 57 dBA contour increased by 2% to 3,300 (2013: 3,250). This was largely due to the inclusion of the Gatwick immigration removal centre residents in the population database for the first time, as part of the 2014 database update.

The area of the 2014 day standard modal split (73% west / 27% east) 57 dBA Leq contour also increased, by 3%, to 42.3 km^2 (2013: 40.9 km^2). The population count within the standard 57 dBA contour was 4% higher than in 2013 at 3,700 (2013: 3,550).

The area of the 2014 night actual modal split (60% west / 40% east) 48 dBA Leq contour was 103.5 km^2, an increase of 13% from 2013 (2013: 91.8 km^2), enclosing a population of 12,850 (2013: 11,200), a 15% rise. The area and population increases can be attributed to the 14% growth in night movements in 2014.

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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 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. Night-time 8-hour Leq contours have therefore also been calculated for Gatwick from 48 to 72 dBA in 3 dB steps in accordance with standard practice. Average summer night contours were first calculated for Gatwick for the year 2013.

1.1.5 This report contains small-scale diagrams of the year 2014 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 GOV.UK website[2].

1.1.6 The objectives of this report are to explain the noise modelling methodology used to produce the year 2014 day and night Leq contours for Gatwick 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] https://www.gov.uk/government/publications/noise-exposure-contours-around-london-airports

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 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 2014 is shown in **Figure 2**.[4]

1.2.3 In the 2014 calendar year there were approximately 260,000 aircraft movements (2013: 251,000) at Gatwick Airport, handling 38.1 million passengers (2013: 35.4 million).[5]

[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 (26 Jun 2014) AD 2-EGKK-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 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 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 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 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, aircraft type and destination. Analyses of departure and arrival flight tracks, and flight profiles, were based on year 2014 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 NPR/SID routes 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 radar data extracted from the Gatwick NTK system over the 92-day summer period, 16 June to 15 September 2014. Mean flight tracks were calculated from 24-hour data since both day and night contours were being produced. A westerly departure trial route ('ADNID') that replaced the 'BOGNA' route was in operation during part of the summer period, so a separate mean flight track was calculated to account for it.

2.3.4 Over the summer night period in 2014, the emergency runway 08L/26R was used by 8% of flights (predominantly arrivals) - this was taken into account in the modelling of the night contours.

2.3.5 **Figure 4** shows a sample of radar flight tracks from a day in August 2014. 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 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 15 and 28 km from threshold for Runway 08R and between 15 and 29 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 year 2014 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 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.

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 employs 5 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.[6]

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

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[7] and lateral directivity[8].

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 – also known as the '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[9] and close agreement was found.

Daytime traffic distribution by noise class

2.6.2 The average number of daily movements at Gatwick over the 2014 summer day period (715.6) was 1% higher than in the previous year (2013: 706.7).

2.6.3 **Table 1a** lists the average summer day movements[10] by 8 noise classes of aircraft, ranked in ascending order of noise emission, i.e. from least to most noisy, in 2013 and 2014. As in 2013, the majority of movements (91%) were by short-haul 'Chapter 3' and 'Chapter 4'[11] jet aircraft (Noise Class 3), for which the numbers were up by 6% in 2014 (note: in 2014 an estimated 92% of the aircraft within Noise Class 3 for the daytime period were compliant with the 'Chapter 4' noise standard).

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

[8] 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.

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

[10] Includes departures and arrivals.

[11] 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 Movements by wide-body twin-engine aircraft (Noise Class 4) were down by 8% in 2014. Although wide-body 3/4-engine aircraft (Noise Class 5) numbers increased by 20%, they comprised just 1% of total movements. Around 1% of movements were by large propeller aircraft (Noise Class 2), the numbers of which dropped substantially from 2013, by 77%. The numbers of aircraft within Noise Classes 1 were insignificant, and there were no movements in Noise Classes 6, 7 and 8.

2.6.5 **Figure 5** illustrates the changing distribution of traffic among the 8 noise classes over the period from 1988 to 2014 inclusive. The shift over the years to increasingly higher proportions of short-haul 'Chapter 3' and 'Chapter 4' aircraft (Noise Class 3) can be clearly seen.

Night-time traffic distribution by noise class

2.6.6 The average number of movements over the summer night period in 2014 was 123.1 (2013: 107.7), a rise of 14%. Arrivals comprised 64% of total 2014 night movements.

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 2014. Short-haul 'Chapter 3' and 'Chapter 4' jet aircraft (Noise Class 3) formed by far the highest proportion of movements (93%). (Note: in 2014 an estimated 94% of the aircraft within Noise Class 3 for the night period were compliant with the 'Chapter 4' noise standard).

2.6.8 The second largest grouping was wide-body twin-engine aircraft (Noise Class 4), with 7% of movements. There were insignificant numbers in Noise Classes 1 and 5, and no movements by aircraft in Noise Classes 2, 6, 7 and 8.

Daytime traffic distribution by ANCON aircraft type

2.6.9 A more detailed breakdown of the year 2014 average summer day movements, indicating the ANCON types that fall into each noise class, is provided in **Table 2a**. The largest increase in movements was for the ANCON type EA320C (Noise Class 3), up by 28 movements per day (note: ANCON type descriptions can be found in **Table 2a**). There were also notable movement increases within Noise Class 3 for the EA319V (up by 23) and the B738 (up by 17). These were offset by decreases in Noise Class 3 for the B733, down by 28 movements per day, and the ERJ170, down by 18 per day. Outside of Noise Class 3, there were 24 fewer daily movements of large-twin turboprops (Noise Class 2).

2.6.10 **Figure 6a** illustrates the numbers of movements by ANCON aircraft type for the 2014 average summer day. It can be seen that in 2014 the EA319C was by far the most frequent ANCON aircraft type at Gatwick with 231 daily movements (32% of total movements). This was followed by the EA320C with 123 movements (17% of total movements), the B738 with 101 movements (14%) and the B733 with 58 movements (8%).

2.6.11 The noise dominant ANCON types (for both departures and arrivals) at Gatwick in 2014 were the EA319C, EA320C, and B738. They were responsible for the

highest contributions of 'noise energy', which is a function of both aircraft noise level and movement numbers.

Night-time traffic distribution by ANCON aircraft type

2.6.12 A more detailed breakdown of the year 2014 average summer night movements, indicating the ANCON types that fall into each noise class, is provided in **Table 2b**. The two largest movement increases were within Noise Class 3 for the B738 (up by 6 per night) and the EA320C (up by 5 per night). The largest decrease was by only one movement per night for the B763G in Noise Class 4.

2.6.13 **Figure 6b** illustrates the numbers of movements by ANCON aircraft type for the 2014 average summer night. It can be seen that movements were dominated by two aircraft types: the EA320C (31 movements per night) and EA319C (27 per night).

Daytime traffic distribution by NPR/SID route

2.6.14 **Figure 7a** shows the distribution of aircraft departures by NPR/SID route for the 2014 summer day period, including distribution figures from 2013 for comparison. The 'wraparound' route LAM/BIG/CLN/DVR from Runway 26L had the highest loading of departure traffic (25%). This was followed by the HAR/BOG route from Runway 26L with 21% of the traffic[12] and then by the 26L KEN/SAM route (17%). Movements decreased by 5% on the LAM/BIG/CLN/DVR 26L route in 2014 compared to 2013. There were increases in traffic of up to 2% on three of the Runway 08R routes.

Night-time traffic distribution by NPR/SID route

2.6.15 **Figure 7b** shows the distribution of aircraft departures by NPR/SID route for the 2014 summer night period, including distribution figures from 2013 for comparison. The 'wraparound' route LAM/BIG/CLN/DVR from Runway 26L had the highest loading of departure traffic (23%), followed by the Runway 26L HAR/BOG route with 20% of departures[13]. The largest percentage increase was on the Runway 08R SFD route, up by 6%.

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*.

[12] The HAR/BOG percentage includes traffic on the 'ADNID' trial route (ADNID was a replacement for BOGNA).

[13] See footnote 12.

2.7.2 Two sets of contours have been produced for the year 2014 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 2014, this is the 20-year period from 1995 to 2014. 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 2014 and the previous year are summarised in the following table:

Gatwick summer day runway modal splits for 2014 and 2013

Modal split scenario	**% west (Runway 26L)**	**% east (Runway 08R)**
Actual 2014	64%	36%
Actual 2013	69%	31%
Standard 2014	73%	27%
Standard 2013	74%	26%

2.7.4 The 2014 proportion of actual westerly operations (64%) was 5% lower than in 2013. This was due to extended periods of easterly operations at the start and end of the 92-day summer period. In contrast, August saw extended periods of westerly operations with half the normal proportion of easterly operations. The 2014 standard modal split had 1% fewer westerly operations compared to 2013. Historical runway modal splits at Gatwick for the past 20 years are summarised in **Figure 8**.

2.7.5 The night-time actual runway modal split for the 2014 summer period was 60% west / 40% east (2013: 73% west / 27% east).

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 metre by 200 metre 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 2014 update of the 2011 Census supplied by CACI Limited[15].

2.9.2 The CACI population database contains data referenced at postcode level. Population and household numbers for 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 Gatwick Airport are illustrated in **Figure 10**.

2.9.3 Within the extent of the 2014 actual 57 dBA Leq contour, the population count using the 2014 population database was 5% higher than for the previous 2013 database, so the effect of the 2014 database update was significant at Gatwick. The main cause of this increase was the inclusion in the database for the first time of residents at the Gatwick immigration removal centres (numbering approximately 150 people). CACI advised that data for these centres had not been available in previous years.

2.9.4 Estimates have also been made of the numbers of noise sensitive buildings situated within the daytime contours, using the *InterestMap*™[16] 'Points of Interest' (2014) database. For the purpose 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 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 Gatwick 2014 day Leq noise contours generated with the actual 2014 summer day period runway modal split (64% west / 36% east) are shown in **Figure 11a**. The contours are plotted from 57 to 72 dBA at 3 dB intervals.

3.1.2 Cumulative estimates of the areas, populations and households within the 2014 day actual modal split contours are provided in the table below:

Gatwick 2014 day actual contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 57	42.2	3,300	1,350
> 60	23.9	1,500	550
> 63	13.0	550	150
> 66	7.0	400	100
> 69	3.7	150	0
> 72	2.0	0	0

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

3.1.3 The 2014 day actual modal split 57 dBA Leq contour enclosed an area of 42.2 km^2 and a population of 3,300.

3.1.4 Estimates of the cumulative numbers of noise sensitive buildings within the 2014 day actual modal split contours are provided in the table below:

Gatwick 2014 day actual contours – noise sensitive building estimates

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

3.2 Night actual modal split contours

3.2.1 The Gatwick 2014 night Leq noise contours generated with the actual 2014 summer night period runway modal split (60% west / 40% 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 from the diagram for clarity).

3.2.2 Cumulative estimates of the areas, populations and households within the 2014 night actual modal split contours are provided in the following table:

Gatwick 2014 night actual contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 48	103.5	12,850	5,000
> 51	52.6	6,300	2,450
> 54	28.2	1,800	750
> 57	15.2	900	300
> 60	7.9	400	100
> 63	4.2	200	50
> 66	2.3	0	0
> 69	1.4	0	0
> 72	0.9	0	0

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

3.2.3 The 2014 night actual modal split 48 dBA Leq contour enclosed an area of 103.5 km^2 and a population of 12,850.

3.3 Day standard modal split contours

3.3.1 The Gatwick 2014 day Leq noise contours generated with the standard 2014 summer day 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.

3.3.2 Cumulative estimates of the areas, populations and households within the 2014 day standard modal split contours are provided in the following table:

Gatwick 2014 day standard contours - area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 57	42.3	3,700	1,500
> 60	23.9	1,550	550
> 63	12.9	600	200
> 66	7.0	400	100
> 69	3.7	150	0
> 72	2.1	0	0

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

3.3.3 The 2014 day standard modal split 57 dBA Leq contour enclosed an area of 42.3 km^2 and a population of 3,700.

3.3.4 Estimates of the cumulative numbers of noise sensitive buildings within the 2014 day standard modal split contours are provided in the table below:

Gatwick 2014 day standard contours - noise sensitive building estimates

Leq (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

4 Analysis of results

4.1 Day actual modal split contours – comparison with 2013 contours

4.1.1 The Gatwick 2014 day actual modal split Leq contours are compared against the 2013 day actual Leq contours in **Figure 13a**. The table below summarises the areas, populations and percentage changes from 2013 to 2014:

Gatwick day actual contours - area and population estimates for 2013 and 2014

Leq (dBA)	2013 Area (km^2)	2014 Area (km^2)	Area change (%)	2013 Pop.	2014 Pop.	Pop. change (%)
> 57	40.9	42.2	+3%	3,250	3,300	+2%
> 60	23.1	23.9	+3%	1,250	1,500	+20%
> 63	12.5	13.0	+4%	350	550	+57%
> 66	6.7	7.0	+4%	150	400	+167%
> 69	3.5	3.7	+6%	0	150	(n/a)
> 72	1.9	2.0	+5%	0	0	(n/a)

Notes: the 2013 and 2014 day actual runway modal splits were 69% west / 31% east and 64% west / 36% east respectively. **The 2014 population counts include Gatwick immigration removal centre residents for the first time (see section 2.9.3)**.

