Environmental Research and Consultancy Department

Noise Exposure Contours for Gatwick Airport 2017

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Summary

1. This report presents the 2017 average summer day and night Leq noise exposure contours generated for London Gatwick Airport.

2. 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.

3. Analysis of the 2017 summer traffic data for Gatwick revealed that average daily movements for the 16-hour daytime period (2017: 780.8) were 1% higher than in the previous year (2016: 770.6). There were on average 128.1 movements per 8-hour night over the 2017 summer period, an increase of 1% from the 2016 total (127.1).

4. The area of the 2017 summer day actual modal split (82% west / 18% east) 54 dBA Leq contour decreased by 5% to 83.8 km^2 (2016: 88.1 km^2). This area change can be attributed to lower measured noise levels for the Airbus A320 on departure and the Airbus A319/A320 on arrival. The population count within the 2017 summer day actual 54 dBA contour decreased by 3% to 11,300 (2016: 11,600).

5. The area of the 2017 summer day standard modal split (76% west / 24% east) 54 dBA Leq contour decreased by 4% to 82.7 km^2 (2016: 86.5 km^2). The population count within the 2017 summer day standard 54 dBA contour of 10,950 was 1% lower than the previous year (2016: 11,100).

6. The area of the 2017 summer night actual modal split (81% west / 19% east) 48 dBA Leq contour was 101.0 km^2, a decrease of 6% from the year before (2016: 107.1 km^2). Similar to the daytime Leq, this area change can be attributed to lower measured noise levels for the Airbus A320 on departure and the Airbus A319/A320 on arrival. The contour enclosed a population of 13,900, which was 5% lower than 2016 (14,600).

7. The 2017 summer night 48 dBA Leq contour area assuming the 10-year average runway modal split (77% west / 23% east) was 101.3 km^2 (2016: 107.7 km^2), enclosing a population of 13,550 (2016: 14,250).

Chapter 1

Introduction

Background

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. Up until 2015, this work was carried out on behalf of the Department for Transport (DfT). Since the 2016 study, ERCD has been commissioned directly by Gatwick Airport Ltd (GAL).

1.2 The UK civil aircraft noise 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.

1.3 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**).

1.4 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. Historically in the UK, Leq 16-hour noise contours have been plotted at levels from 57 to 72 dBA, in 3 dB steps. However, the Survey of Noise Attitudes (SoNA 2014)[1] found that the degree of annoyance (based on the percentage of respondents highly annoyed) previously occurring at 57 dBA, now occurs at 54 dBA. The Leq 16-hour contours have been plotted down to the lower level of 54 dBA since 2016.

1.5 Following the publication of the Aviation Policy Framework in March 2013 (**Ref 3**), night-time (2300-0700 local time) Leq noise contours have been produced on an annual basis for the designated airports. Night-time 8-hour Leq contours for 2017 have been calculated for Gatwick from 48 to 72 dBA at 3 dB intervals in accordance with standard practice. Average summer night Leq contours were first calculated for Gatwick for 2013.

1.6 The objectives of this report are to explain the noise modelling methodology used to produce the 2017 contours for Gatwick Airport, to present the calculated noise contours and to assess the changes from the previous year (**Ref 4**). Long-term trends are also examined.

[1] *Survey of Noise Attitudes 2014* (**Ref 2**), https://www.caa.co.uk/cap1506

Gatwick Airport

1.7 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 B1**, Appendix B).

1.8 Gatwick Airport has one main runway, designated 08R/26L, which is 3,316 m long. The Runway 26L landing threshold is displaced by 424 m, and the Runway 08R landing threshold displaced by 393 m.[2] 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 is shown in **Figure B2**.[3]

1.9 In the 2017 calendar year there were approximately 286,000 aircraft movements at Gatwick (2016: 281,000) and the airport handled 46.5 million passengers (2016: 44.1 million).[4]

[2] 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.

[3] UK AIP, AD 2-EGKK-2-1 (14 Sep 2017)

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

Chapter 2

Noise modelling methodology

ANCON model

2.1 Noise contours were calculated with the UK civil aircraft noise model ANCON (version 2.4), 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 5**). The ANCON model is also used for the production of annual contours for Heathrow and Stansted airports, and a number of other UK airports.

2.2 ANCON is fully compliant with the latest European guidance on noise modelling, ECAC.CEAC Doc 29 (Fourth edition), published in December 2016 (**Ref 6**). This guidance document represents internationally agreed best practice as implemented in modern aircraft noise models. The fourth edition introduced some minor changes to the modelling of start-of-roll noise, which have now been incorporated in the 2017 software update to ANCON (version 2.4).

Radar data

2.3 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, aircraft registration, aircraft type and destination. Analyses of departure and arrival flight tracks, and flight profiles, were based on 2017 summer radar data.

Flight tracks

2.4 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 B3**.

2.5 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 3,000 or 4,000 ft (depending on the route) 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, to avoid storms for example.

2.6 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 2017. Mean flight tracks were calculated from 24-hour data since both day and night contours were being produced.

2.7 **Figure B4** shows a sample of radar flight tracks from a day in July 2017. 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 14 and 31 km (7.6 and 16.7 nm) from threshold for Runway 26L, and between 13 and 26 km (7.0 and 14.0 nm) from threshold for Runway 08R.

Flight profiles

2.8 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 2017 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.

2.9 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.

2.10 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.

Noise emissions

2.11 At Gatwick, the NTK system captures data from both fixed and mobile noise monitors around the airport. Noise event data for individual aircraft operations were 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.[5]

2.12 The noise data collected were screened by ERCD with reference to several criteria so that only reliable data were used in the analysis. First of all, noise data that lay outside a 'weather window' were discarded. This ensured that the data used were not affected by adverse meteorological conditions such as precipitation and strong winds. Secondly, the maximum noise level of the aircraft event had to 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 passed through a 60-degree inverted cone, centred at the noise monitor, were retained in order to minimise the effects of lateral attenuation and lateral directivity.[6]

2.13 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.

2.14 The most significant noise database updates as identified by noise measurements undertaken in 2017 were as follows:

- Departure noise for the Airbus A320 with CFM engines (EA320C) was lower by around 0.5 to 1 dB at distances greater than 3 km from start-of-roll;
- Arrival noise for the Airbus A319 with CFM engines (EA319C) was about 1 dB lower at most distances from threshold;
- Arrival noise for the Airbus A319 and A320 with IAE V2500 engines (EA319V and EA320V) was lower by about 1 dB, mostly at distances beyond 13 km from threshold.

2.15 The above arrival noise reductions were most likely the result of the majority of these aircraft having received the Fuel Over Pressure Protector (FOPP) air flow deflectors to reduce noise on approach.

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

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

Daytime traffic distributions by Noise Class

2.16 The Leq contours were based on the daily average movements that took 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 was 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 Air Navigation Solutions Ltd[7] and close agreement was found.

2.17 The average number of daily movements at Gatwick over the 2017 summer day period was 780.8, 1% higher than the previous year (2016: 770.6).

2.18 **Table C1** of Appendix C lists the average summer day movements by 8 Noise Classes of aircraft (A to H), ranked in ascending order of noise emission, i.e. from least to most noisy.

2.19 In 2017 the majority of movements (90%) were within Noise Class C (i.e. narrow-body ICAO Chapter 3 and Chapter 4 jet aircraft[8]), which was similar to 2016 when the figure was 91%.

2.20 Wide-body twin-engine aircraft (Noise Class D) represented 7% of total movements in 2017, the same as in 2016.

2.21 Wide-body 3 or 4-engine aircraft (Noise Class E) comprised 2% of total movements in 2017, also the same as in 2016.

2.22 Movements by large propeller aircraft (Noise Class B) and small propeller aircraft (Noise Class A) were insignificant, and there were no movements in Noise Classes F, G and H, which represent the oldest and noisiest aircraft types that no longer operate at Gatwick.

2.23 It is estimated that over 99%[9] of aircraft in the 2017 summer day period were compliant with the ICAO Chapter 4 noise standard.

2.24 **Figure B5** illustrates the changing distribution of traffic among the 8 Noise Classes over the period from 1988 to 2017 inclusive. The shift over the years to

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[7] Air Navigation Solutions Ltd, a wholly owned subsidiary of the DFS Group, is the provider of air traffic control services to Gatwick Airport. Prior to March 2016, this responsibility belonged to NATS.

[8] Aircraft certification 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', 'Chapter 4' and 'Chapter 14' types. The Chapter 4 standard (applicable from 2006) is more stringent than the Chapter 3 standard (1977) and typically characterised by modern, quieter, high-bypass turbofan aircraft. The latest Chapter 14 standard is applicable to new large aircraft types presented for certification from 31 December 2017 and it represents a further level of stringency compared to the Chapter 4 standard.

[9] The percentage figure is an estimate because in some cases, detailed aircraft information (e.g. aircraft weight, engine modifications) was not readily available, so some assumptions had to be made.

increasingly higher proportions of narrow-body jet aircraft (i.e. Noise Class C) can be clearly seen.

Night-time traffic distributions by Noise Class

2.25 The average number of movements over the 2017 summer night period was 128.1, a 1% increase from the previous year (2016: 127.1). Arrivals comprised 63% of night movements in 2017.

2.26 **Table C2** 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. Similar to daytime, narrow-body jet aircraft (Noise Class C) made up the majority of movements at night in 2017 (91%), similar to 2016 (92%). The second largest grouping was wide-body twin-engine aircraft (Noise Class D), with 8% of movements. Wide-body 4-engine aircraft movements (Noise Class E) accounted for 1% of total night movements. There were insignificant numbers in Noise Classes A and B, and no movements in Noise Classes F, G and H.

2.27 It is estimated that 99% of aircraft in the 2017 summer night period were compliant with the ICAO Chapter 4 noise standard.

Daytime traffic distributions by ANCON aircraft type

2.28 A breakdown of the year 2017 average summer day movements by ANCON type is provided in **Table C3**. The largest increase in movements was for the ANCON type EA319C (Noise Class C), which was up by 16 movements per day (note: descriptions of all the ANCON types can be found in **Table D1** of Appendix D). The second highest increase was for the B789, which was up by 5 per day. These rises were offset by decreases for the B738, which was down by 12 daily movements, and the B788 and EA321C (both down by 3).

2.29 The Airbus A319/A320/A321 aircraft family accounted for 69% of total daytime movements in 2017.

2.30 **Figure B6** illustrates the numbers of movements by ANCON aircraft type for the 2017 average summer day. The EA319C and EA320C were the most frequent ANCON types at Gatwick with 196 and 177 daily movements respectively, the majority of which were operated by Easyjet. The next most frequent type was the B738 with 117 movements.

2.31 The noise dominant ANCON types (for both departures and arrivals) at Gatwick over the 2017 daytime period were the EA320C, EA319C 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 distributions by ANCON aircraft type

2.32 A breakdown of the year 2017 average summer night movements by ANCON type is provided in **Table C4**. The largest movement increases were for the EA320C (up by 2 per night) and the B753 (up by 1). The largest decreases were for the EA321C down by 2 per night and the EA321V down by 1.

2.33 **Figure B7** illustrates the numbers of movements by ANCON aircraft type for the 2017 average summer night. Movements were dominated by three aircraft types: the EA320C with 39 movements per night, the EA319C with 27 movements and the B738 with 18 movements.

2.34 The noise dominant ANCON types (for both departures and arrivals) at Gatwick over the 2017 night-time period were the EA320C, EA319C and B738. They were responsible for the highest contributions of 'noise energy', which is a function of both aircraft noise level and movement numbers.

Daytime traffic distributions by NPR/SID route

2.35 **Figure B8** shows the percentage distribution of aircraft departures by NPR/SID route for the 2017 average summer day period, with distribution figures from 2016 for comparison. The 'wraparound' route LAM/BIG/CLN/DVR from Runway 26L had the highest loading of departure traffic in 2017 (30%). This was followed by the Runway 26L KEN/SAM and HAR/BOG routes, each with 26% of total departure movements. The largest loading change on the Runway 26L routes was for LAM/BIG/CLN/DVR, which fell from 32% to 30%. There were increases of up to 2% in the traffic loadings on the Runway 08R routes. The changes in percentage loading on the routes were largely due to the lower percentage of westerly operations in 2017.