4.1.2 The 57 dBA contour area increased by 3% in 2014, following the replacement of a significant number of large-twin turboprops by short-haul jets (such as the Airbus A320) and a 1% overall increase in movements. Area increases were also seen at the other contour levels.

4.1.3 The population counts in 2014 were affected significantly by the inclusion of residents of the Gatwick immigration removal centres (numbering 150 people) in the 2014 population database update, as described in section 2.9.3. Within the 57 dBA contour this offset the population reductions caused by the eastern contour tip pulling away from Lingfield. At the higher contours the percentage increases in population for 2014 were somewhat distorted by the inclusion of the immigration removal centre resident counts for the first time.

4.1.4 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.

4.1.5 The 57 dBA contour in 2014 enlarges slightly to the south-west of the airport near Rusper (**Figure 13a**) - this was caused by the use of the 'ADNID' trial departure route over the summer period.

4.2 Night actual modal split contours – comparison with 2013 contours

4.2.1 The Gatwick 2014 night actual modal split Leq contours are compared against the 2013 night actual Leq contours in **Figure 13b** (note: the 69 and 72 dBA contours have been omitted from the diagram for clarity). The table below summarises the areas, populations and percentage changes from 2013 to 2014:

Gatwick night actual contours - area and population estimates for 2013 and 2014

Leq (dBA)	2013 Area (km^2)	2014 Area (km^2)	Area change (%)	2013 Pop.	2014 Pop.	Pop. change (%)
> 48	91.8	103.5	+13%	11,200	12,850	+15%
> 51	47.7	52.6	+10%	5,050	6,300	+25%
> 54	25.9	28.2	+9%	1,550	1,800	+16%
> 57	13.9	15.2	+9%	450	900	+100%
> 60	7.2	7.9	+10%	150	400	+167%
> 63	3.8	4.2	+11%	50	200	+300%
> 66	2.0	2.3	+15%	0	0	(n/a)
> 69	1.2	1.4	+17%	0	0	(n/a)
> 72	0.7	0.9	+29%	0	0	(n/a)

Note: the 2013 and 2014 night actual runway modal splits were 73% west / 27% east and 60% west / 40% east respectively. **The 2014 population counts include Gatwick immigration removal centre residents for the first time (see section 2.9.3)**.

4.2.2 It can be seen that the 48 dBA contour area grew by 13%, in line with the 14% rise in night traffic in 2014. Increases in area were also seen at the higher contour levels. Populations within the 2014 contours were also higher at the 48 to 63 dBA contour levels, with an increase of 15% for the 48 dBA contour. In a similar manner to the daytime results, the 2014 population counts and associated percentage changes were affected by the inclusion of the Gatwick immigration removal centre residents (numbering approximately 150 people) in the 2014 population database update.

4.2.3 The contour lobe to the far west of the airport extended in 2014 because of the significantly higher proportion of easterly arrivals, in combination with the rise in traffic. At the opposite end to the east of the airport, the lower proportion of westerly arrivals was counterbalanced by the increase in movements, thereby leaving the extent of the contour relatively unchanged.

4.2.4 The slight expansion of the 48 dBA contour for 2014 between Kingsfold and Rusper resulted from the use of the ‘ADNID’ trial route.

4.3 Day standard modal split contours – comparison with 2013 contours

4.3.1 The Gatwick 2014 day standard modal split Leq contours are compared against the 2013 day standard Leq contours in **Figure 14**. The following table summarises the areas, populations and percentage changes from 2013 to 2014:

Gatwick day standard contours - area and population estimates for 2013 and 2014

Leq (dBA)	2013 Area (km^2)	2014 Area (km^2)	Area change (%)	2013 Pop.	2014 Pop.	Pop. change (%)
> 57	40.9	42.3	+3%	3,550	3,700	+4%
> 60	23.0	23.9	+4%	1,200	1,550	+29%
> 63	12.5	12.9	+3%	350	600	+71%
> 66	6.7	7.0	+4%	150	400	+167%
> 69	3.5	3.7	+6%	0	150	(n/a)
> 72	1.9	2.1	+11%	0	0	(n/a)

Note: the 2013 and 2014 day standard runway modal splits were 74% west / 26% east and 73% west / 27% east respectively. **The 2014 population counts include Gatwick immigration removal centre residents for the first time (see section 2.9.3)**.

4.3.2 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 effects of any difference between the ratios of westerly to easterly operations.

4.3.3 The standard modal split 57 dBA contour area enlarged by 3% in 2014 for the same reasons as the actual modal split contours (see section 4.1.2), with increases also found at the higher contour levels.

4.3.4 The 4% higher population count within the 57 dBA contour in 2014 was caused by the inclusion for the first time of the Gatwick immigration removal centre residents (approximately 150 people) in the 2014 population database update. The effect on the percentage changes was even greater at the higher contour levels.

4.3.5 The main difference in shape for the 57 dBA standard contours was an expansion near Rusper in 2014. Similar to the actual contours, this was caused by use of the 'ADNID' trial route over the summer period.

4.4 Day noise contour historical trend

4.4.1 **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. Please note that actual modal split data are used in this figure because standard modal split contours were not produced prior to 1995.

Movement trend

4.4.2 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 have impacts upon the aviation industry.

4.4.3 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. However, movement numbers increased by 2% in 2013 and a further 4% in 2014 as passenger demand continued to return.

Area and population trend

4.4.4 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, as the global recession impacted the aviation industry.

4.4.5 The contour area increased slightly in 2011 to 40.4 km^2 as movements started to recover. In 2012 the area was again slightly higher, this time mainly due to some changes in the fleet mix. The 2013 contour area reduced slightly from 2012 despite a rise in movements, largely because of fleet mix changes in favour of quieter types. However, in 2014 the contour area increased by 3% as total movements rose again and some large twin-turboprop aircraft were replaced by short-haul jets.

4.4.6 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). In 2013, the population dropped significantly as the higher proportion of easterly movements caused the contour to move away from Lingfield. The population increased in 2014 following the inclusion of Gatwick immigration removal centre residents in the population database for the first time.

5 Conclusions

5.1 Year 2014 average summer 16-hour day and 8-hour night 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 day contour area increased by 3% to 42.2 km^2 in 2014 (2013: 40.9 km^2). Movements in 2014 (715.6) rose by 1% compared to 2013 (706.7) and significant numbers of large twin-turboprop aircraft were replaced by short-haul jets such as the Airbus A320. The population count within the 57 dBA actual contour increased by 2% to 3,300 (2013: 3,250) following the inclusion of the Gatwick immigration removal centre residents in the 2014 database update for the first time. This offset any population reductions caused by the contour retracting from Lingfield.

5.3 The 2014 standard modal split 57 dBA Leq day contour area also increased by 3%, to 42.3 km^2 (2013: 40.9 km^2). The area increased for the same reasons as the actual modal split contours. The population enclosed by the 2014 standard 57 dBA Leq contour (3,700) was 4% higher than in 2013 (2013: 3,550), following the inclusion of the Gatwick immigration removal centre residents in the 2014 database update.

5.4 Night-time Leq contours have also been produced. The 2014 night actual modal split 48 dBA Leq contour enclosed an area of 103.5 km^2 (2013: 91.8 km^2), an increase of 13% from 2013, with a population count of 12,850 (2013: 11,200), a rise of 15%. The area and population increases followed a marked 14% growth in 2014 summer night movements.

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Table 1a Gatwick 2013 and 2014 average summer day movements by noise class

Noise Class	Description	2013	2014	Percentage of total 2014 movements	Change
PROPELLER AIRCRAFT					
1	Small propeller aircraft	0.2	0.2	< 1%	0.0 (*)
2	Large propeller aircraft	31.7	7.4	1%	-24.3 (-77%)
CHAPTER 3/4 JETS **					
3	Short-haul aircraft	617.2	652.9	91%	+35.7 (+6%)
4	Wide-body twin-engine aircraft	48.9	44.8	6%	-4.1 (-8%)
5	2nd generation wide-body 3,4-engine aircraft	8.7	10.4	1%	+1.7 (+20%)
LARGE CHAPTER 2/3 JETS					
6	1st generation wide-body 3,4-engine aircraft	0.0	0.0	0%	0.0 (*)
2nd GENERATION TWIN JETS					
7	Narrow-body twin-engine aircraft *(including Ch.2 and hush-kitted versions)*	< 0.1	0.0	0%	0.0 (*)
1st GENERATION JETS					
8	Narrow-body 3,4-engine aircraft	0.0	0.0	0%	0.0 (*)
	TOTAL	706.7	**715.6**	100%	**+8.9 (+1%)**

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

** An estimated 92% of *Noise Class 3* aircraft in the 2014 daytime period met the 'Chapter 4' noise standard (2013: 87%).

Note: Totals may not sum exactly due to rounding.

Table 1b Gatwick 2013 and 2014 average summer night movements by noise class

Noise Class	Description	2013	2014	Percentage of total 2014 movements	Change
PROPELLER AIRCRAFT					
1	Small propeller aircraft	0.1	0.1	< 1%	0.0 (*)
2	Large propeller aircraft	0.1	0.0	0%	-0.1 (*)
CHAPTER 3/4 JETS **					
3	Short-haul aircraft	96.7	114.5	93%	+17.8 (+18%)
4	Wide-body twin-engine aircraft	10.2	8.1	7%	-2.1 (-21%)
5	2nd generation wide-body 3,4-engine aircraft	0.6	0.3	< 1%	-0.3 (*)
LARGE CHAPTER 2/3 JETS					
6	1st generation wide-body 3,4-engine aircraft	0.0	0.0	0%	0.0 (*)
2nd GENERATION TWIN JETS					
7	Narrow-body twin-engine aircraft *(including Ch.2 and hush-kitted versions)*	0.0	0.0	0%	0.0 (*)
1st GENERATION JETS					
8	Narrow-body 3,4-engine aircraft	< 0.1	0.0	0%	0.0 (*)
	TOTAL	107.7	**123.1**	100%	**+15.4 (+14%)**

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

** An estimated 94% of *Noise Class 3* aircraft in the 2014 night-time period met the 'Chapter 4' noise standard (2013: 93%).

Note: Totals may not sum exactly due to rounding.

Table 2a Gatwick 2013 and 2014 average summer day movements by ANCON aircraft type

Aircraft type	Noise class	ANCON type	2013	2014	Change
Single piston propeller	1	SP	< 0.1	< 0.1	0.0
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	31.7	7.4	-24.3
Large four-engine propeller	2	L4P	< 0.1	0.0	0.0
Boeing 737-300/400/500	3	B733	86.0	57.7	-28.3
Boeing 737-600/700	3	B736	0.4	1.3	+0.9
Boeing 737-800/900	3	B738	84.2	101.0	+16.8
Boeing 757-200 (RB211-535E4/E4B engines)	3	B757E	24.8	29.3	+4.5
Boeing 757-200 (PW2037/2040 engines)	3	B757P	0.1	< 0.1	-0.1
Boeing 757-300	3	B753	3.0	5.7	+2.7
BAe 146/Avro RJ	3	BA46	0.6	0.1	-0.5
Airbus A318	3	EA318	0.1	< 0.1	-0.1
Airbus A319 (CFM56 engines)	3	EA319C	230.3	231.3	+1.0
Airbus A319 (IAE V2500 engines)	3	EA319V	18.2	41.4	+23.2
Airbus A320 (CFM56 engines)	3	EA320C	95.7	123.3	+27.6
Airbus A320 (IAE V2500 engines)	3	EA320V	10.0	19.6	+9.6
Airbus A321 (CFM56 engines)	3	EA321C	0.2	0.1	-0.1
Airbus A321 (IAE V2500 engines)	3	EA321V	26.7	28.7	+2.0
Executive Business Jet (Chapter 3)	3	EXE3	3.0	2.9	-0.1
Bombardier CRJ100/200	3	CRJ	< 0.1	0.0	0.0
Bombardier CRJ900	3	CRJ900	0.3	0.3	0.0
Embraer ERJ 135/145	3	ERJ	0.2	0.1	-0.1
Embraer E-170	3	ERJ170	18.4	0.5	-17.9
Embraer E-190	3	ERJ190	12.7	9.4	-3.3
Fokker 100	3	FK10	0.8	0.0	-0.8
McDonnell Douglas MD-80 series	3	MD80	1.5	0.2	-1.3
Boeing 767-200	4	B762	< 0.1	0.0	0.0
Boeing 767-300 (GE CF6-80 engines)	4	B763G	7.7	2.5	-5.2
Boeing 767-300 (PW PW4000 engines)	4	B763P	0.8	0.8	0.0
Boeing 777-200 (GE GE90 engines)	4	B772G	11.8	13.9	+2.1
Boeing 777-200 (PW PW4000 engines)	4	B772P	0.1	0.1	0.0
Boeing 777-200 (RR Trent 800 engines)	4	B772R	3.2	2.8	-0.4
Boeing 777-200LR/300ER (GE GE90 engines)	4	B773G	4.9	3.8	-1.1
Boeing 777-300 (RR Trent 800 engines)	4	B773R	0.6	0.0	-0.6
Boeing 787-8	4	B788	4.3	7.3	+3.0
Airbus A300	4	EA30	2.7	< 0.1	-2.7
Airbus A310	4	EA31	1.2	1.3	+0.1
Airbus A330	4	EA33	11.5	12.2	+0.7
Airbus A340-200/300	5	EA34	0.1	0.1	0.0
Airbus A340-500/600	5	EA346	0.2	0.0	-0.2
Airbus A380 (Engine Alliance GP7000 engines)	5	EA38GP	0.0	2.0	+2.0
Airbus A380 (RR Trent 900 engines)	5	EA38R	< 0.1	0.0	0.0
Boeing 747-400 (GE CF6-80F engines)	5	B744G	8.4	8.2	-0.2
Boeing 747-400 (RR RB211 engines)	5	B744R	< 0.1	0.0	0.0
Executive Business Jet (Chapter 2)	7	EXE2	< 0.1	0.0	0.0
		TOTAL	706.7	**715.6**	**+8.9 (+1%)**

Note: Totals may not sum exactly due to rounding.