Night-time traffic distributions by NPR/SID route

2.36 **Figure B9** shows the percentage distribution of aircraft departures by NPR/SID route for the 2017 average summer night period, with distribution figures from 2016 for comparison. Like the daytime distributions, the 'wraparound' route LAM/BIG/CLN/DVR from Runway 26L had the highest loading of departure traffic (35%), followed by the Runway 26L HAR/BOG route with 23%. The largest percentage decrease of 3% was found on the Runway 26L LAM/BIG/CLN/DVR route. All the easterly routes experienced percentage loading increases of 1%. The changes in percentage loading on the routes were largely due to the lower percentage of westerly operations in 2017.

Runway modal splits

2.37 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 (i.e. Runway 26L) and easterly (i.e. Runway 08R) operations is referred to as the runway modal split.

2.38 Two sets of contours have been produced for the year 2017 summer day:

(a) Using the 'actual' modal split over the Leq day period; and

(b) 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 2017, this is the 20-year period from 1998 to 2017. Use of the standard modal split enables year-on-year comparisons without the runway usage significantly affecting the contour shape.

2.39 The actual and standard daytime west / east (W / E) percentage modal splits for 2017 and 2016 are summarised in **Table 1**.

Table 1 Gatwick summer day runway modal splits

Year	Actual (W / E percentage)	Standard (W / E percentage)
2017	82 / 18	76 / 24
2016	85 / 15	75 / 25

2.40 The daytime actual modal split in 2017 (82% west / 18% east) had a 3% lower proportion of westerly operations compared to 2016. The 2017 standard modal split of 76% west / 24% east had a 1% higher percentage of westerly operations compared to 2016. Historical runway modal splits at Gatwick for the past 20 years are summarised in **Figure B10**.

2.41 The night-time actual runway modal split for the 2017 summer period was 81% west / 19% east. The percentage of westerly operations was 3% lower compared to 2016. The night-time modal splits for the past 5 years (2013-2017) are summarised in **Table 2**. The summer night 10-year (2008-2017) average modal split was 77% west / 23% east.

Table 2 Gatwick summer night runway modal splits (2013-2017)

Year	Actual (W / E percentage)
2017	81 / 19
2016	84 / 16
2015	74 / 26
2014	60 / 40
2013	73 / 27

Topography

2.42 The topography around Gatwick Airport was modelled by accounting for terrain height. This was achieved by geometrical corrections for source-receiver distance and elevation angles. Other, more complex effects, such as lateral attenuation from uneven ground surfaces and noise screening/reflection effects due to topographical features, were not taken into account.

2.43 ERCD holds OS terrain height data on a 50-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 shown in **Figure B11**.

Population and 'Points of Interest' databases

2.44 Estimates were made of the numbers of people and households enclosed within the noise contours. The population data used in this report for the summer contours are a 2017 update of the 2011 Census supplied by CACI Limited.

2.45 The CACI population database contains data referenced at postcode level. Population and household numbers for each postcode are assigned to a single coordinate located at the postcode's centroid. The postcode data points and associated population counts for the area around Gatwick Airport are illustrated in **Figure B12**.

2.46 Within the extent of the 2017 day actual 54 dBA Leq contour, the population count using the 2017 population database was 1% higher than the 2016 database.

2.47 Estimates have also been made of the numbers of noise sensitive buildings situated within the contours, using the PointX 'Points of Interest' (2017) database. For this study, the noise sensitive buildings that have been considered are community buildings, hospitals, schools (including nurseries) and places of worship.

Chapter 3

Results

2017 summer day actual Leq contours

3.1 The Gatwick 2017 summer day Leq noise contours generated with the actual 2017 summer day period runway modal split (82% west / 18% east) are shown in **Figure B13**. The contours are plotted from 54 to 72 dBA at 3 dB intervals.

3.2 Cumulative estimates of the areas, populations and households within the 2017 summer day actual contours are provided in **Table 3**.

Table 3 Gatwick 2017 summer day actual Leq contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 54	83.8	11,300	4,500
> 57	42.7	4,050	1,650
> 60	24.1	1,450	550
> 63	13.3	500	150
> 66	7.1	350	100
> 69	3.7	150	< 50
> 72	2.1	150	0

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

3.3 The 2017 summer day actual 54 dBA Leq contour enclosed an area of 83.8 km^2 and a population of 11,300.

3.4 Estimates of the cumulative numbers of noise sensitive buildings within the 2017 summer day actual contours are provided in **Table 4**.

Table 4 Gatwick 2017 summer day actual Leq contours – noise sensitive building estimates

Leq (dBA)	Community buildings	Hospitals	Schools	Places of worship
> 54	2	0	16	13
> 57	0	0	5	4
> 60	0	0	3	3
> 63	0	0	2	3
> 66	0	0	1	3
> 69	0	0	0	0
> 72	0	0	0	0

2017 summer night actual Leq contours

3.5 The Gatwick 2017 summer night Leq noise contours generated with the actual 2017 summer night period runway modal split (81% west / 19% east) are shown in **Figure B14**. The contours are plotted from 48 to 66 dBA at 3 dB intervals (the 69 and 72 dBA contours have been omitted for clarity).

3.6 Cumulative estimates of the areas, populations and households within the 2017 summer night actual contours are provided in **Table 5**.

3.7 The 2017 summer night actual 48 dBA Leq contour enclosed an area of 101.0 km^2 and a population of 13,900.

3.8 Estimates of the cumulative numbers of noise sensitive buildings within the 2017 summer night actual contours are provided in **Table 6**.

Table 5 Gatwick 2017 summer night actual Leq contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 48	101.0	13,900	5,550
> 51	54.4	6,700	2,700
> 54	27.7	1,800	700
> 57	15.1	900	300
> 60	7.8	350	100
> 63	4.0	200	< 50
> 66	2.2	150	0
> 69	1.3	0	0
> 72	0.8	0	0

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

Table 6 Gatwick 2017 summer night actual Leq contours – noise sensitive building estimates

Leq (dBA)	Community buildings	Hospitals	Schools	Places of worship
> 48	2	1	20	15
> 51	1	0	12	10
> 54	0	0	3	4
> 57	0	0	2	3
> 60	0	0	2	3
> 63	0	0	0	1
> 66	0	0	0	0
> 69	0	0	0	0
> 72	0	0	0	0

2017 summer day standard Leq contours

3.9 The Gatwick 2017 summer day Leq noise contours generated with the standard 2017 summer day period runway modal split (76% west / 24% east) are shown in **Figure B15**. The contours are plotted from 54 to 72 dBA at 3 dB intervals.

3.10 Cumulative estimates of the areas, populations and households within the 2017 summer day standard contours are provided in **Table 7**.

Table 7 Gatwick 2017 summer day standard Leq contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 54	82.7	10,950	4,350
> 57	42.6	3,400	1,350
> 60	24.1	1,500	550
> 63	13.4	550	150
> 66	7.1	350	100
> 69	3.7	150	< 50
> 72	2.1	150	0

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

3.11 The 2017 summer day standard 54 dBA Leq contour enclosed an area of 82.7 km^2 and a population of 10,950.

3.12 Estimates of the cumulative numbers of noise sensitive buildings within the 2017 summer day standard contours are provided in **Table 8**.

Table 8 Gatwick 2017 summer day standard Leq contours – noise sensitive building estimates

Leq (dBA)	Community buildings	Hospitals	Schools	Places of worship
> 54	2	0	16	13
> 57	0	0	5	4
> 60	0	0	3	3
> 63	0	0	2	3
> 66	0	0	1	3
> 69	0	0	0	0
> 72	0	0	0	0

2017 summer night 10-year average modal split Leq contours

3.13 The Gatwick 2017 summer night Leq noise contours generated with the 10-year average (2008-2017) summer night period runway modal split (77% west / 23% east) are shown in **Figure B16**. The contours are plotted from 48 to 66 dBA at 3 dB intervals (the 69 and 72 dBA contours have been omitted for clarity).

3.14 Cumulative estimates of the areas, populations and households within the 2017 summer night 10-year average modal split contours are provided in **Table 9**.

3.15 The 2017 night 10-year average modal split 48 dBA Leq contour enclosed an area of 101.3 km^2 (2016: 107.7 km^2) and a population of 13,550 (2016: 14,250).

3.16 Estimates of the cumulative numbers of noise sensitive buildings within the 2017 summer night 10-year average modal split contours are provided in **Table 10**.

Table 9 Gatwick 2017 summer night 10-year average modal split Leq contours – area, population and household estimates

Leq (dBA)	Area (km^2)	Population	Households
> 48	101.3	13,550	5,350
> 51	53.3	6,650	2,650
> 54	27.5	1,800	700
> 57	15.1	750	250
> 60	7.8	350	100
> 63	4.1	200	< 50
> 66	2.2	150	0
> 69	1.3	0	0
> 72	0.8	0	0

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

Table 10 Gatwick 2017 summer night 10-year average modal split Leq contours – noise sensitive building estimates

Leq (dBA)	Community buildings	Hospitals	Schools	Places of worship
> 48	1	1	19	13
> 51	1	0	12	10
> 54	0	0	4	4
> 57	0	0	2	3
> 60	0	0	2	3
> 63	0	0	0	1
> 66	0	0	0	0
> 69	0	0	0	0
> 72	0	0	0	0

2017 summer day actual Leq contours – comparison with 2016

3.17 The Gatwick 2017 summer day actual modal split Leq contours are compared against the 2016 summer day actual Leq contours in **Figure B17**, for contour levels from 54 to 72 dBA.

3.18 **Table 11** summarises the areas, populations and percentage changes from 2016 to 2017.

Table 11 Gatwick 2016 and 2017 summer day actual Leq contours – area and population estimates

Leq (dBA)	2016 area (km^2)	2017 area (km^2)	Area change	2016 population	2017 population	Population change
> 54	88.1	83.8	-5%	11,600	11,300	-3%
> 57	44.2	42.7	-3%	4,150	4,050	-2%
> 60	25.1	24.1	-4%	1,550	1,450	-6%
> 63	13.7	13.3	-3%	550	500	-9%
> 66	7.2	7.1	-1%	350	350	0%
> 69	3.8	3.7	-3%	150	150	0%
> 72	2.1	2.1	0%	0	150	(n/a)

Note: The 2016 and 2017 day actual runway modal splits were 85% west / 15% east and 82% west / 18% east respectively.

3.19 The 54 dBA contour area decreased by 5% in 2017 and area reductions were also found at the higher contour levels. This was caused by noise reductions for the EA319C, EA319V and EA320V ANCON aircraft types on arrival and the EA320C type on departure, as identified by noise measurements undertaken in 2017 (see section 2.14).

3.20 The population count for the 54 dBA contour fell by 3% in 2017, in line with the area reduction. The population counts also decreased at the 57, 60 and 63 dBA contour levels.

3.21 Percentage changes in contour area are not necessarily accompanied by similar changes in enclosed population because of the uneven distribution of populations around the airport.

2017 summer night actual Leq contours – comparison with 2016

3.22 The Gatwick 2017 summer night actual modal split Leq contours are compared against the 2016 summer night actual Leq contours in **Figure B18** (the 69 and 72 dBA contours have been omitted from the diagram for clarity).

3.23 **Table 12** summarises the areas, populations and percentage changes from 2016 to 2017.

Table 12 Gatwick 2016 and 2017 summer night actual Leq contours – area and population estimates

Leq (dBA)	2016 area (km^2)	2017 area (km^2)	Area change	2016 population	2017 population	Population change
> 48	107.1	101.0	-6%	14,600	13,900	-5%
> 51	58.8	54.4	-7%	7,150	6,700	-6%
> 54	28.6	27.7	-3%	1,850	1,800	-3%
> 57	15.9	15.1	-5%	950	900	-5%
> 60	8.0	7.8	-3%	350	350	0%
> 63	4.1	4.0	-2%	200	200	0%
> 66	2.2	2.2	0%	150	150	0%
> 69	1.3	1.3	0%	0	0	(-)
> 72	0.8	0.8	0%	0	0	(-)

Note: The 2016 and 2017 night actual runway modal splits were 84% west / 16% east and 81% west / 19% east respectively.

3.24 The 48 dBA contour area decreased by 6% in 2017 despite the 1% rise in night traffic in 2017. Decreases in area were also seen at the higher contour levels. This was caused by noise reductions for the EA319C, EA319V and EA320V ANCON aircraft types on arrival and the EA320C type on departure, as identified by noise measurements undertaken in 2017 (see section 2.14).

3.25 The population count within the 48 dBA contour decreased by 5% in line with the area reduction. Decreases in population counts were also found at the 51, 54 and 57 dBA levels.

3.26 There was a 3% shift in the night-time runway modal split in 2017 in favour of easterly operations, which also helped to reduce the extent of the westerly arrival contour lobes to the east of the airport.

2017 summer day standard Leq contours – comparison with 2016

3.27 The Gatwick 2017 summer day standard modal split Leq contours are compared against the 2016 summer day standard Leq contours in **Figure B19**, for levels from 54 to 72 dBA.

3.28 **Table 13** summarises the areas, populations and percentage changes from 2016 to 2017.

3.29 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 differences between the ratios of westerly to easterly operations.

Table 13 Gatwick 2016 and 2017 summer day standard Leq contours – area and population estimates

Leq (dBA)	2016 area (km^2)	2017 area (km^2)	Area change	2016 population	2017 population	Population change
> 54	86.5	82.7	-4%	11,100	10,950	-1%
> 57	43.8	42.6	-3%	3,400	3,400	0%
> 60	25.2	24.1	-4%	1,600	1,500	-6%
> 63	13.8	13.4	-3%	550	550	0%
> 66	7.2	7.1	-1%	350	350	0%
> 69	3.7	3.7	0%	150	150	0%
> 72	2.1	2.1	0%	0	150	(n/a)

Note: The 2016 and 2017 summer day standard runway modal splits were 75% west / 25% east and 76% west / 24% east respectively.

3.30 The standard modal split 54 dBA contour area decreased by 4% in 2017 and area decreases were also seen at the higher contour levels. This was caused by noise reductions for the EA319C, EA319V and EA320V ANCON aircraft types on arrival and the EA320C type on departure, as identified by noise measurements undertaken in 2017 (see section 2.14).

3.31 There was a 1% population decrease in 2017 at the 54 dBA contour level. The 60 dBA population count reduced by 6% because the contour retracted from Newchapel.

Summer day Leq noise contour historical trend

3.32 **Figure B20** shows how the 57 dBA Leq day actual modal split contour has changed in area and population terms since 1988 by comparison with the total annual (365-day) aircraft movements. Actual modal split data are used in this figure because standard modal split contours were not produced prior to 1995.

3.33 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.

3.34 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 2% following a drop in charter flights at Gatwick. However, movement numbers increased from 2013 through to 2017 as demand returned.

3.35 From 1988 to 1993, the area within the 57 dBA Leq contour diminished and then increased until 1996. From 1996 onwards the area decreased each year but levelled off between 1999 and 2000. In 2001, the area fell 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 upon the aviation industry.

3.36 Since 2011 the contour area has fluctuated within the range 40-44 km^2. The contour area increased by 2% in 2011 to 40.4 km^2 as movements started to recover. In 2012 the area was again higher by 2%, this time mainly due to some changes in the fleet mix. The 2013 contour area reduced by 1% 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 narrow-body jets. There was a 1% area increase in 2015 as higher numbers of movements were largely offset by noise adjustments to some of the ANCON aircraft types in the light of monitoring data. In 2016 the area increased again to 44.2 km^2 as movements rose by 4%. However, in 2017 the area fell by 3% as noise levels reduced for the Airbus A319/A320 aircraft on arrival, which was

likely the result of most of these types having received the FOPP modification to reduce approach noise.

3.37 The population numbers within the contours have generally moved in line with the areas. They dropped to the lowest ever level in 2010 when the area was also at its lowest, but since 2011 have fluctuated between approximately 3,000-4,000. The 19% rise in population for 2012 was largely the result of the contour extending over a densely populated area (Lingfield). In 2013, the population dropped by 11% as the higher proportion of easterly movements caused the contour to retreat from Lingfield. The population count increased by 2% in 2014 following the inclusion of Gatwick immigration removal centre residents in the population database for the first time. An 11% rise in population occurred in 2015 as the contour extended over Lingfield, after a shift in the runway modal split back to a more typical figure. The population increased again in 2016 as an 11% higher proportion of westerly operations extended the contour over parts of Lingfield. However, in 2017 the population decreased by 2% following an area reduction.

Chapter 4

Conclusions

4.1 Year 2017 average summer 16-hour day and 8-hour night Leq noise exposure contours have been generated for Gatwick Airport using the ANCON noise model.

4.2 There was a 1% rise in summer 16-hour day movements in 2017. However, the 2017 summer day actual modal split (82% west / 18% east) 54 dBA Leq contour area decreased by 5% to 83.8 km^2 (2016: 88.1 km^2). This resulted from noise reductions to ANCON aircraft types such as the Airbus A320 on departure and the Airbus A319/A320 on arrival, as identified by 2017 noise measurements. The arrival noise reductions were most likely due to Fuel Over Pressure Protector (FOPP) modifications. The population count within the 54 dBA Leq actual contour decreased by 3% in 2017 to 11,300 (2016: 11,600).

4.3 The 2017 summer day standard modal split (76% west / 24% east) 54 dBA Leq contour area decreased by 4% to 82.7 km^2 (2016: 86.5 km^2). The population enclosed by the 2017 standard 54 dBA Leq contour (10,950) was 1% lower than the previous year (2016: 11,100).

4.4 The summer 8-hour night traffic increased by 1% in 2017. The 2017 summer night actual modal split (81% west / 19% east) 48 dBA Leq contour enclosed an area of 101.0 km^2, a decrease of 6% from 2016 (107.1 km^2). The reduction in area can be attributed mainly to reductions in noise for the Airbus A320 on departure, and lower arrival noise levels for the Airbus A319/A320 types. The population count within the 48 dBA contour for 2017 was 13,900, a 5% decrease (2016: 14,600).

4.5 The 2017 summer night 48 dBA Leq contour area assuming the 10-year average runway modal split (77% west / 23% east) was 101.3 km^2 (2016: 107.7 km^2), enclosing a population of 13,550 (2016: 14,250).

APPENDIX A

References

1. Critchley J B, Ollerhead J B, *The Use of Leq as an Aircraft Noise Index*, DORA Report 9023, September 1990.
2. Civil Aviation Authority, *Survey of Noise Attitudes (2014): Aircraft*, CAP 1506, February 2017.
3. Department for Transport, *Aviation Policy Framework*, Cm 8584, March 2013.
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5. Ollerhead J B, Rhodes D P, Viinikainen M S, Monkman D J, Woodley A C, *The UK Civil Aircraft Noise Contour Model ANCON: Improvements in Version 2*, R&D Report 9842, June 1999.
6. European Civil Aviation Conference, *Report on Standard Method of Computing Noise Contours around Civil Airports*, ECAC.CEAC Doc 29, Fourth edition, December 2016.
7. Civil Aviation Authority, *Noise Monitor Positions at Heathrow, Gatwick and Stansted Airports*, CAP 1149, Third edition, December 2016.