Table 2b Gatwick 2013 and 2014 average summer night movements by ANCON aircraft type

Aircraft type	Noise class	ANCON type	2013	2014	Change
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	0.1	0.0	-0.1
Large four-engine propeller	2	L4P	< 0.1	0.0	0.0
Boeing 737-300/400/500	3	B733	8.4	7.7	-0.7
Boeing 737-600/700	3	B736	< 0.1	< 0.1	0.0
Boeing 737-800/900	3	B738	12.5	18.2	+5.7
Boeing 757-200 (RB211-535E4/E4B engines)	3	B757E	10.3	11.2	+0.9
Boeing 757-300	3	B753	1.4	2.1	+0.7
BAe 146/Avro RJ	3	BA46	< 0.1	< 0.1	0.0
Airbus A318	3	EA318	< 0.1	0.0	0.0
Airbus A319 (CFM56 engines)	3	EA319C	26.1	27.3	+1.2
Airbus A319 (IAE V2500 engines)	3	EA319V	1.6	3.2	+1.6
Airbus A320 (CFM56 engines)	3	EA320C	26.3	30.8	+4.5
Airbus A320 (IAE V2500 engines)	3	EA320V	1.5	3.3	+1.8
Airbus A321 (CFM56 engines)	3	EA321C	0.1	0.0	-0.1
Airbus A321 (IAE V2500 engines)	3	EA321V	7.9	9.9	+2.0
Executive Business Jet (Chapter 3)	3	EXE3	0.3	0.3	0.0
Bombardier CRJ900	3	CRJ900	< 0.1	0.0	0.0
Embraer ERJ 135/145	3	ERJ	0.1	< 0.1	0.0
Embraer E-190	3	ERJ190	0.3	0.4	+0.1
Boeing 767-200	4	B762	< 0.1	0.0	0.0
Boeing 767-300 (GE CF6-80 engines)	4	B763G	2.0	0.8	-1.2
Boeing 767-300 (PW PW4000 engines)	4	B763P	0.0	< 0.1	0.0
Boeing 777-200 (GE GE90 engines)	4	B772G	2.4	2.2	-0.2
Boeing 777-200 (PW PW4000 engines)	4	B772P	0.1	0.0	-0.1
Boeing 777-200 (RR Trent 800 engines)	4	B772R	0.2	0.3	+0.1
Boeing 777-200LR/300ER (GE GE90 engines)	4	B773G	0.4	0.3	-0.1
Boeing 777-300 (RR Trent 800 engines)	4	B773R	0.1	0.0	-0.1
Boeing 787-8	4	B788	0.9	0.7	-0.2
Airbus A300	4	EA30	0.6	0.0	-0.6
Airbus A310	4	EA31	< 0.1	0.0	0.0
Airbus A330	4	EA33	3.6	3.7	+0.1
Airbus A340-200/300	5	EA34	< 0.1	< 0.1	0.0
Airbus A340-500/600	5	EA346	< 0.1	< 0.1	0.0
Airbus A380 (Engine Alliance GP7000 engines)	5	EA38GP	0.0	< 0.1	0.0
Boeing 747-400 (GE CF6-80F engines)	5	B744G	0.5	0.3	-0.2
Boeing 747-400 (RR RB211 engines)	5	B744R	< 0.1	0.0	0.0
Boeing 727 (Chapter 3)	8	B727	< 0.1	0.0	0.0
		TOTAL	107.7	**123.1**	**+15.4 (+14%)**

Note: Totals may not sum exactly due to rounding.

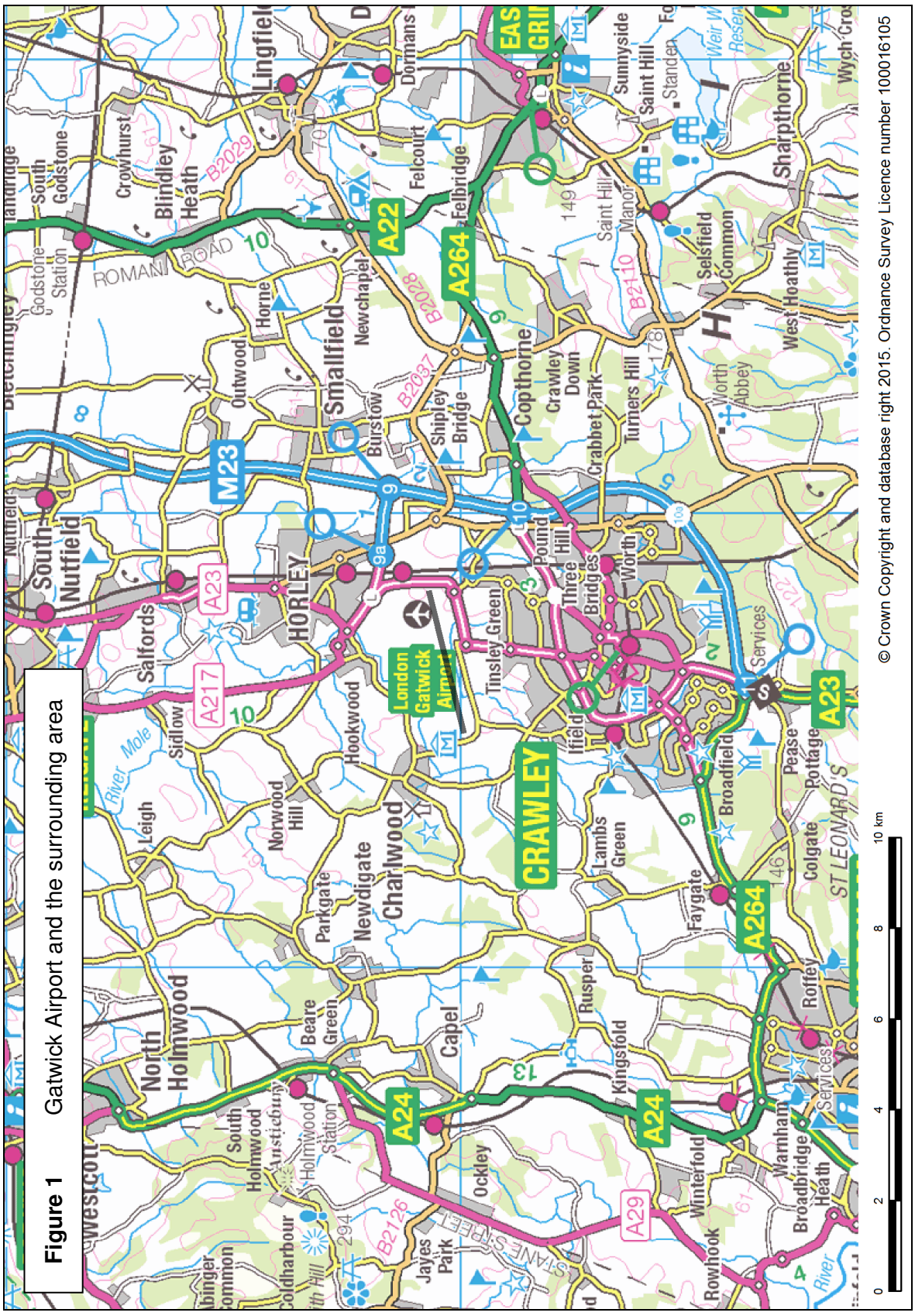
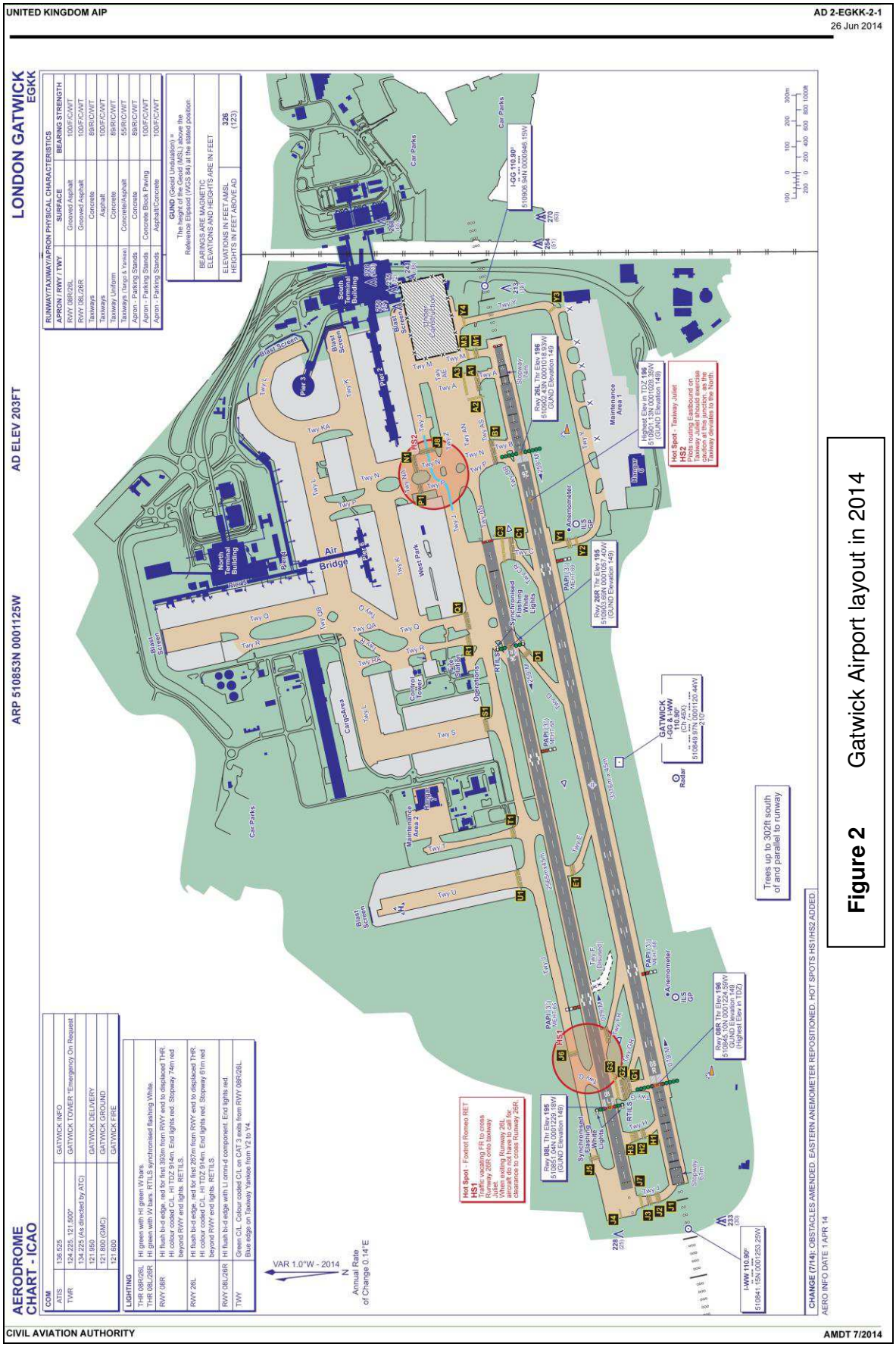