APPENDIX B

Figures

Figure B1 Gatwick Airport and the surrounding area

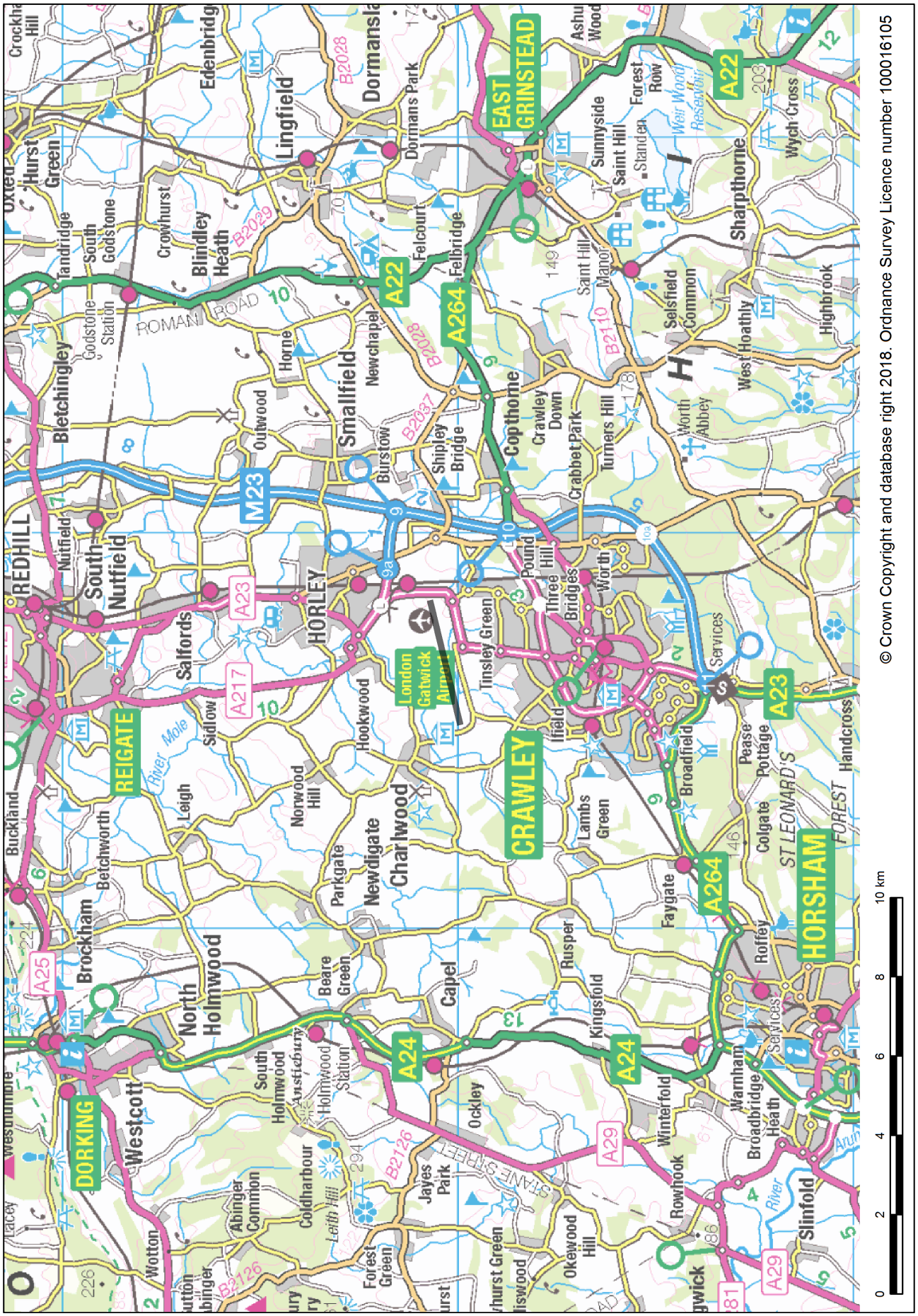


Figure B2 Gatwick Airport layout in 2017

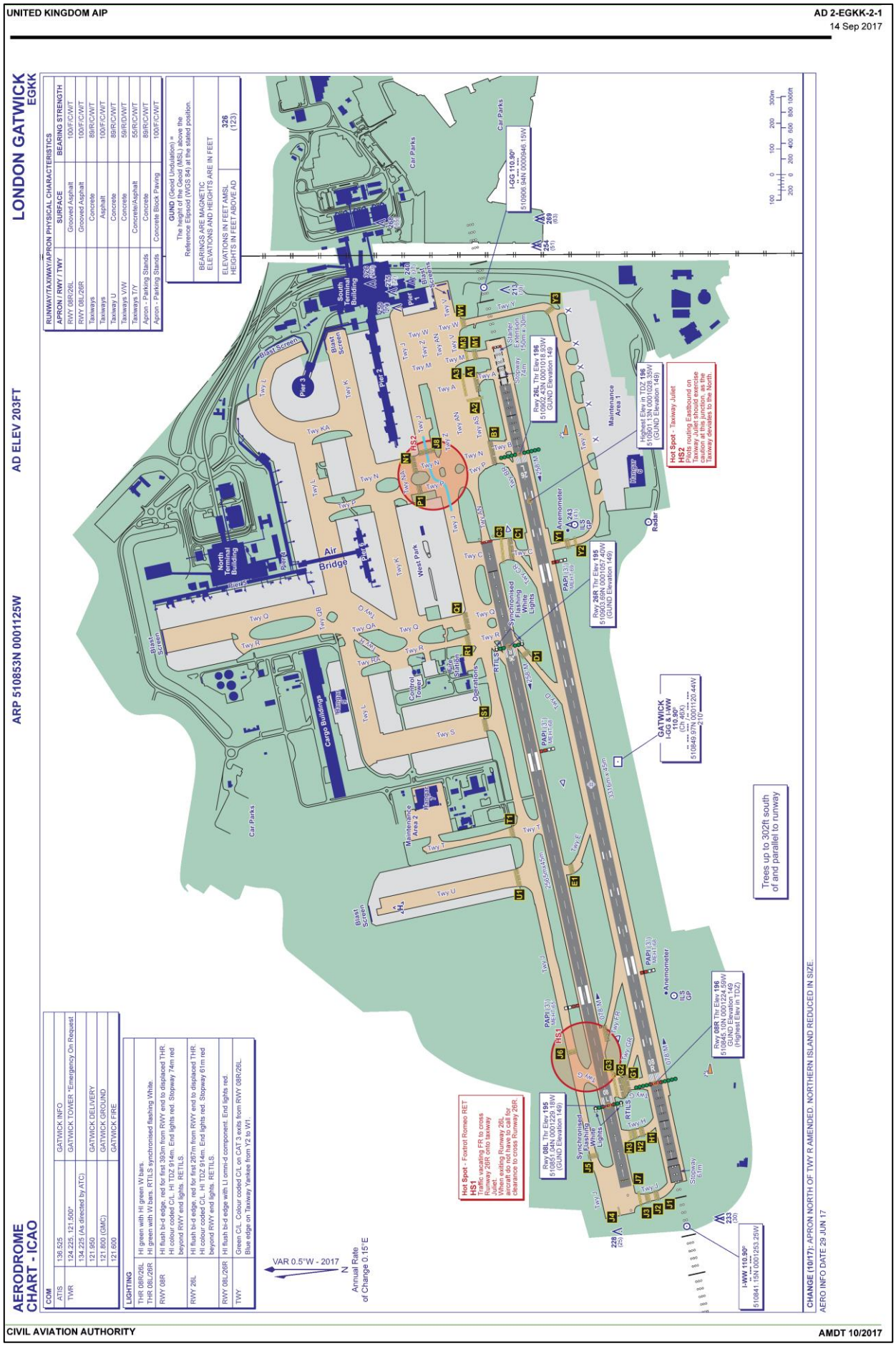


Figure B3 Gatwick NPR/SID routes

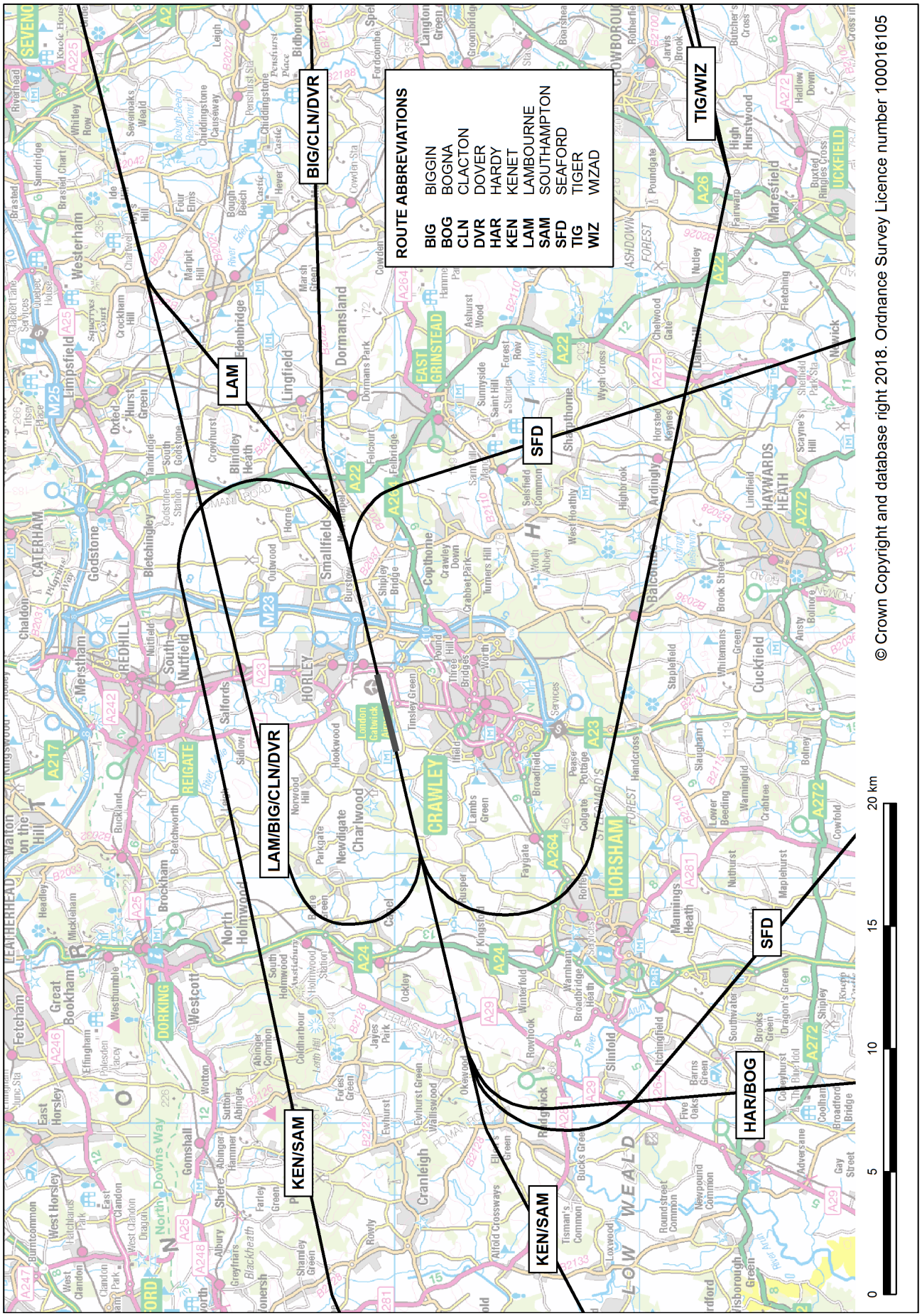


Figure B4 Typical arrival and departure radar tracks at Gatwick

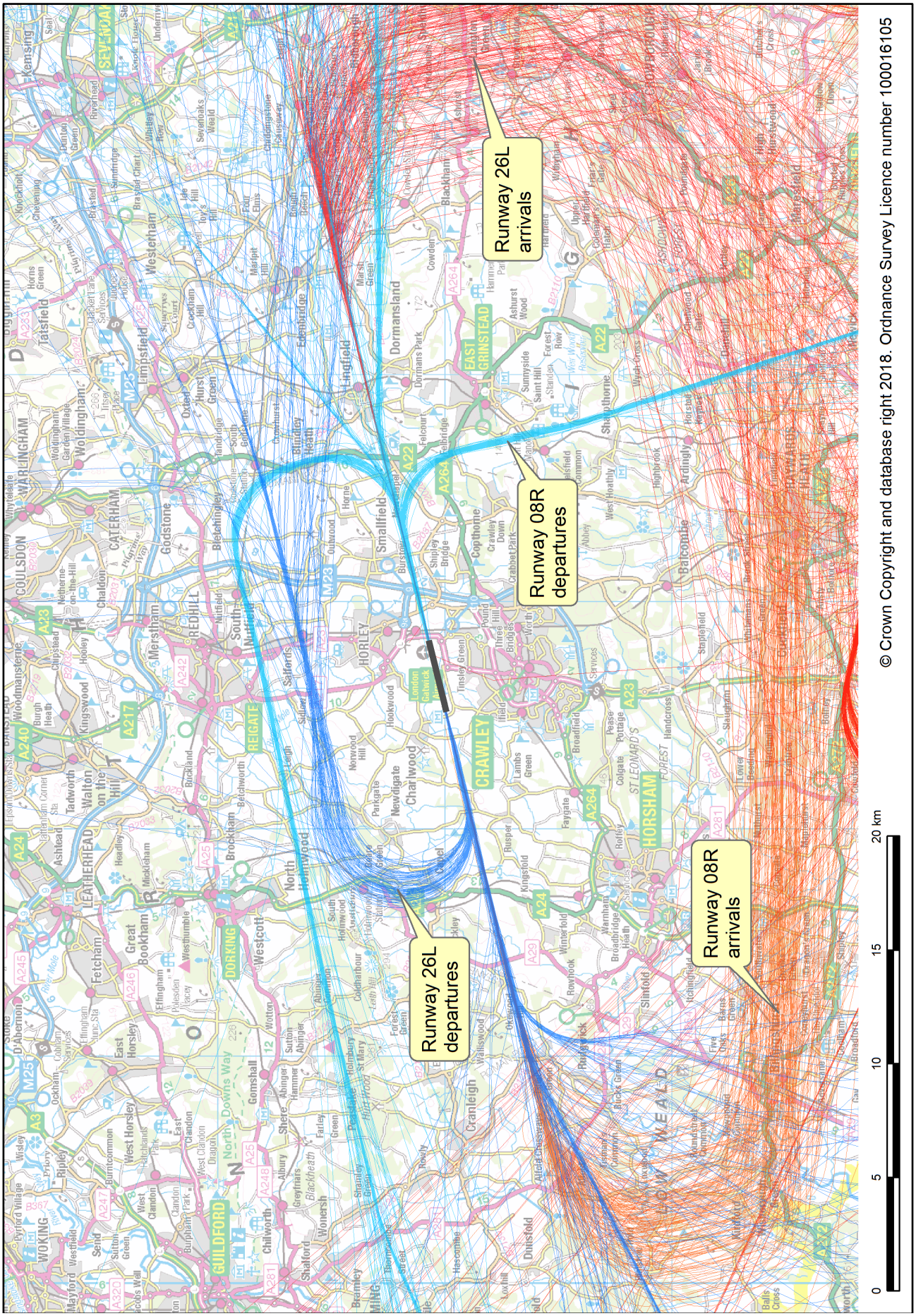
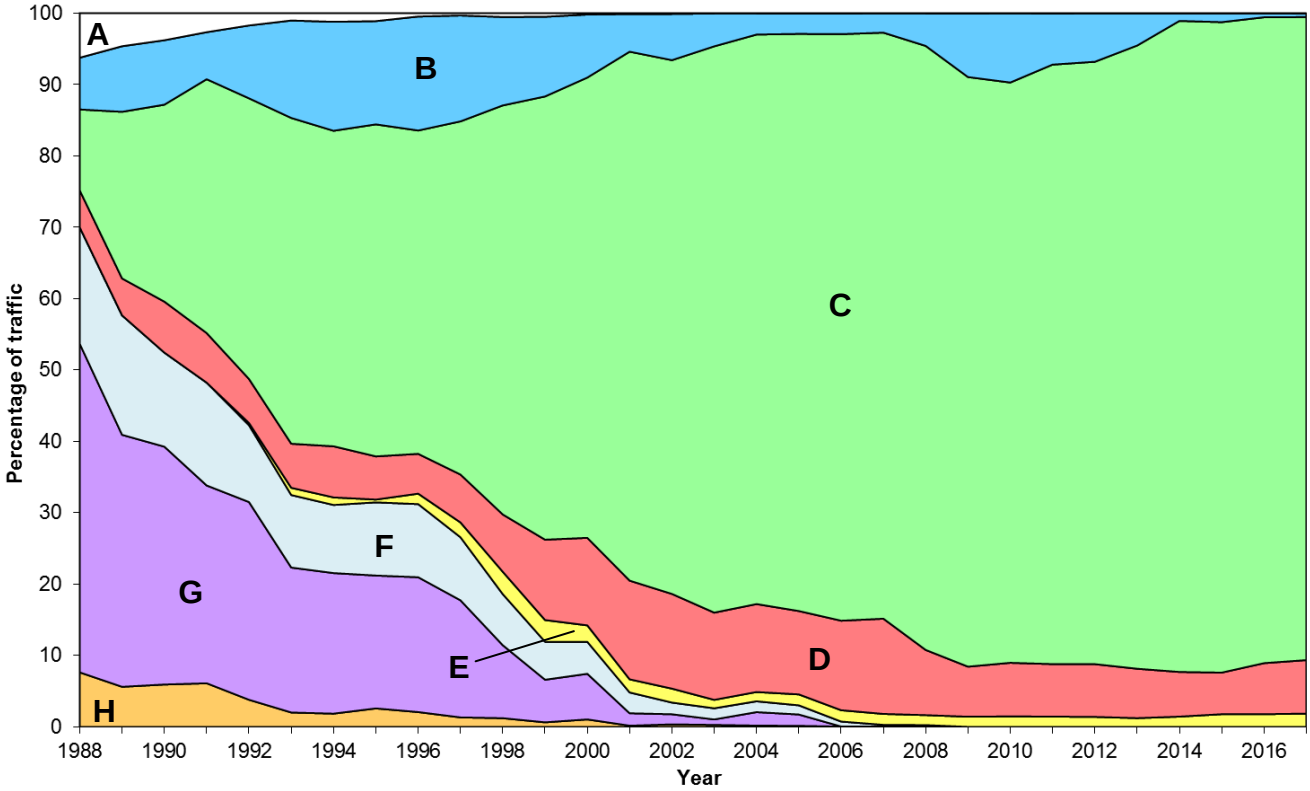