Figure 1 Gatwick Airport and the surrounding area



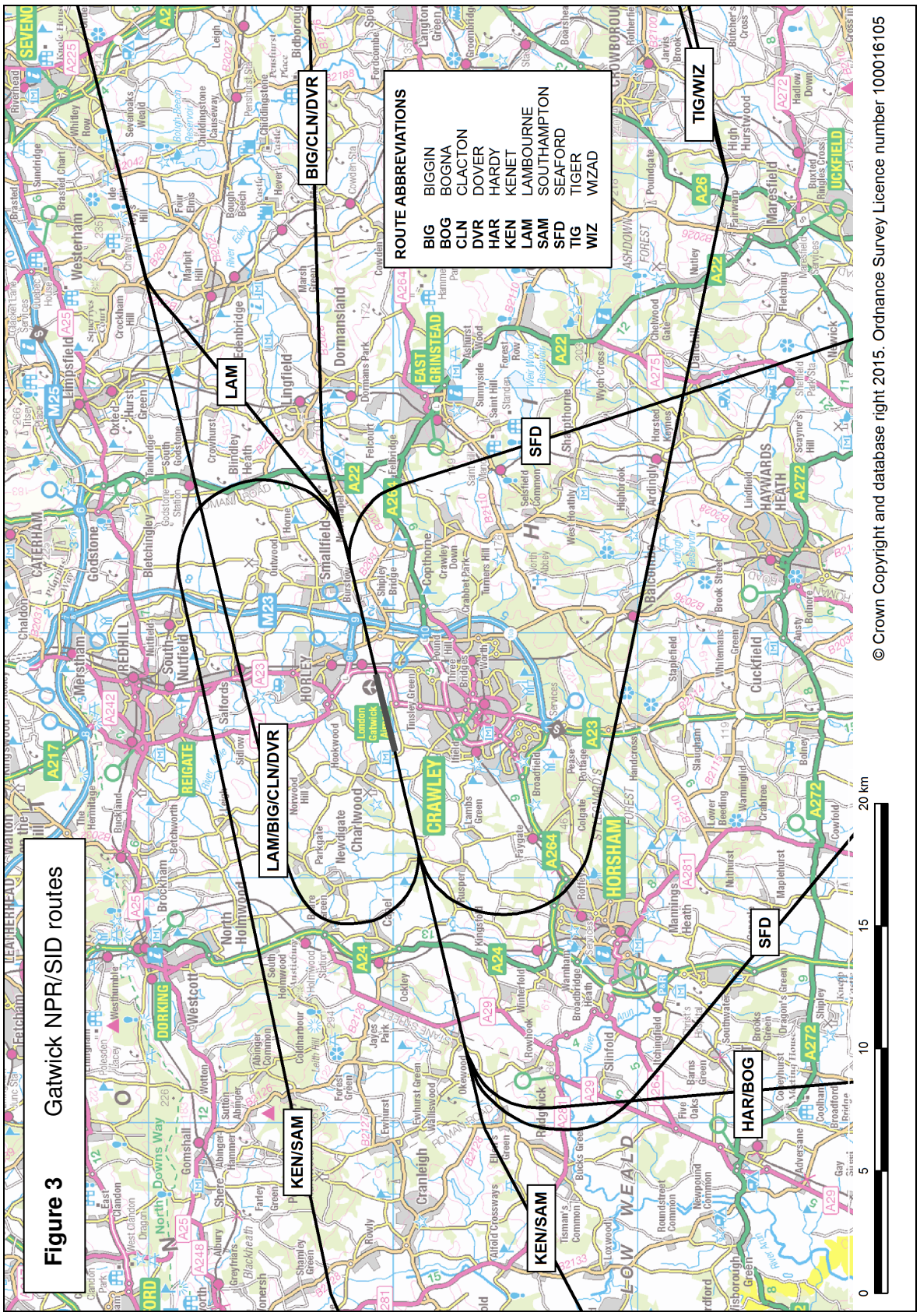


Figure 3 Gatwick NPR/SID routes

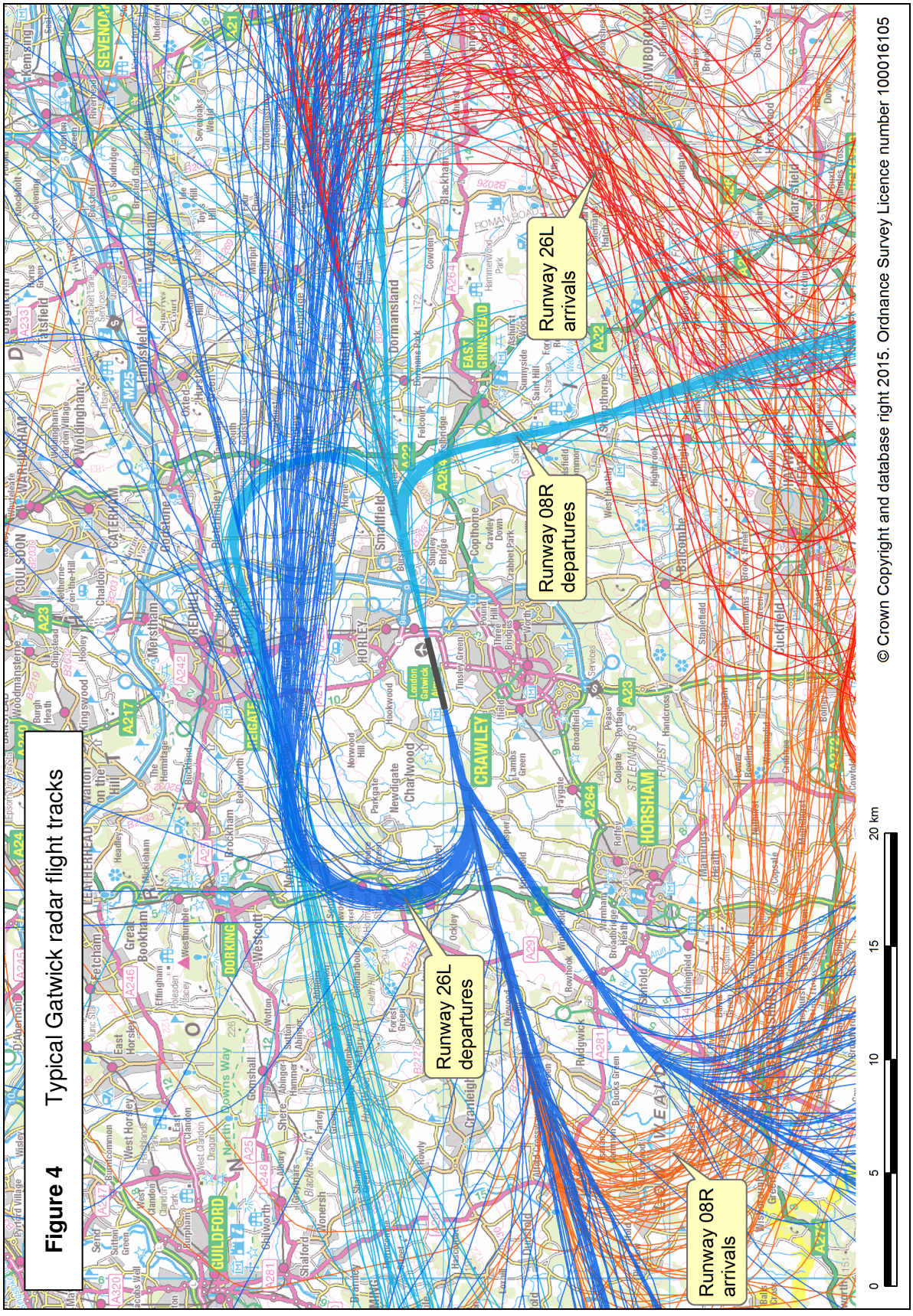
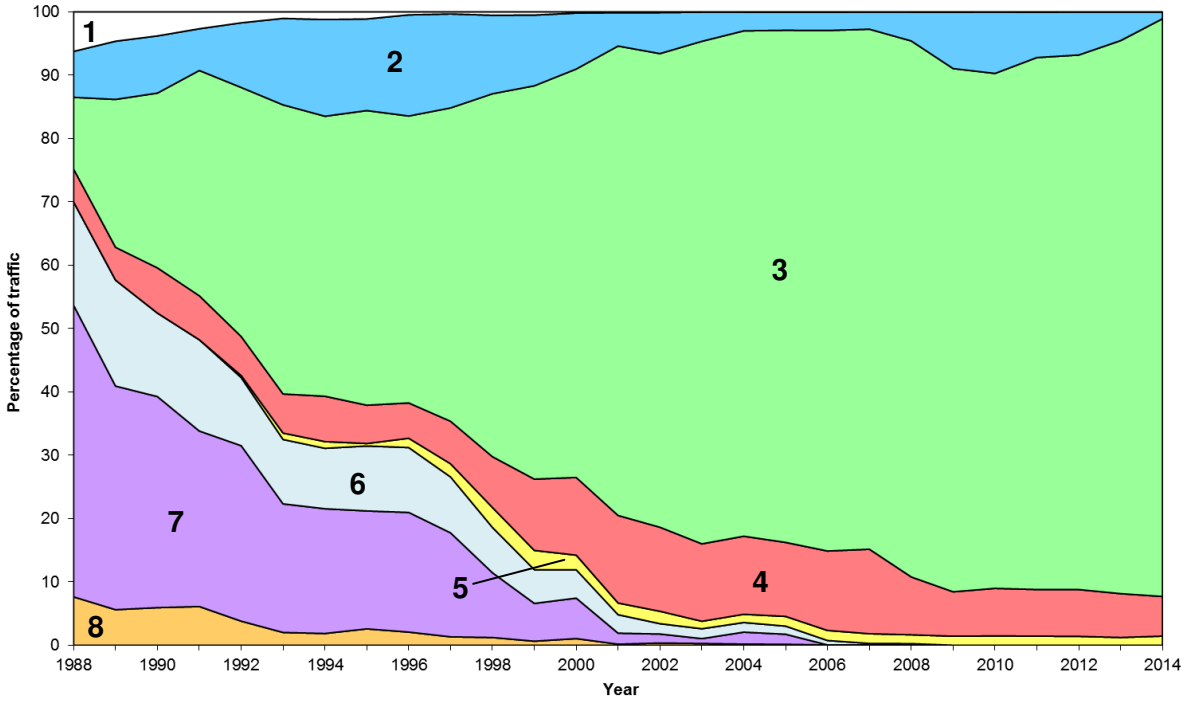


Figure 4 Typical Gatwick radar flight tracks

Figure 5 Gatwick noise class trend 1988-2014



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

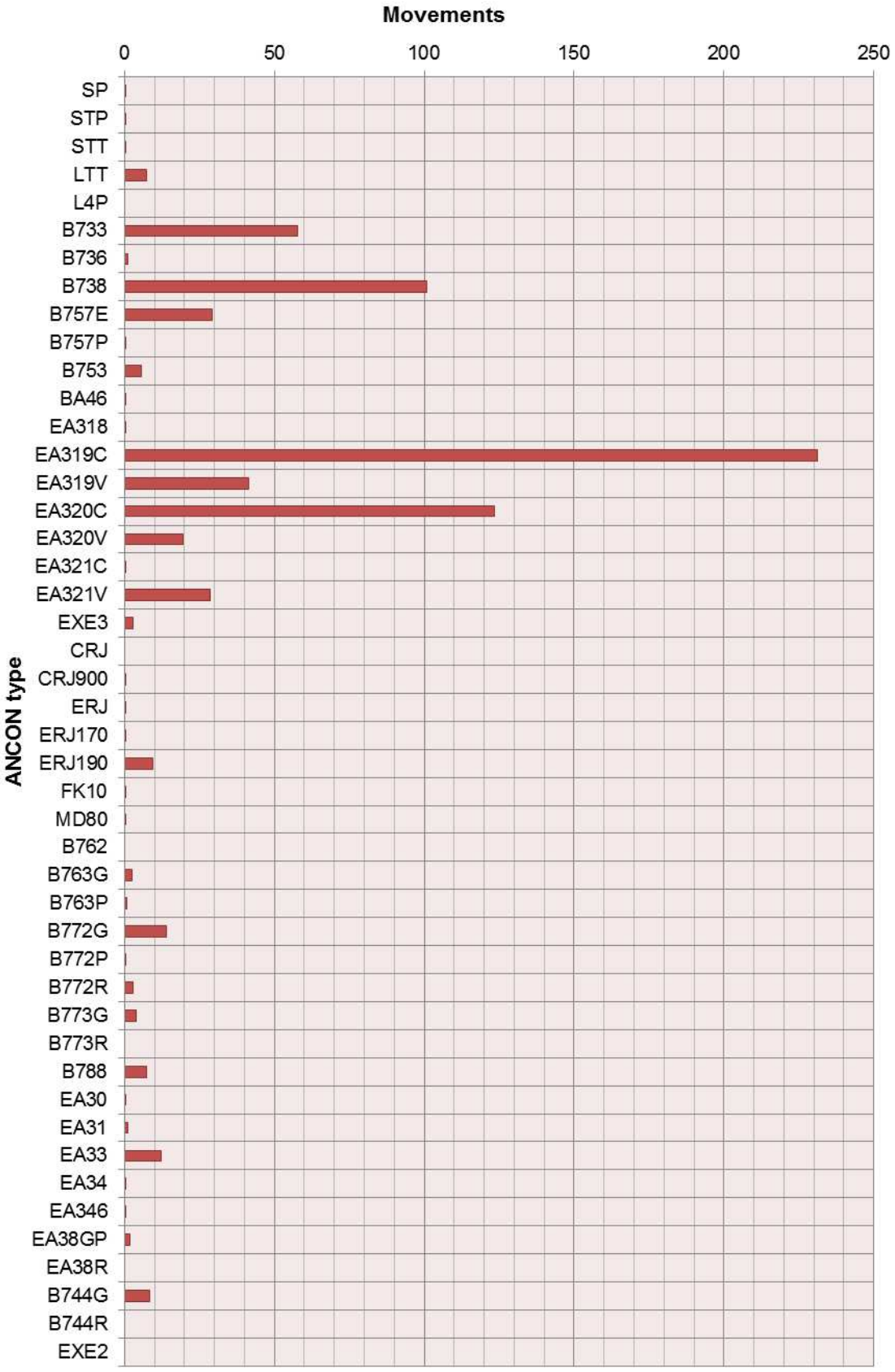
Chapter 3/4 jets
3 Short-haul, e.g. Airbus A319, Boeing 737-800
4 Wide-body twins, e.g. Airbus A330, Boeing 777-200
5 2nd generation wide-body 3/4-engine aircraft, e.g. Airbus A380, Boeing 747-400

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 hush-kitted versions), e.g. Boeing 737-200

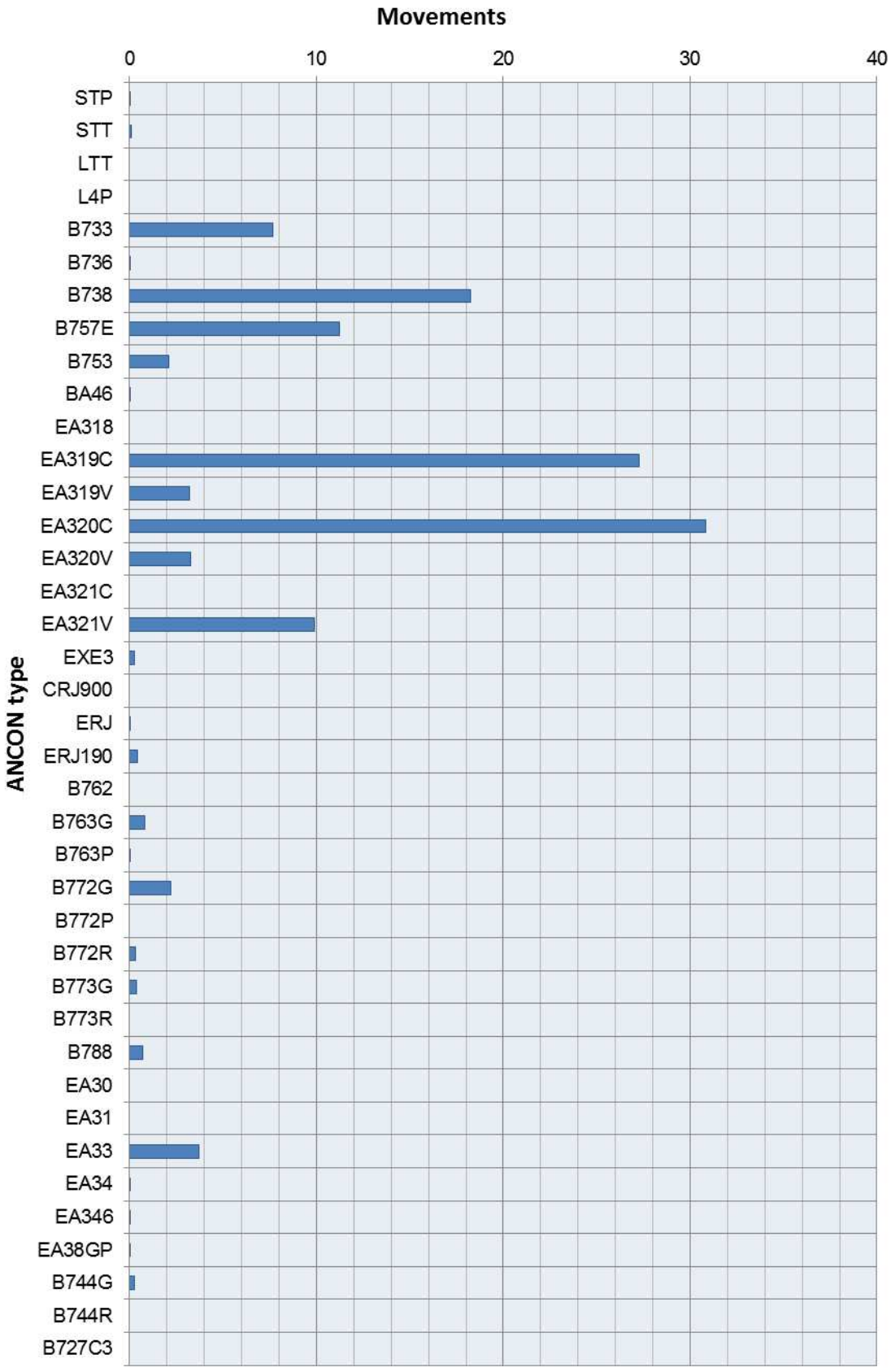
1st generation jets
8 Narrow body 3/4-engine aircraft (including hush-kitted versions), e.g. Boeing 707

Figure 6a Gatwick 2014 average summer day movements by ANCON type

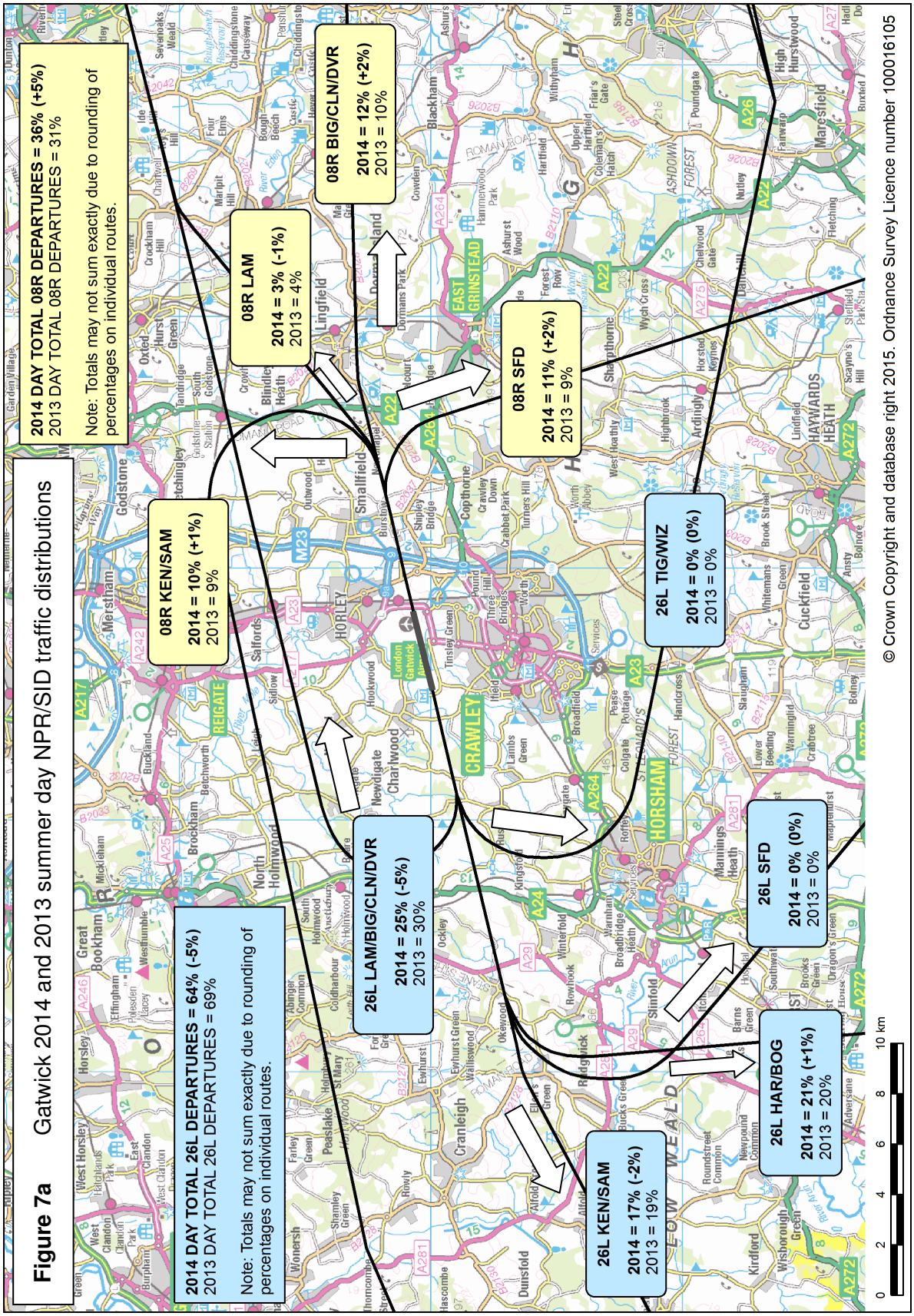


Note: the ANCON types are shown in the same order as in **Table 2a**.

Figure 6b Gatwick 2014 average summer night movements by ANCON type



Note: the ANCON types are shown in the same order as in **Table 2b**.



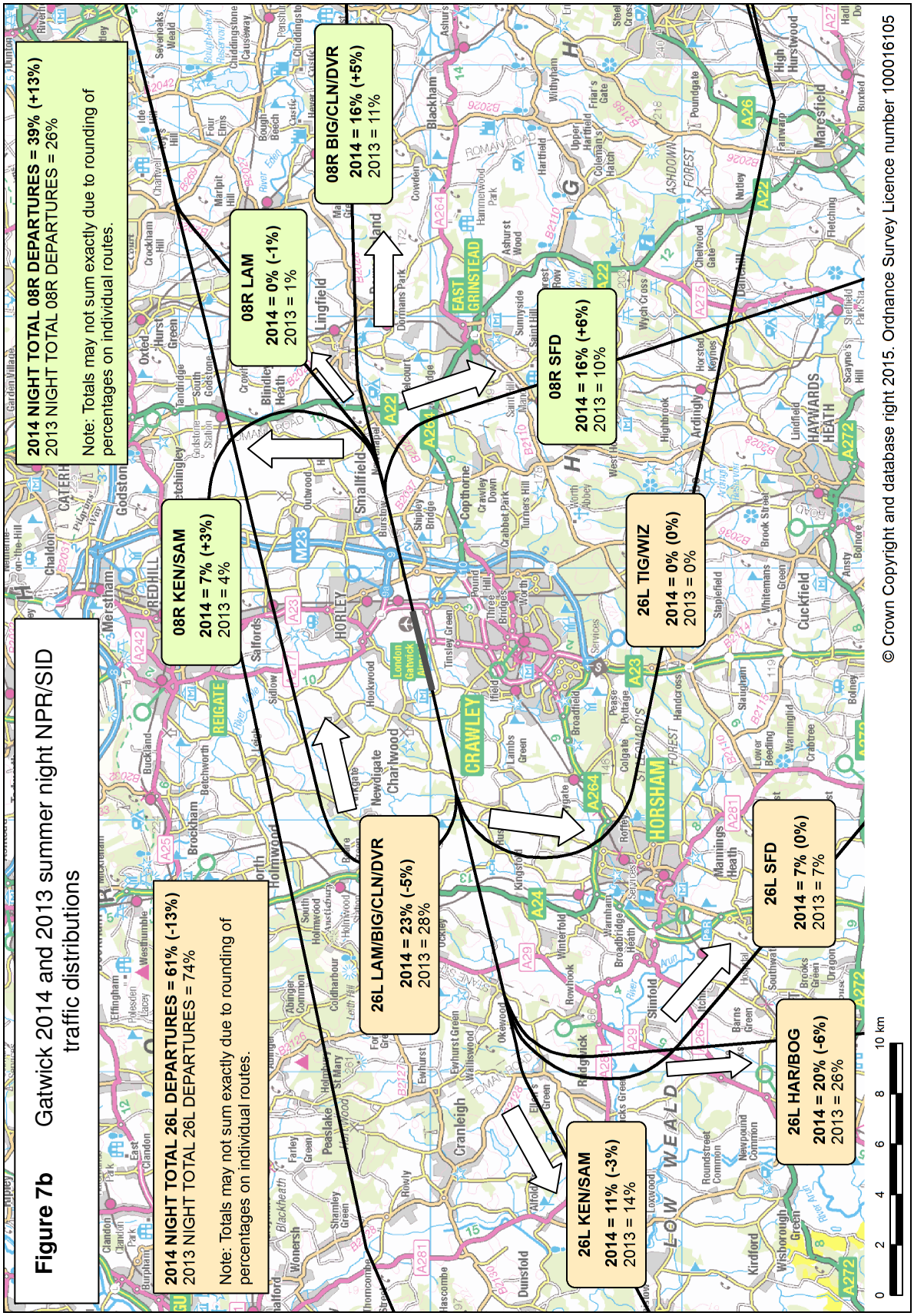
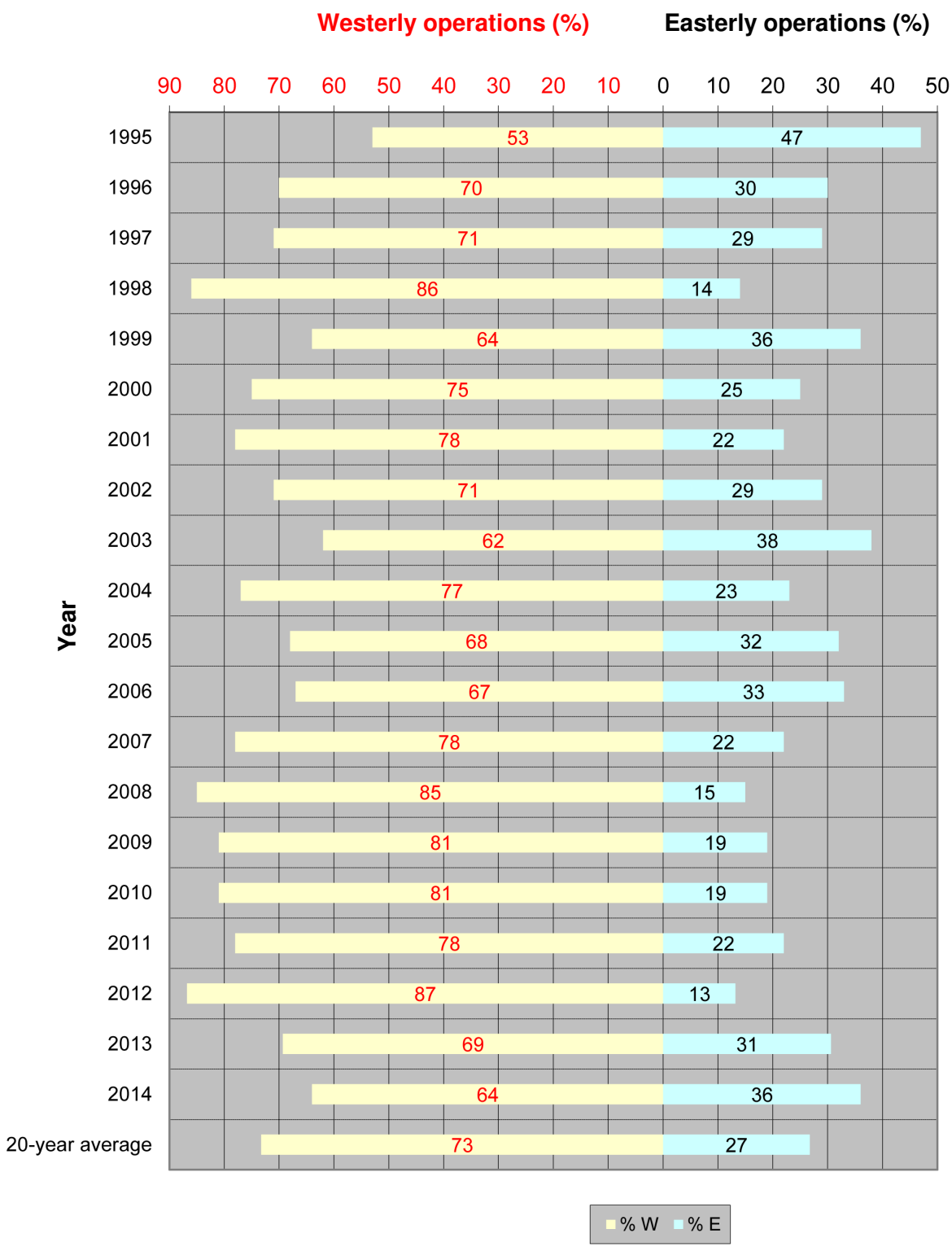