Figure B5 Gatwick Noise Class trend 1988-2017



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

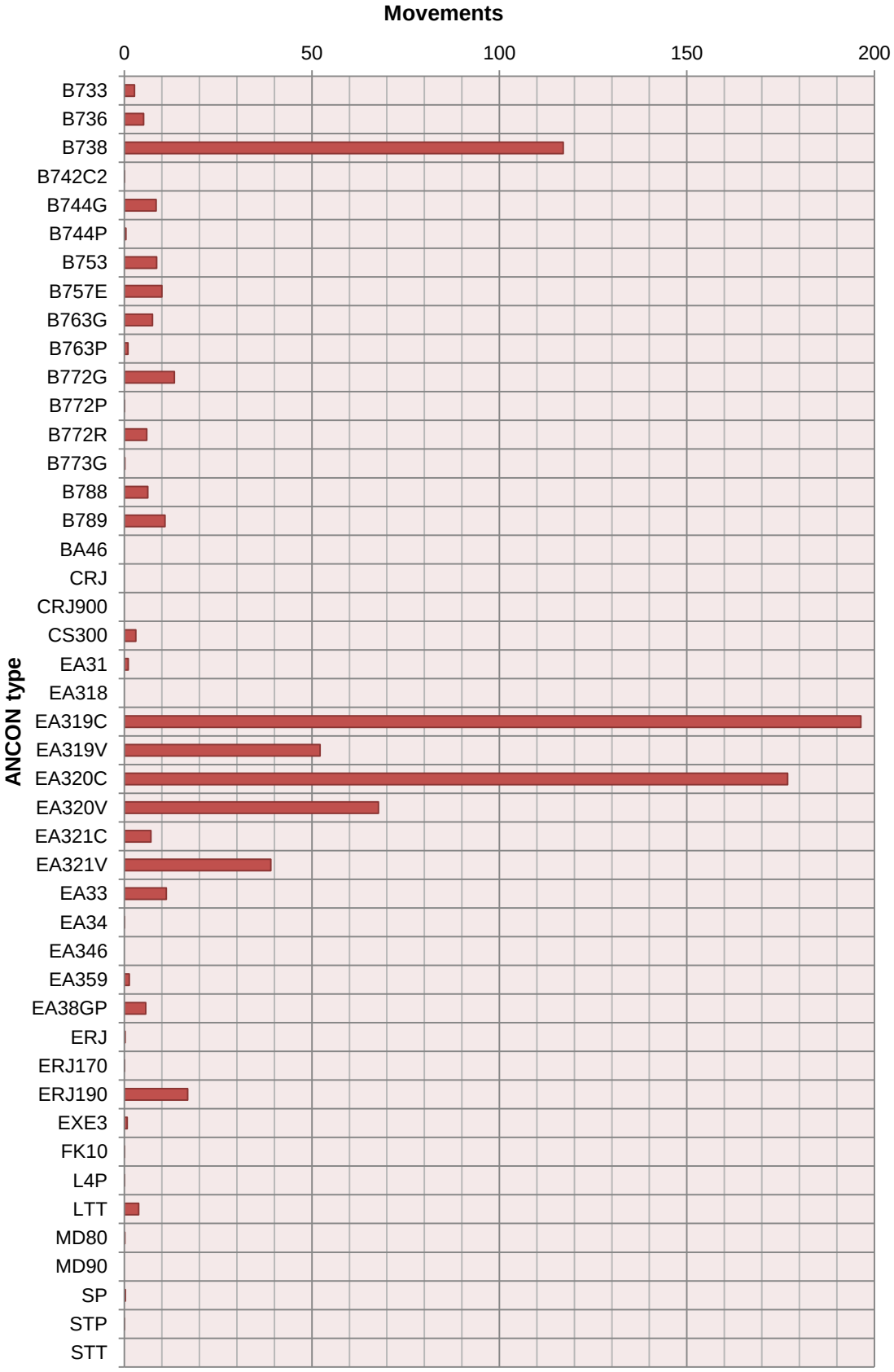
Chapter 3/4 jets
C Narrow-body aircraft, e.g. Airbus A319, Boeing 737-800
D Wide-body twins, e.g. Airbus A330, Boeing 777-200
E Wide-body 3 or 4-engine aircraft, e.g. Airbus A380, Boeing 747-400

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

2nd generation twin jets
G Narrow-body twins (including Ch.2 and hush-kitted versions), e.g. Boeing 737-200

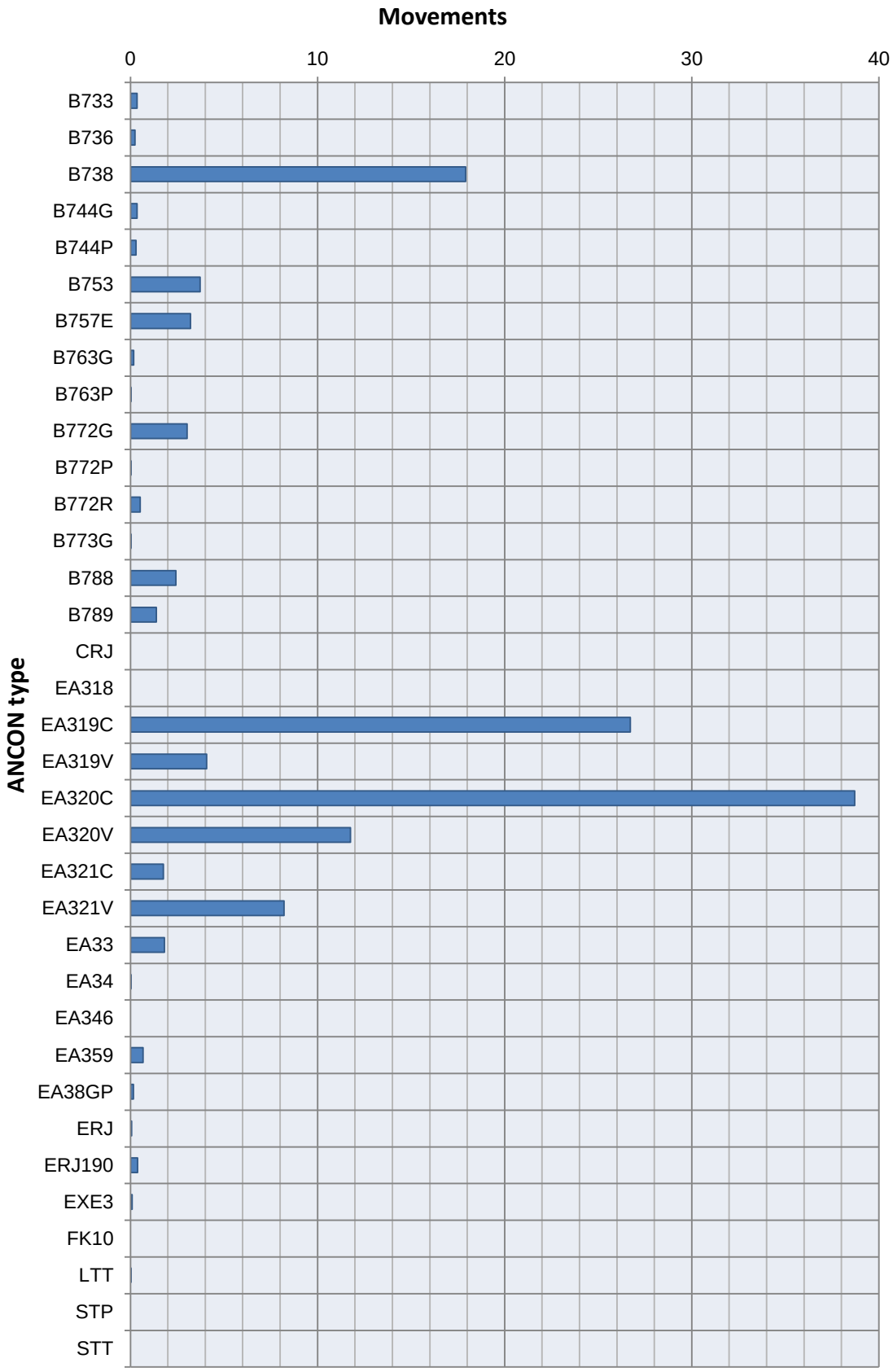
1st generation jets
H Narrow-body 3 or 4-engine aircraft (including hush-kitted versions), e.g. Boeing 707

Figure B6 Gatwick 2017 summer day movements by ANCON aircraft type



Note: ANCON types are shown in the same order as **Table C3**.

Figure B7 Gatwick 2017 summer night movements by ANCON aircraft type



Note: ANCON types are shown in the same order as **Table C4**.

Figure B8 Gatwick 2017 summer day departure traffic distributions by NPR/SID

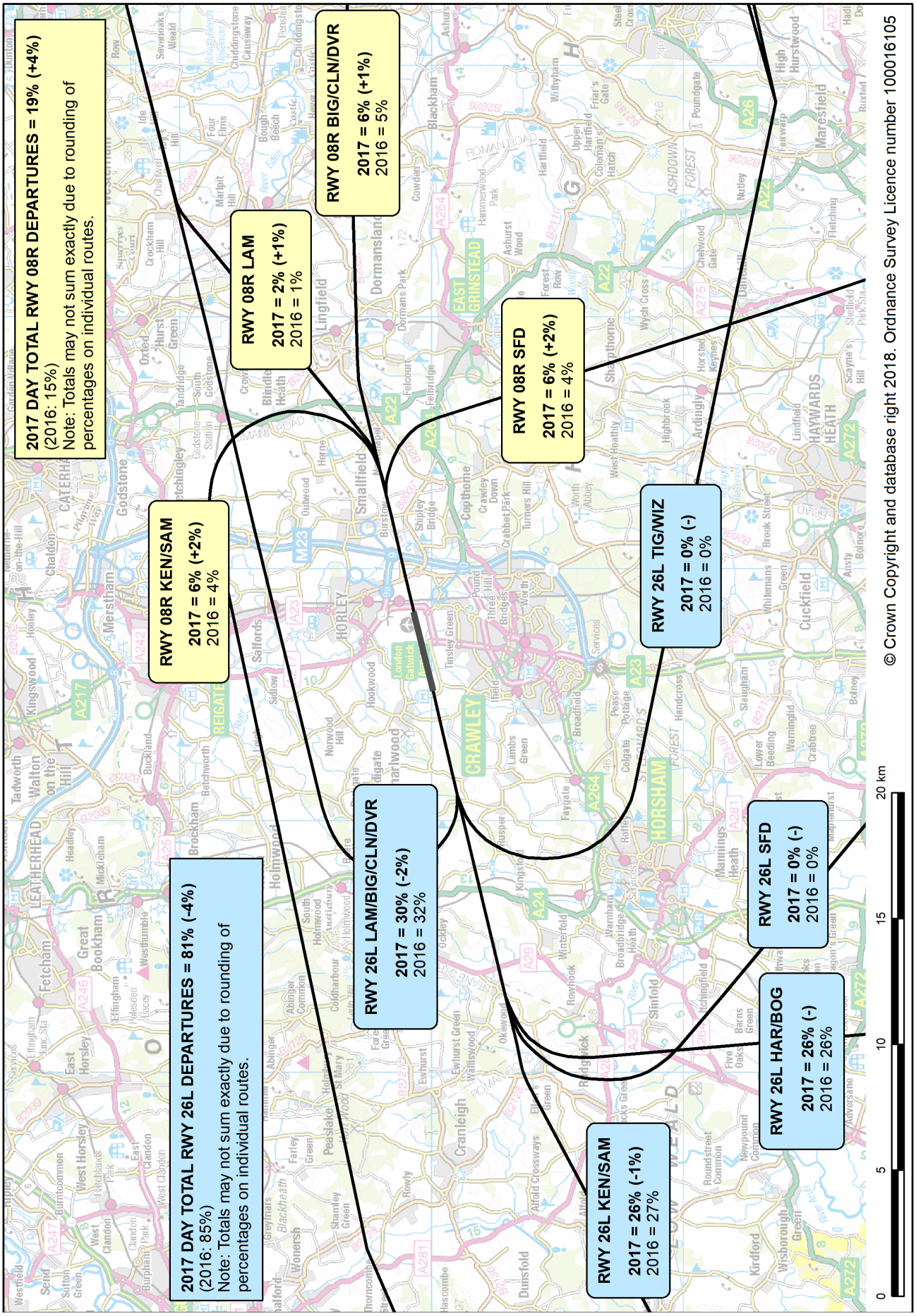


Figure B9 Gatwick 2017 summer night departure traffic distributions by NPR/SID

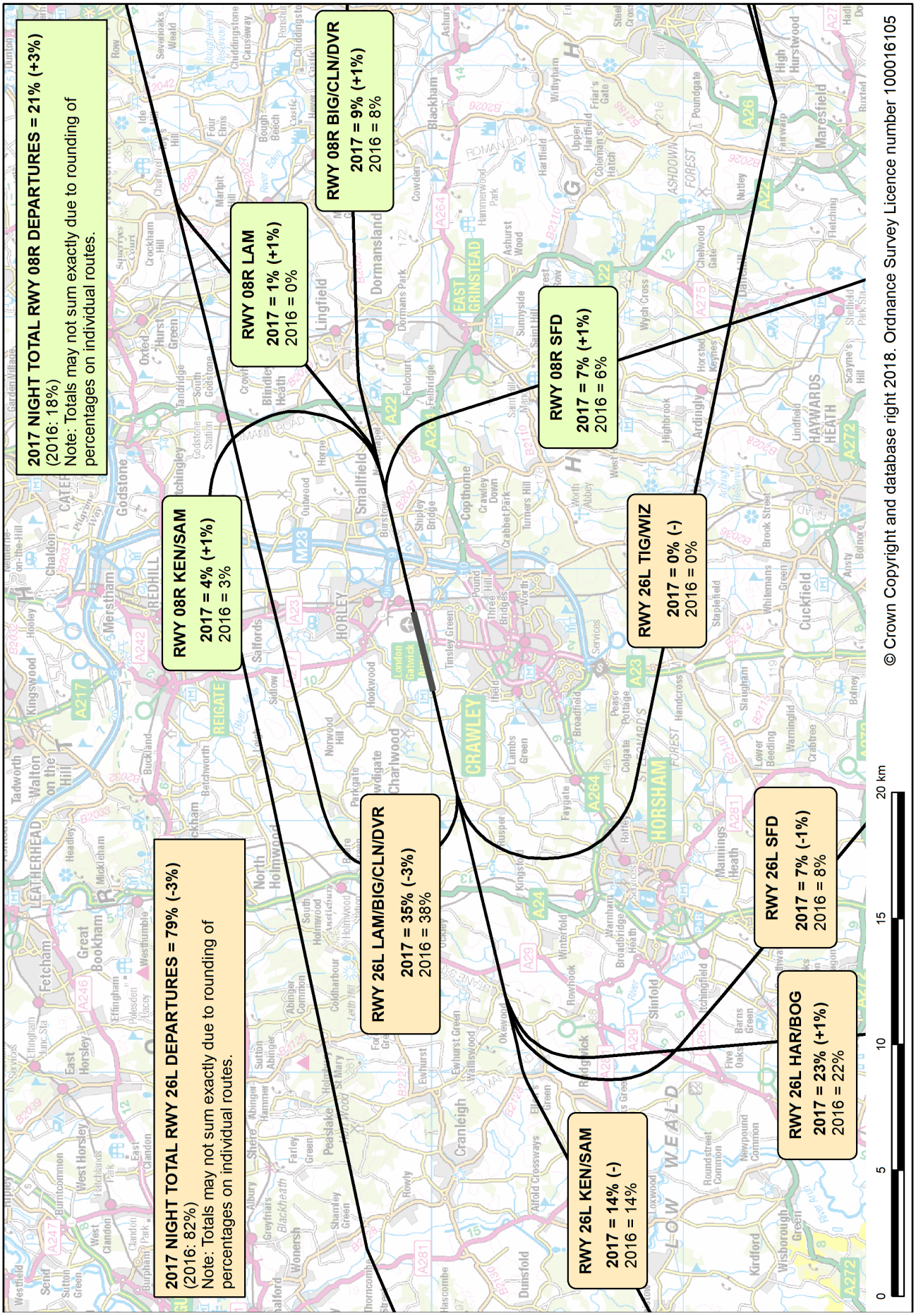


Figure B10 Gatwick summer day modal splits 1998-2017

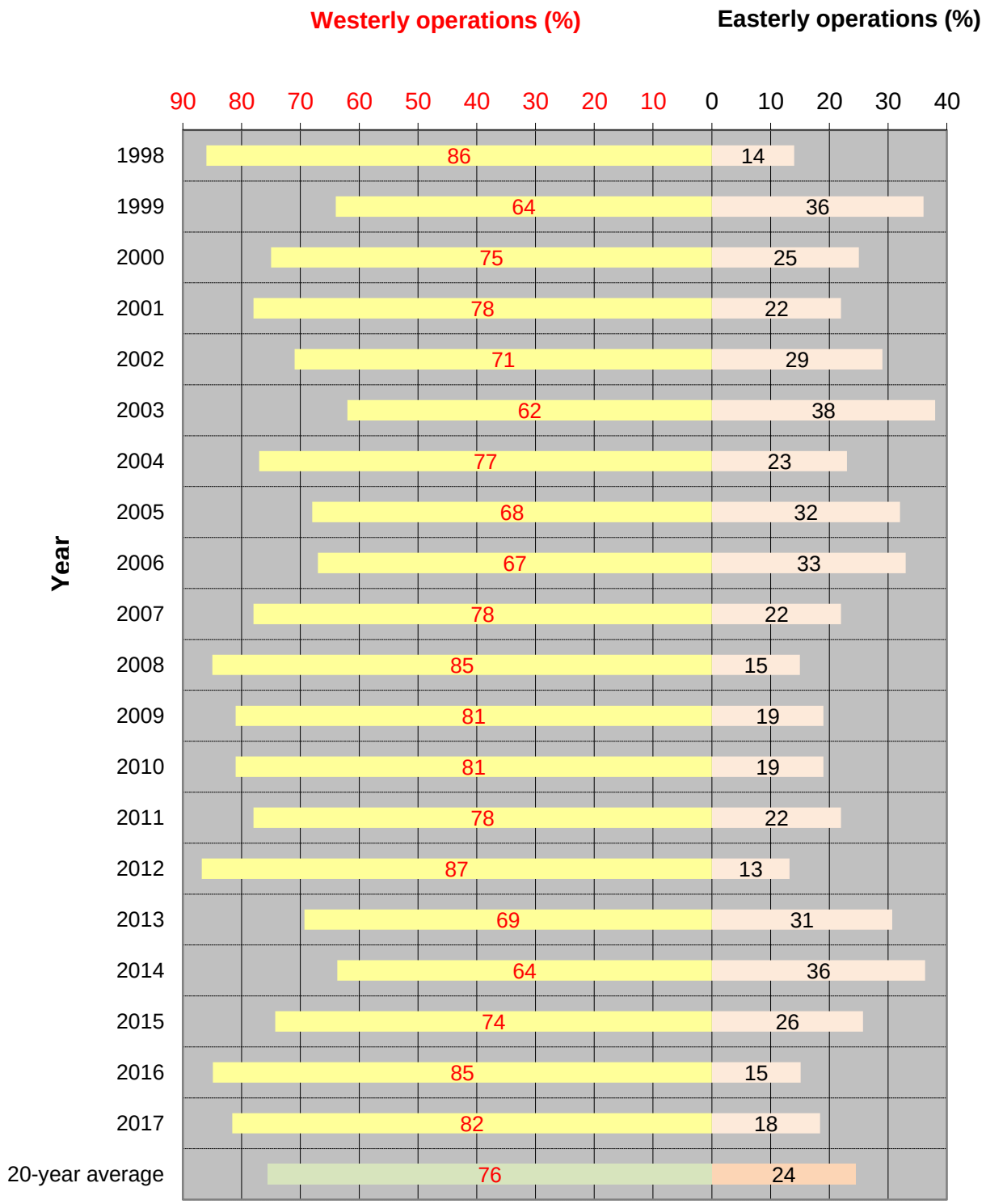


Figure B11 Terrain heights around Gatwick Airport

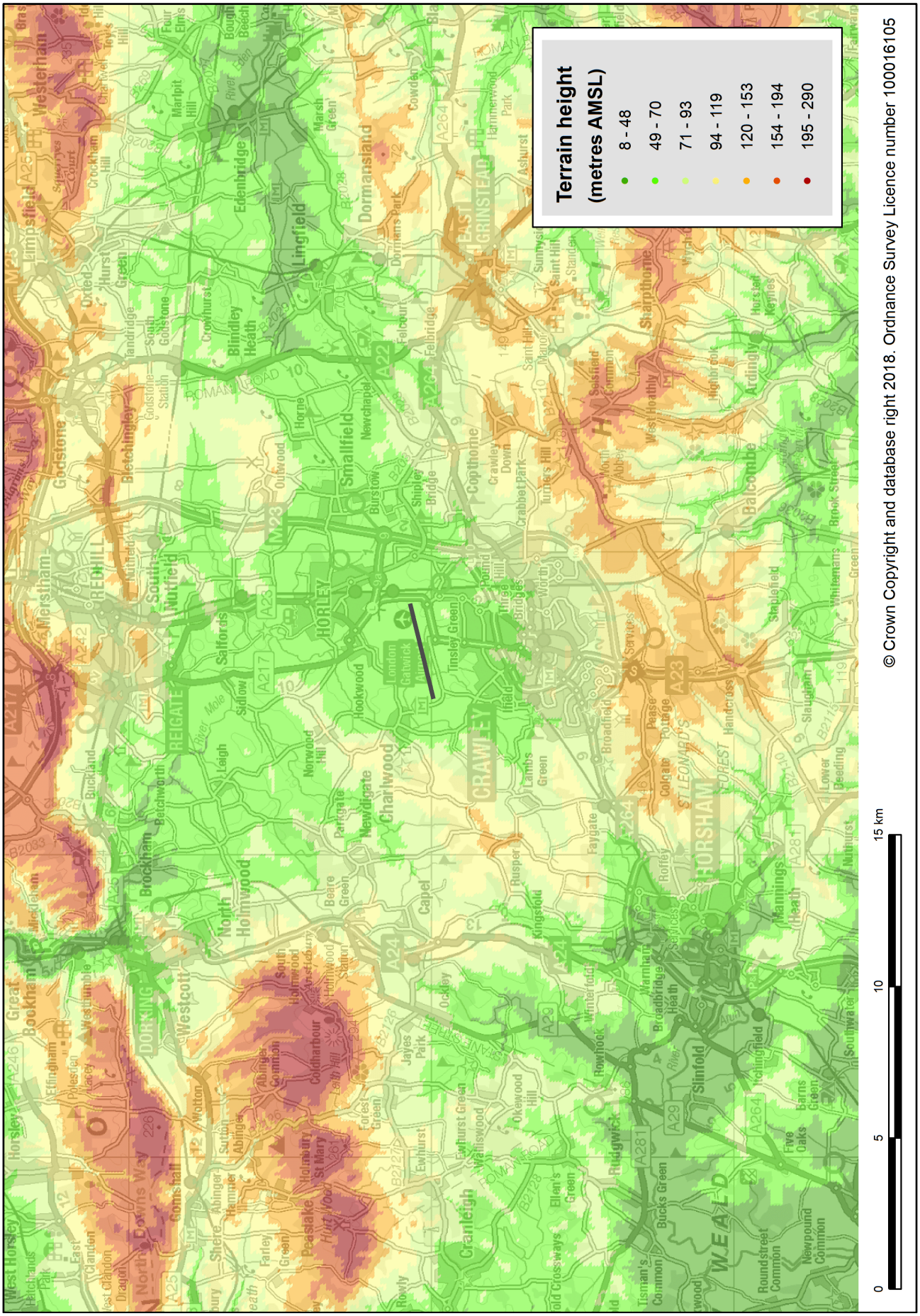


Figure B12 Population data points around Gatwick Airport

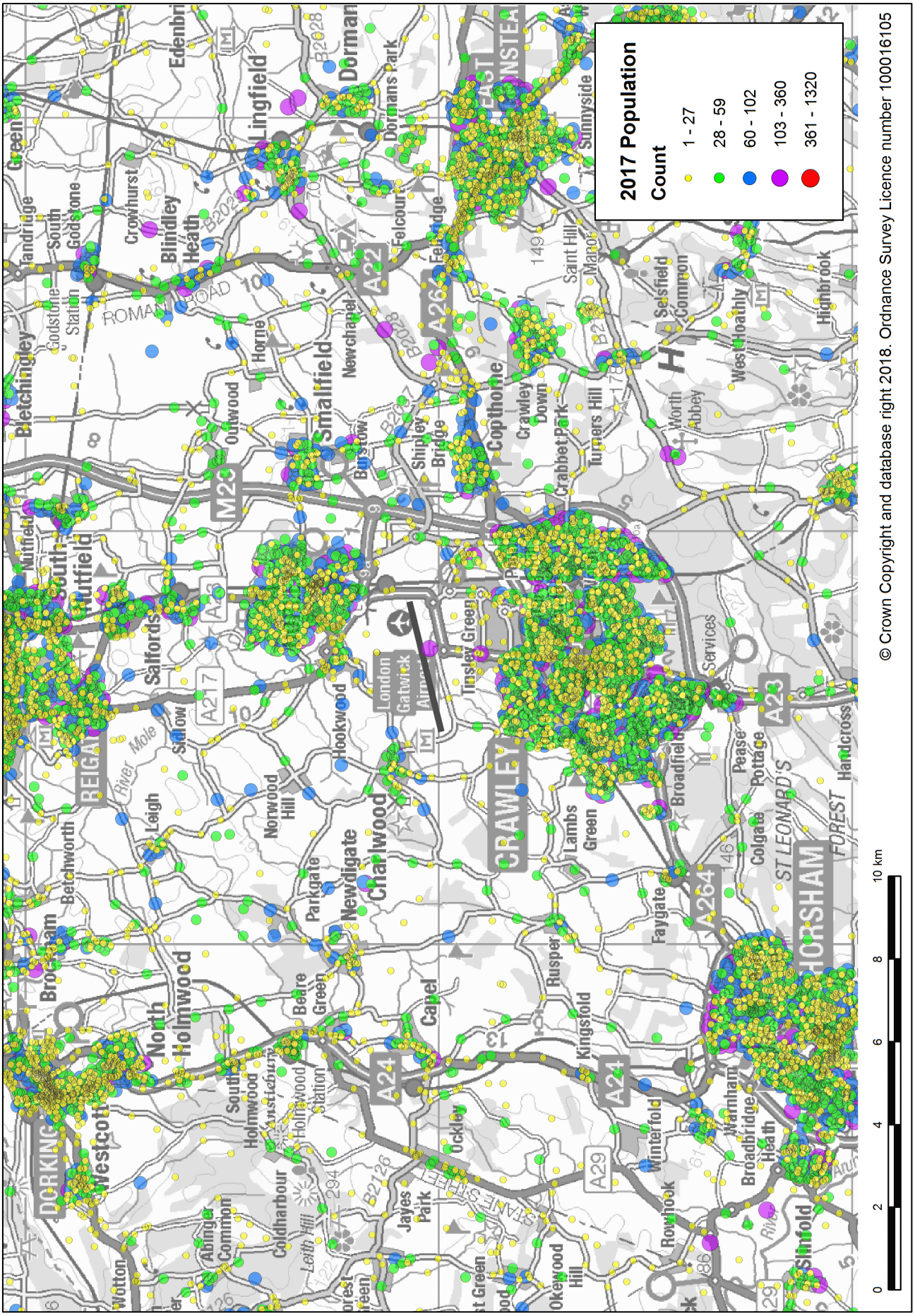