Figure 7b Gatwick 2014 and 2013 summer night NPR/SID traffic distributions

Figure 8 Gatwick average summer day runway modal splits 1995-2014



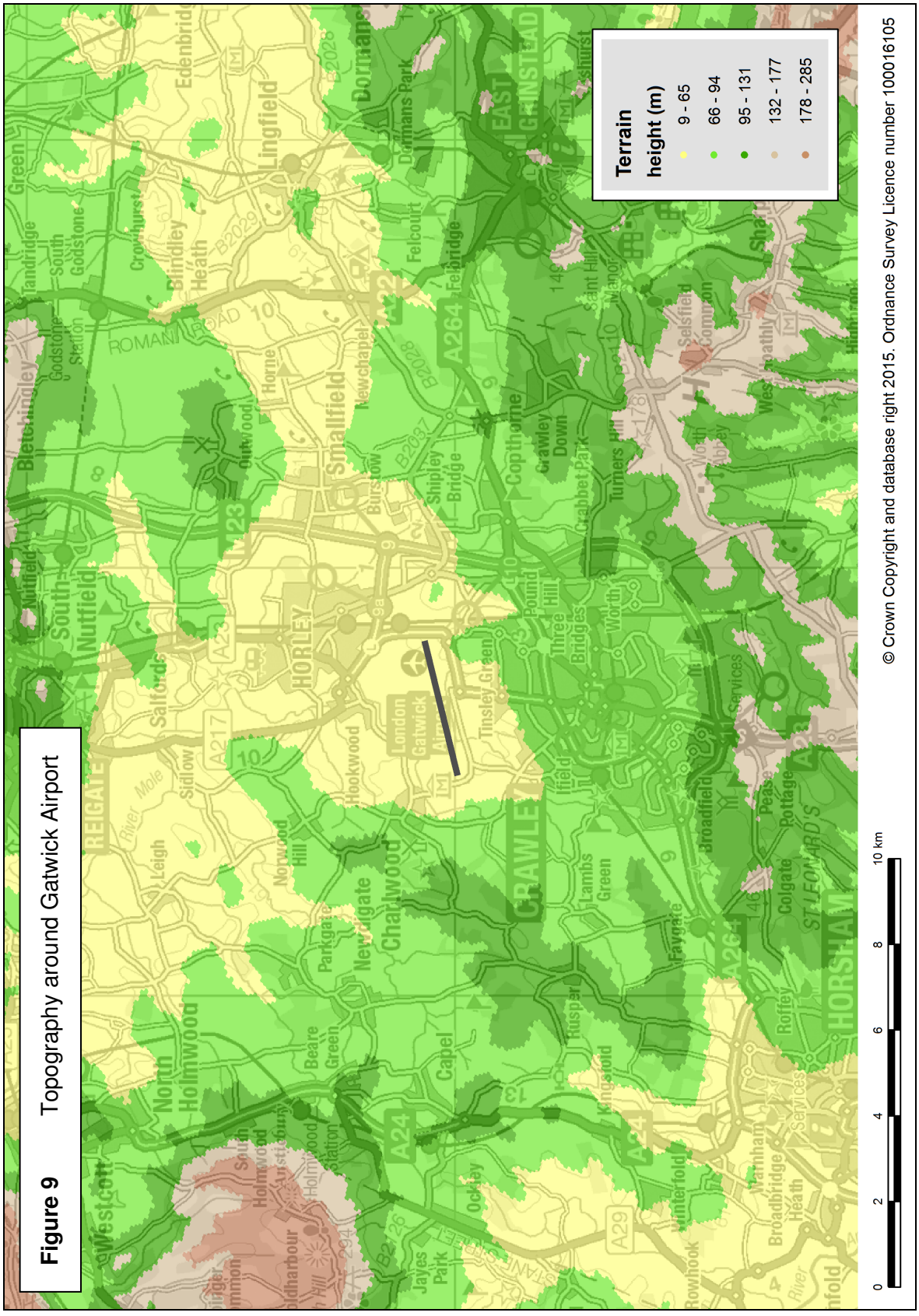


Figure 9 Topography around Gatwick Airport

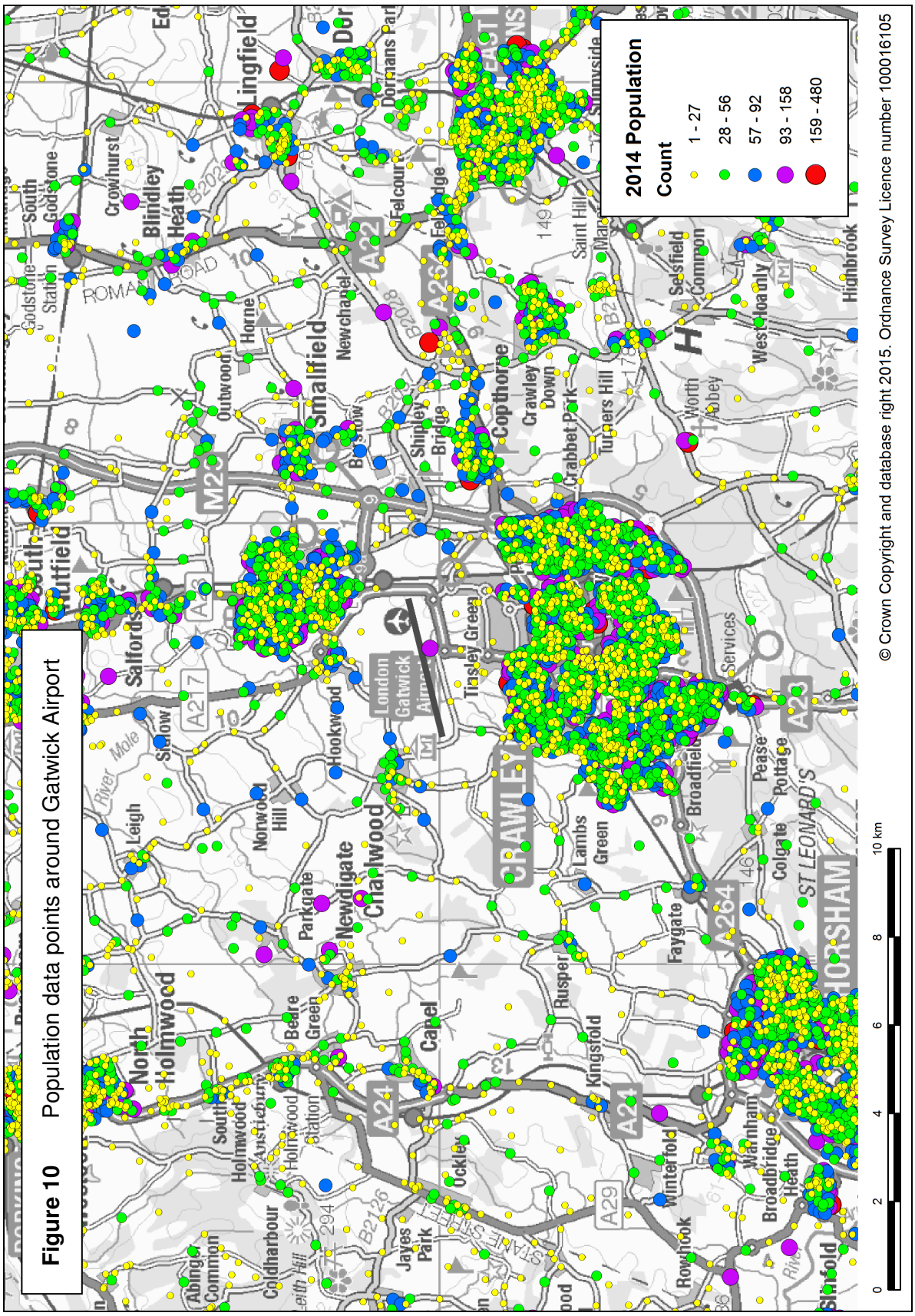


Figure 10 Population data points around Gatwick Airport

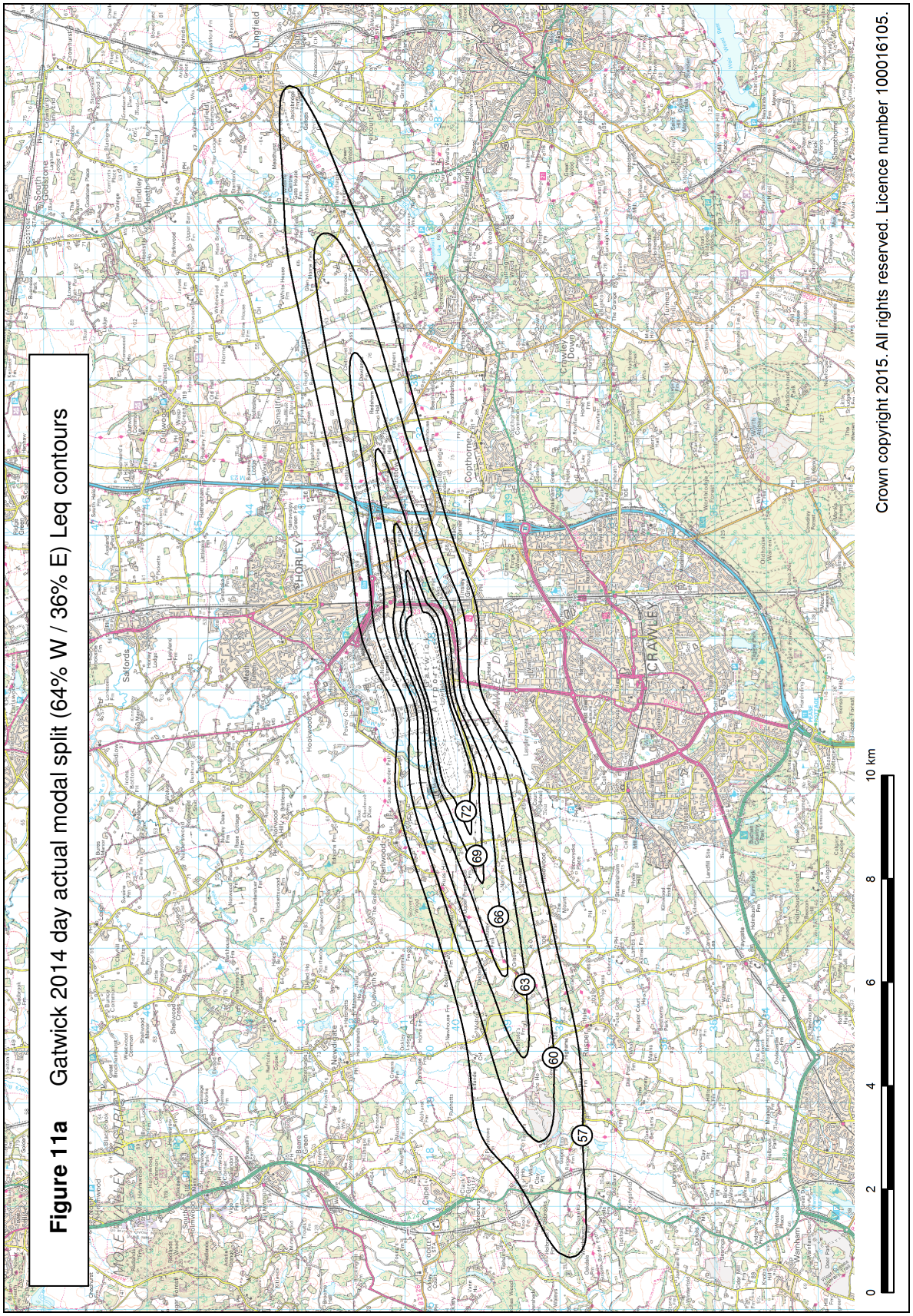


Figure 11a Gatwick 2014 day actual modal split (64% W / 36% E) Leq contours