Figure B13 Gatwick 2017 summer day actual modal split (82% west / 18% east) Leq contours

Figure B14 Gatwick 2017 summer night actual modal split (81% west / 19% east) Leq contours

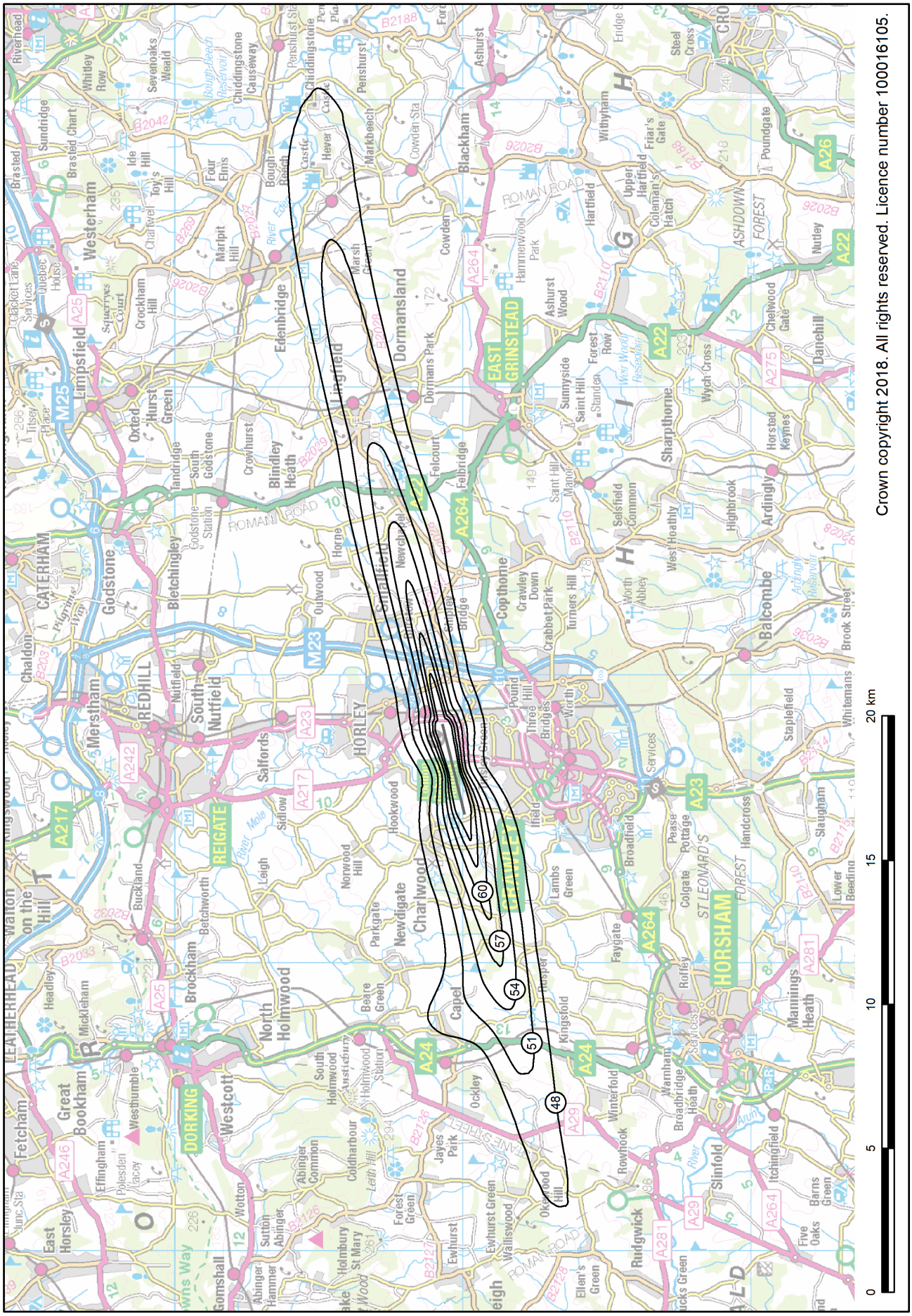


Figure B15 Gatwick 2017 summer day standard modal split (76% west / 24% east) Leq contours

Figure B16 Gatwick 2017 summer night 10-year average modal split (77% west / 23% east) Leq contours

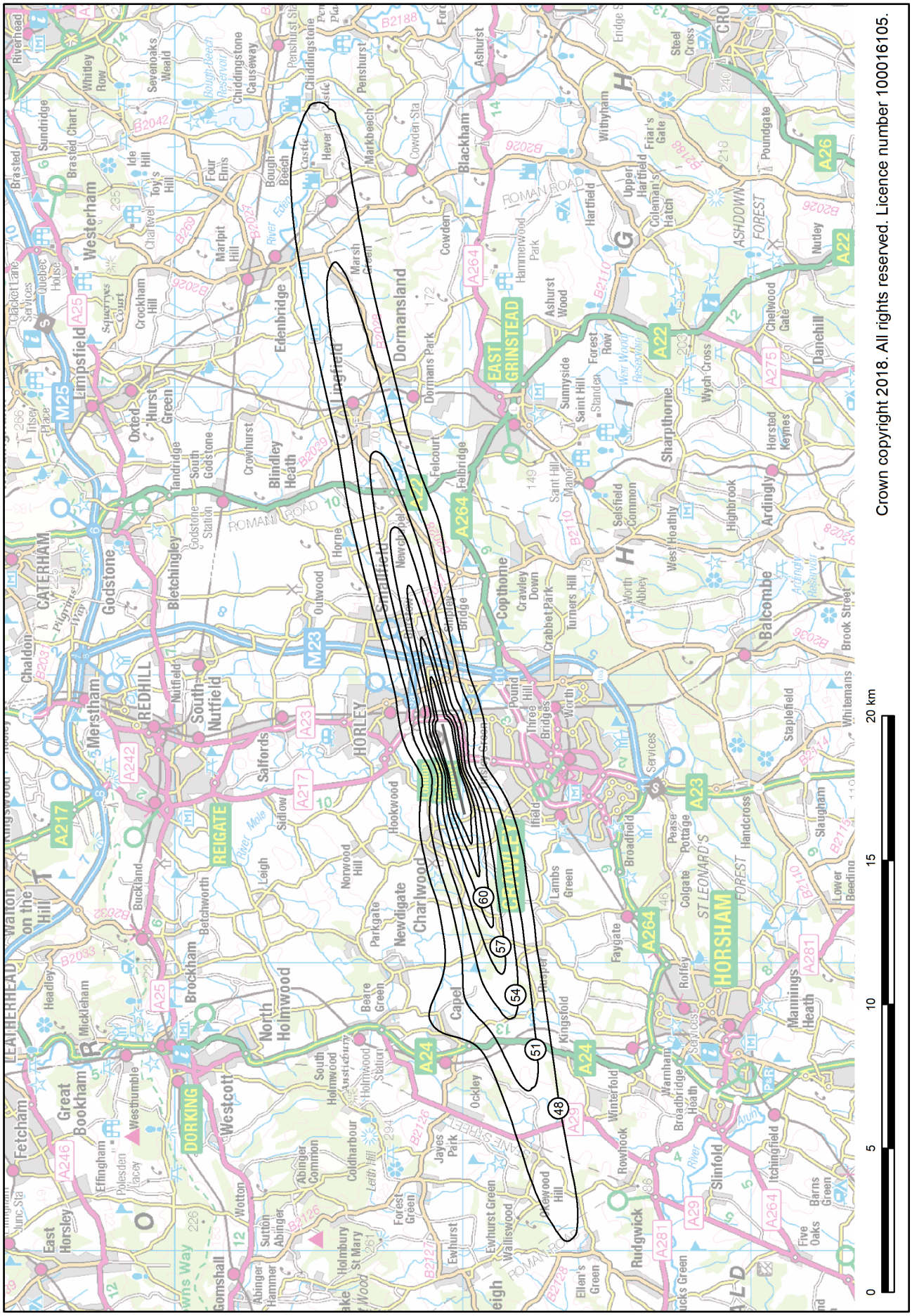


Figure B17 Gatwick summer day actual 2017 (82% W / 18% E) and 2016 (85% W / 15% E) Leq contours