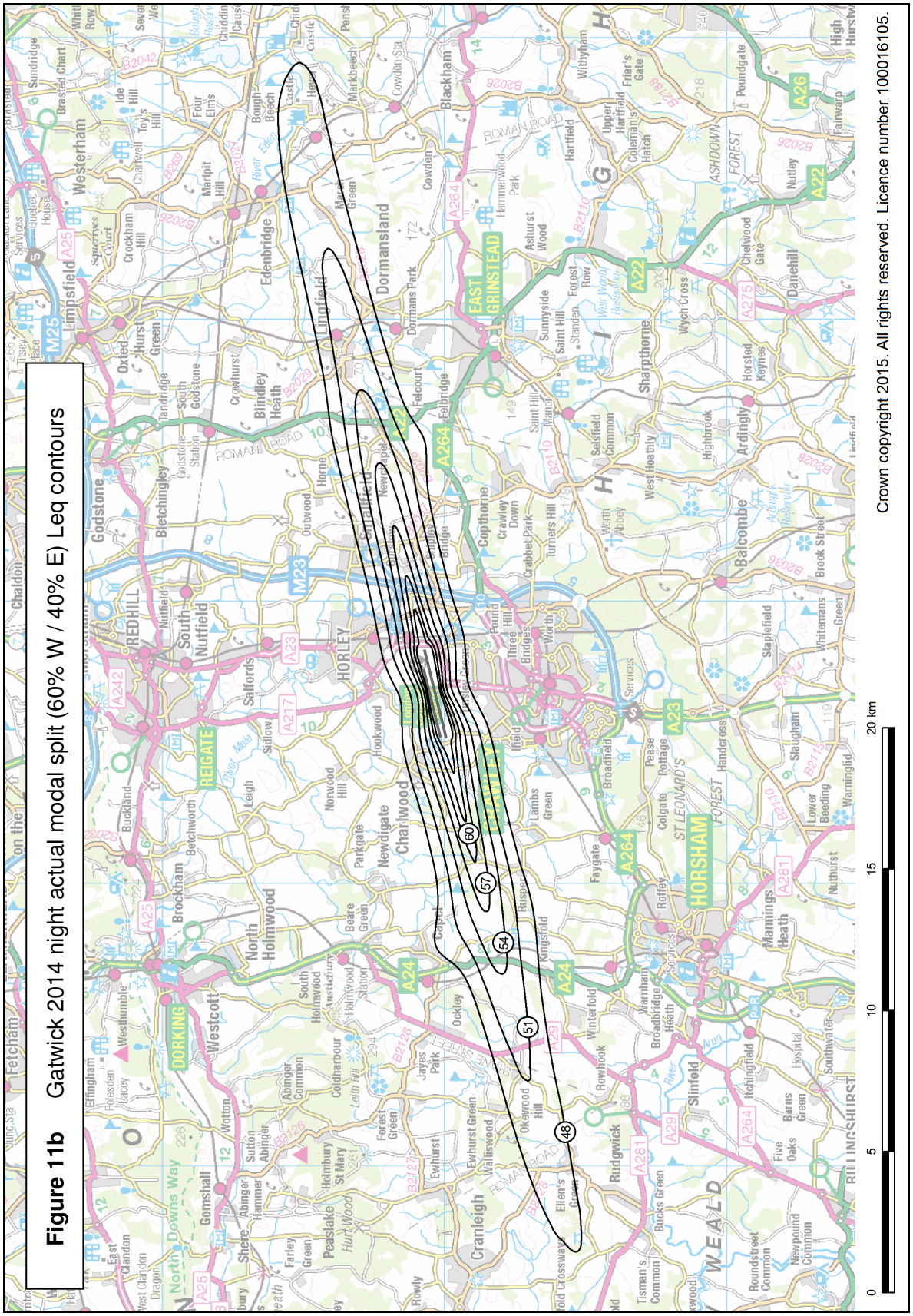


Figure 11b Gatwick 2014 night actual modal split (60% W / 40% E) Leq contours

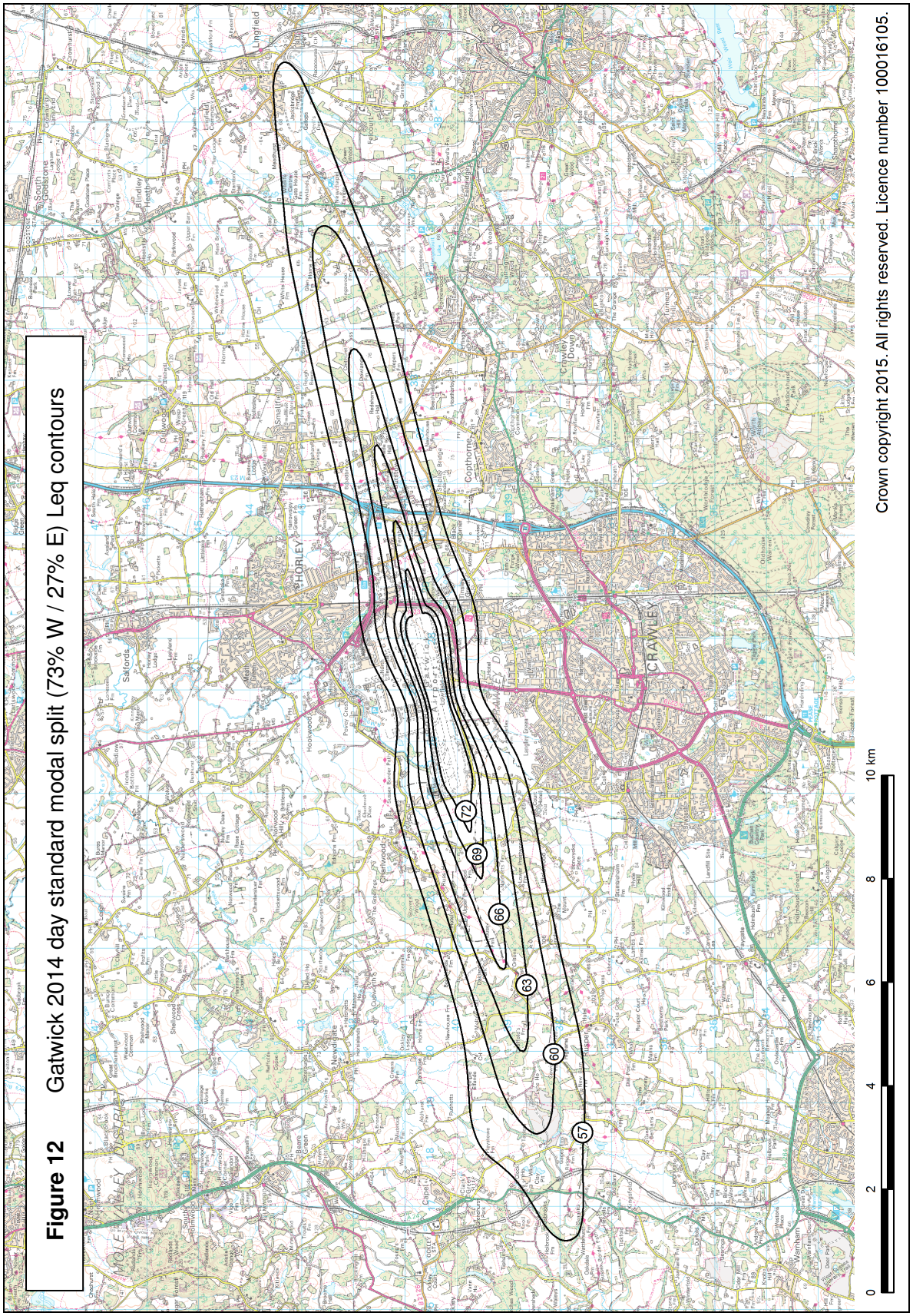


Figure 12 Gatwick 2014 day standard modal split (73% W / 27% E) Leq contours

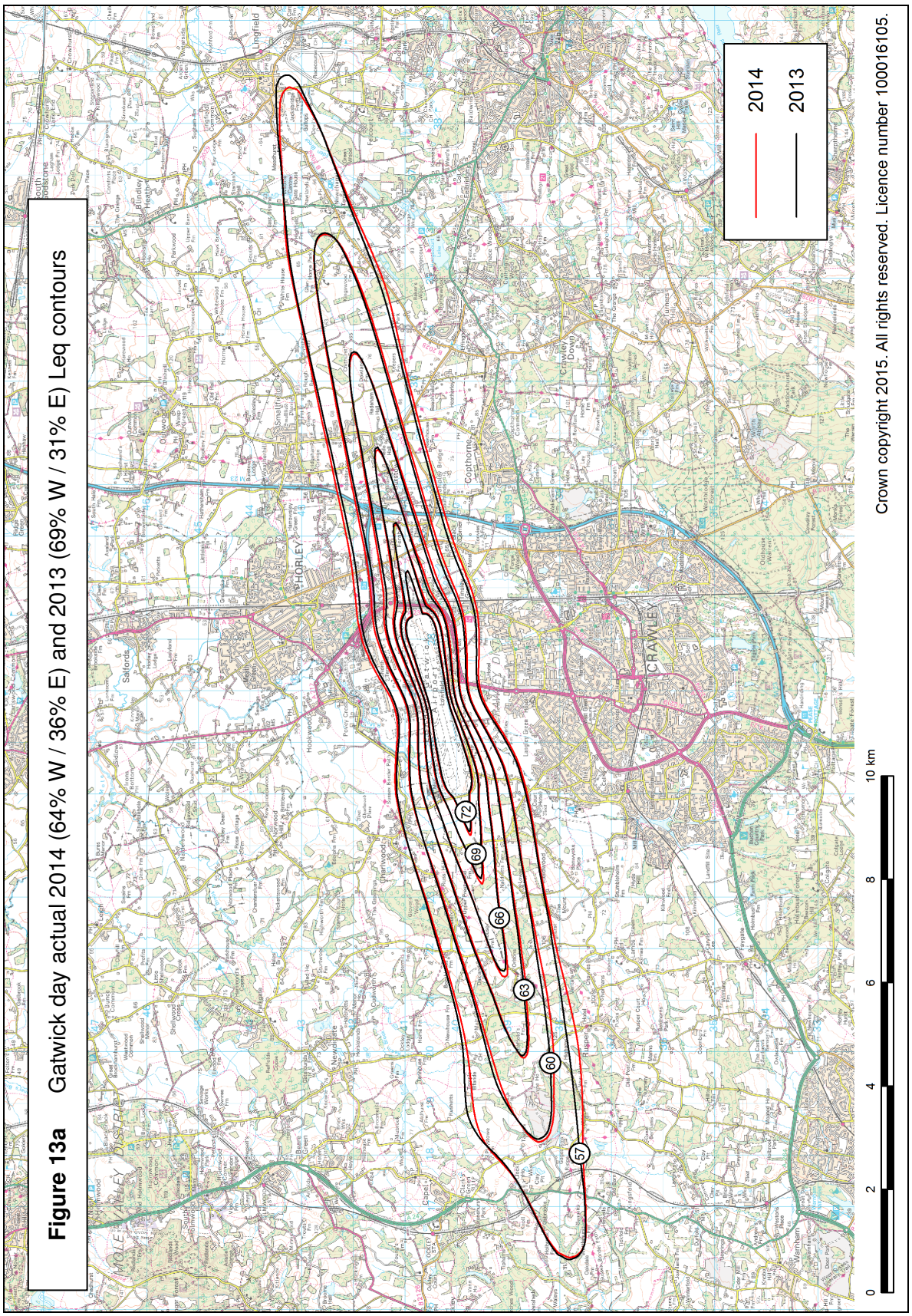


Figure 13a Gatwick day actual 2014 (64% W / 36% E) and 2013 (69% W / 31% E) Leq contours

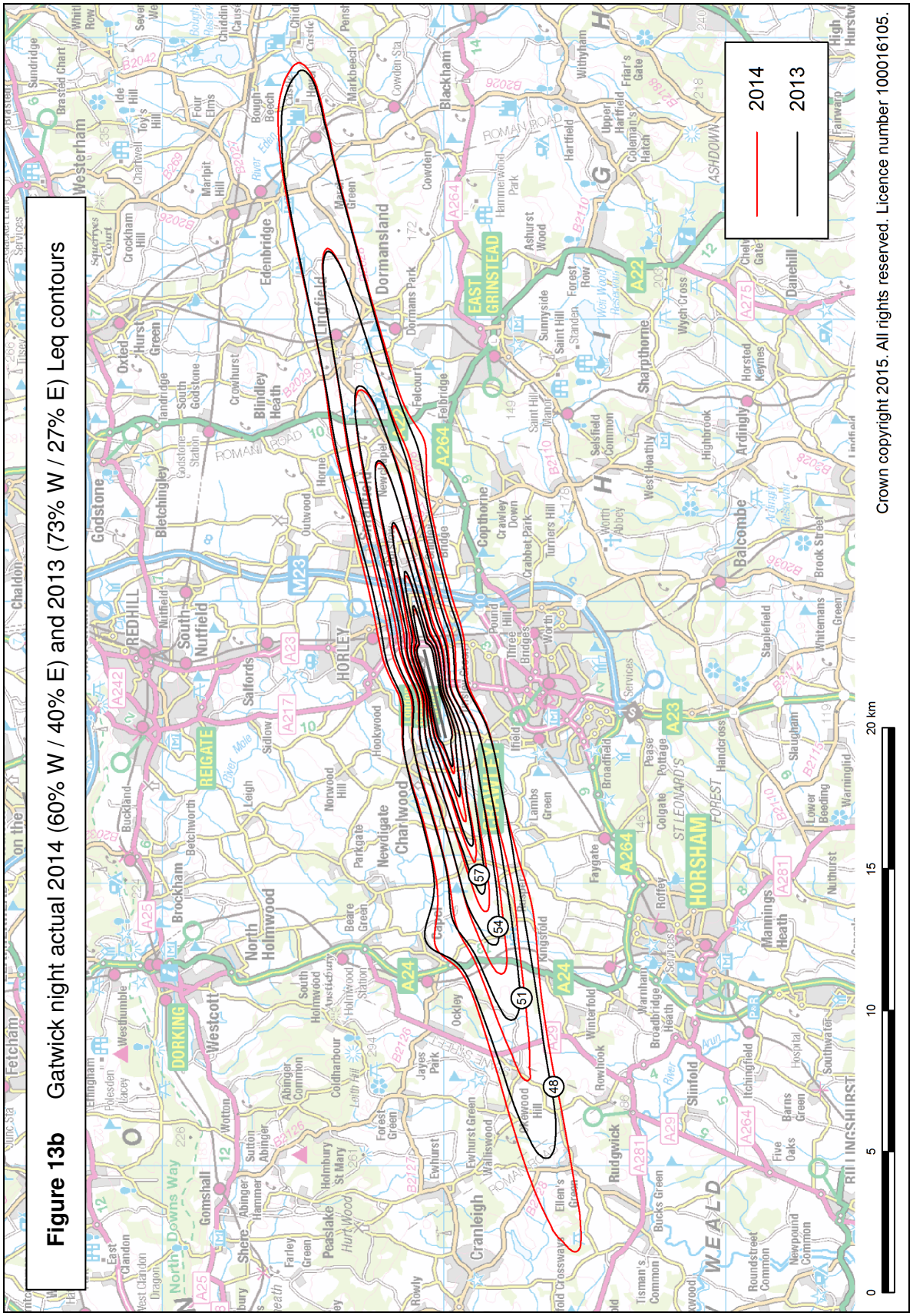


Figure 13b Gatwick night actual 2014 (60% W / 40% E) and 2013 (73% W / 27% E) Leq contours

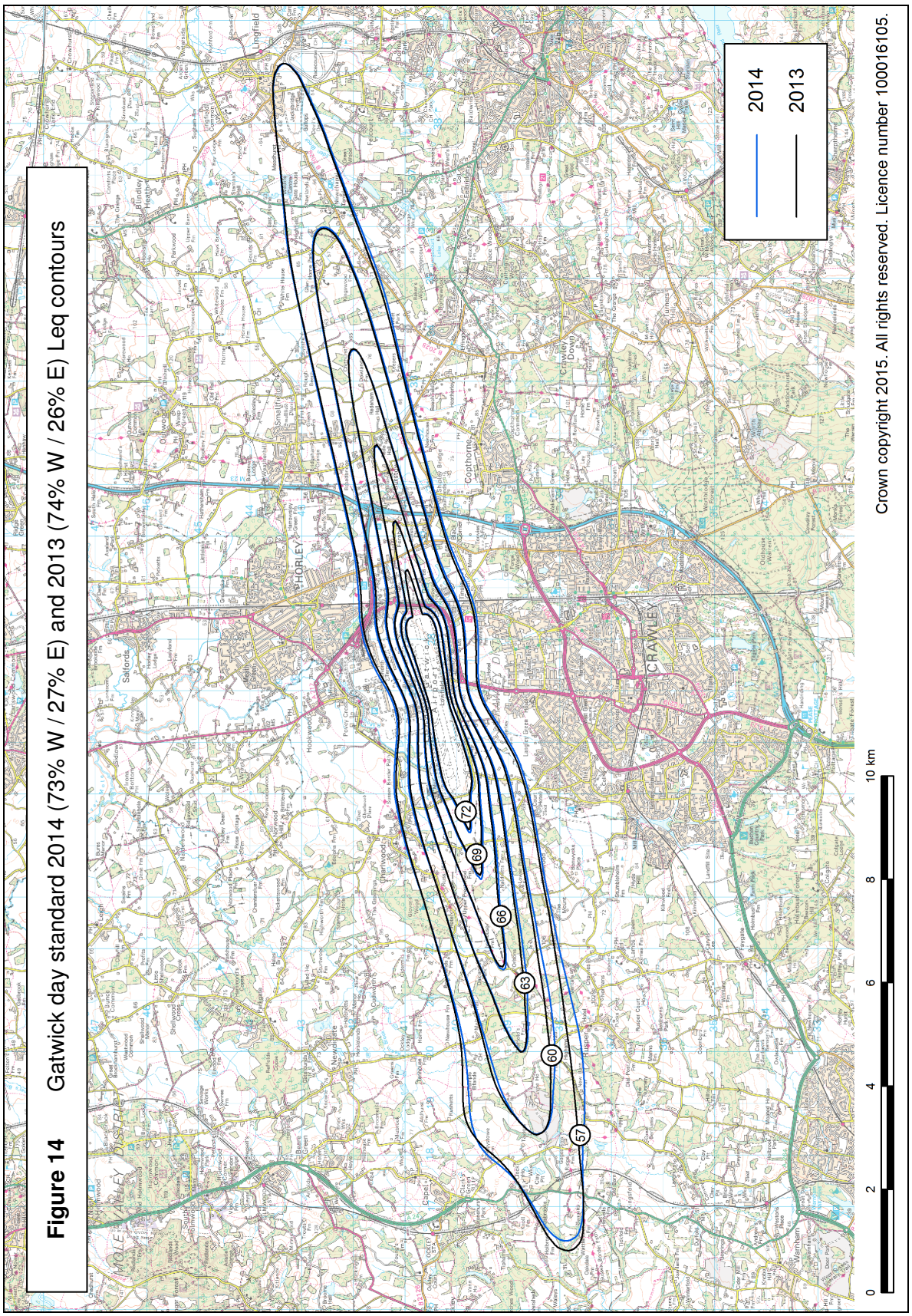


Figure 14 Gatwick day standard 2014 (73% W / 27% E) and 2013 (74% W / 26% E) Leq contours

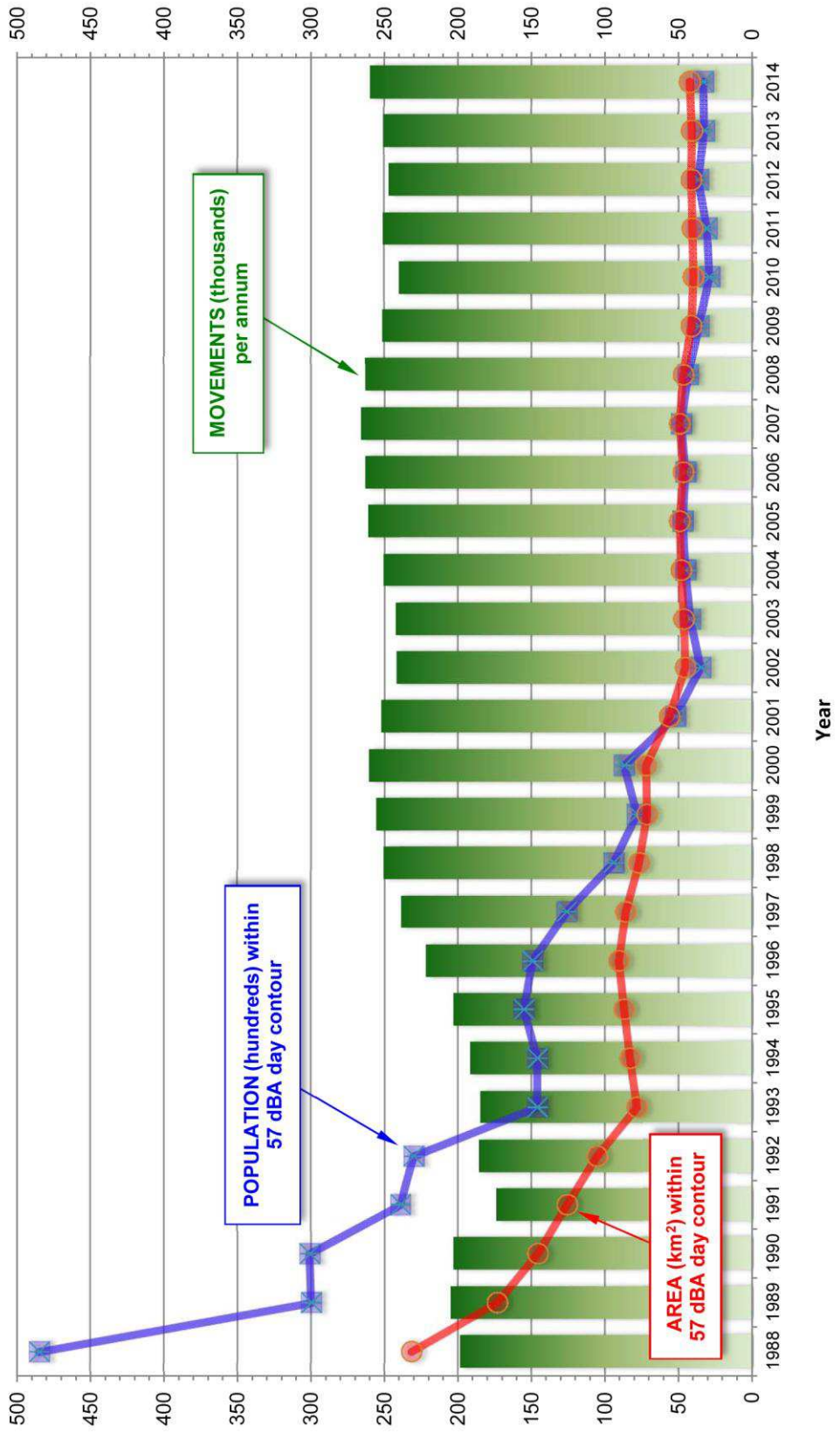


Figure 15 Gatwick annual traffic and summer day Leq noise contour area/population trend 1988-2014