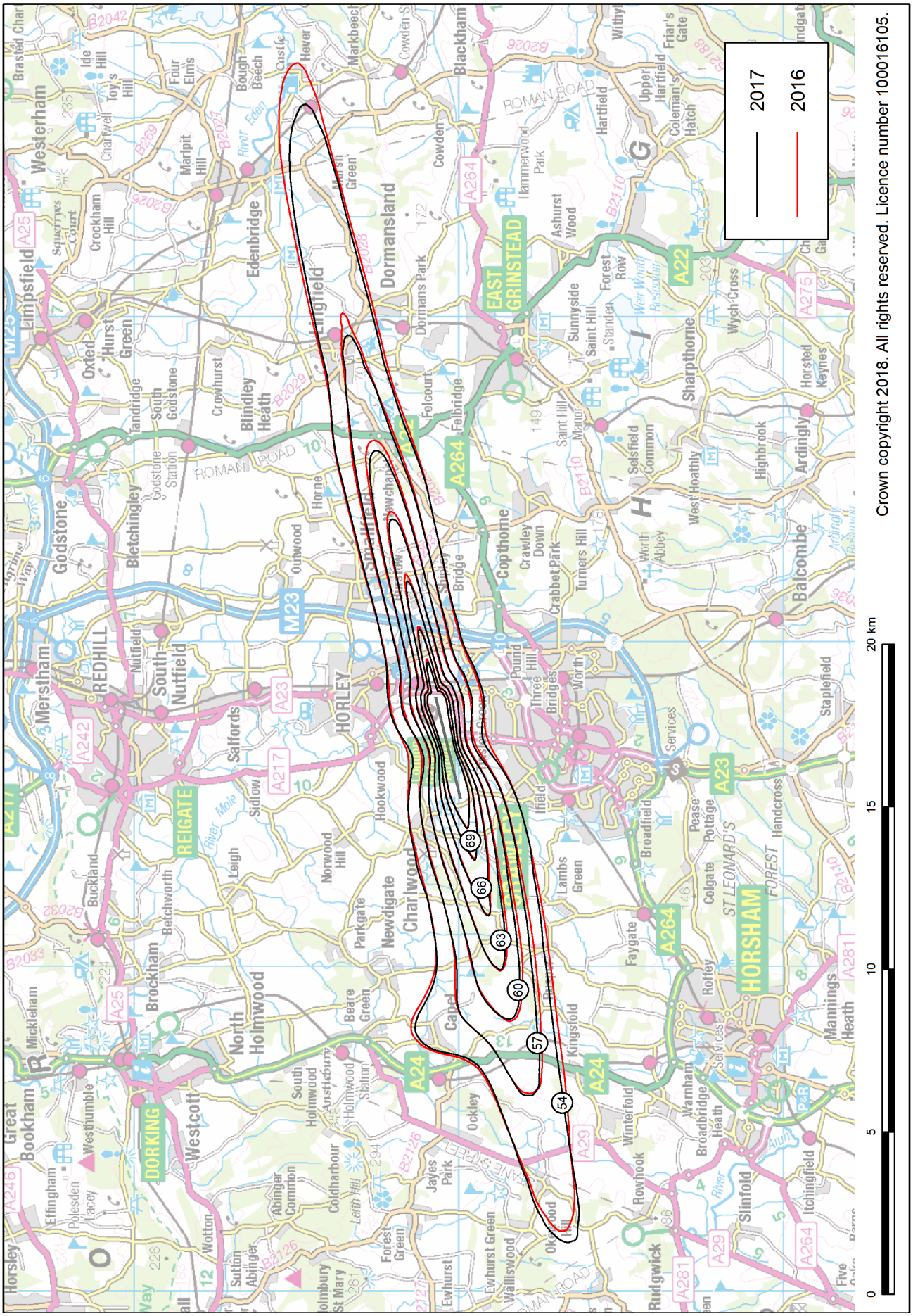


Figure B18 Gatwick summer night actual 2017 (81% W / 19% E) and 2016 (84% W / 16% E) Leq contours

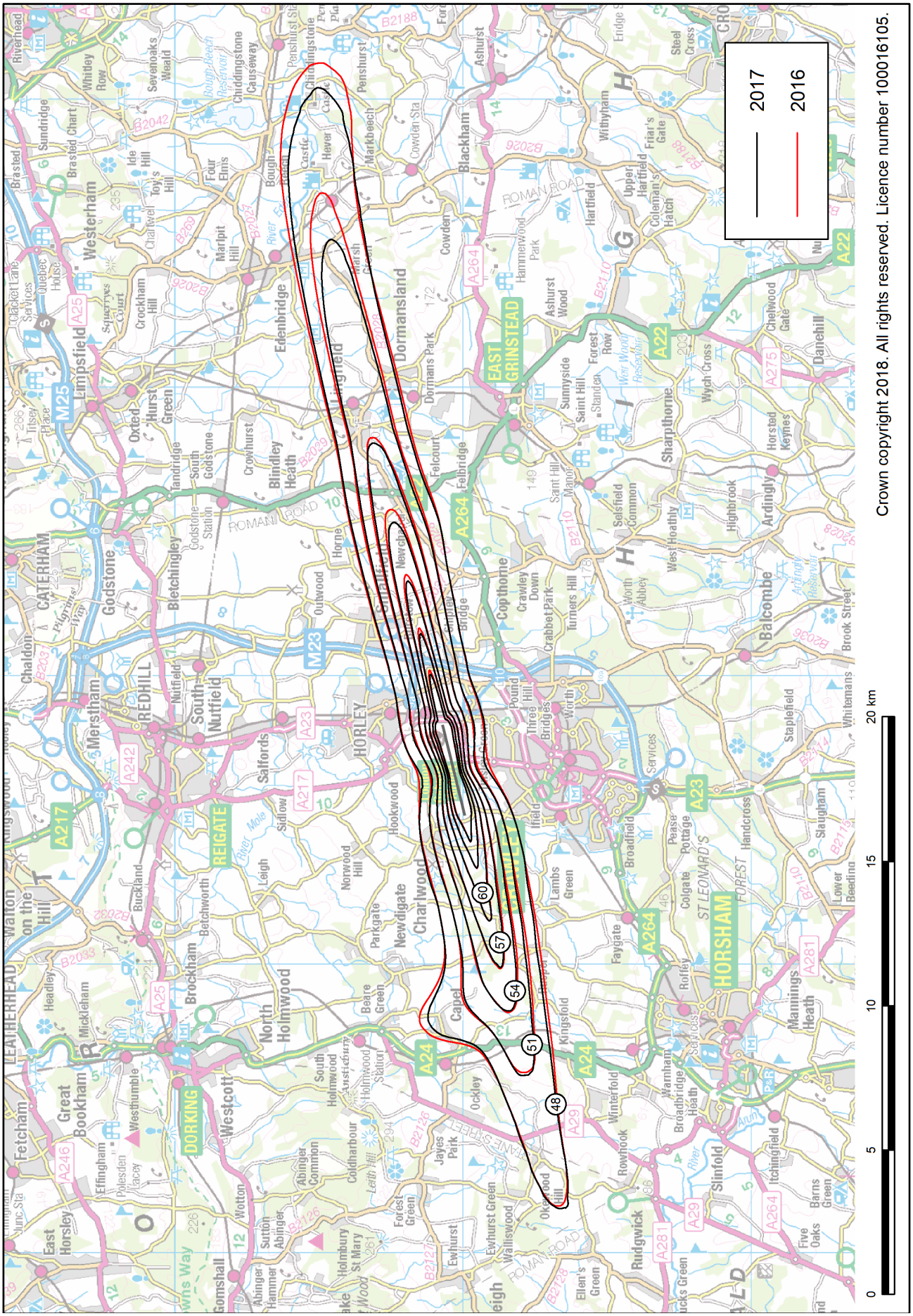


Figure B19 Gatwick summer day standard 2017 (76% W / 24% E) and 2016 (75% W / 25% E) Leq contours

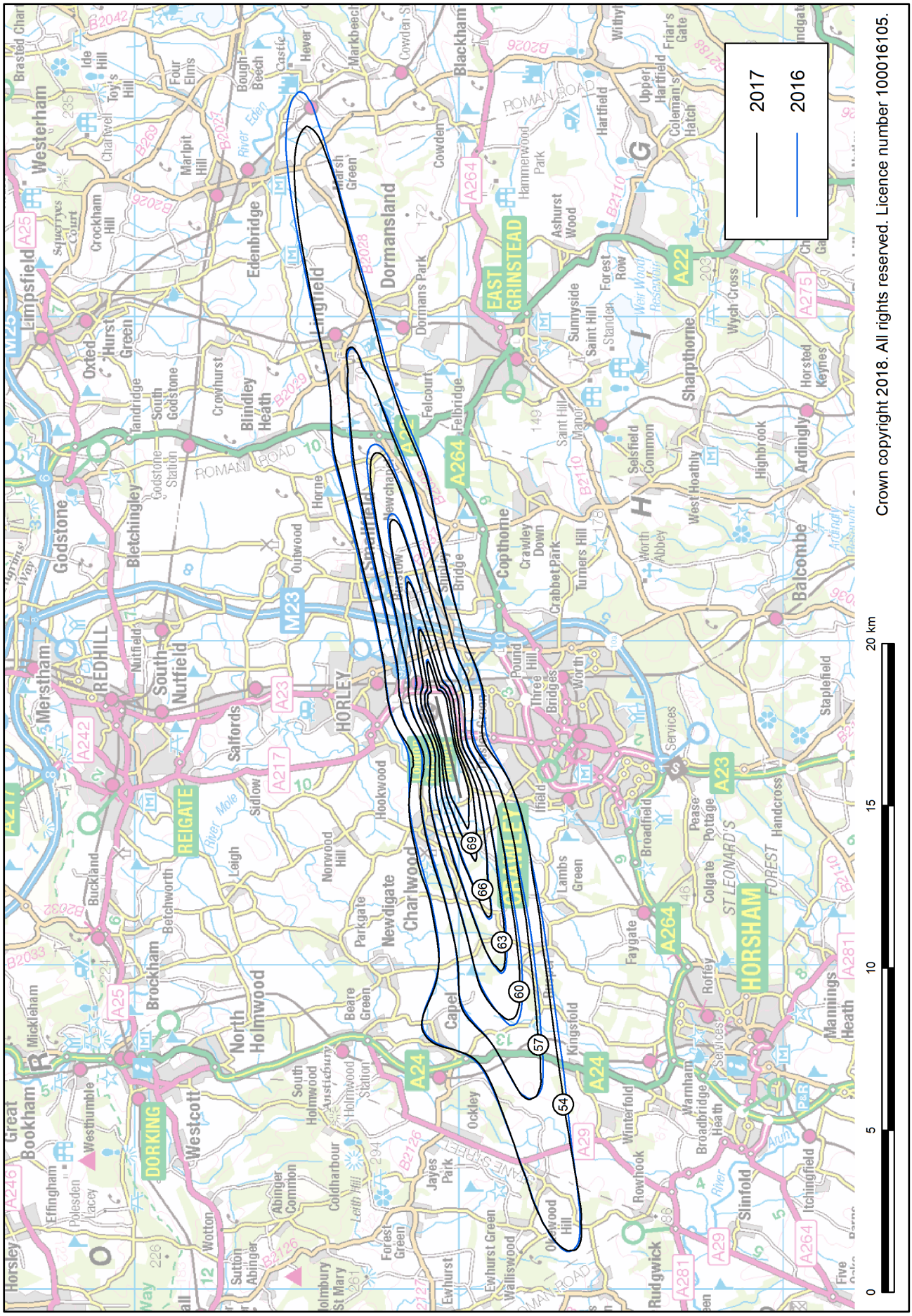
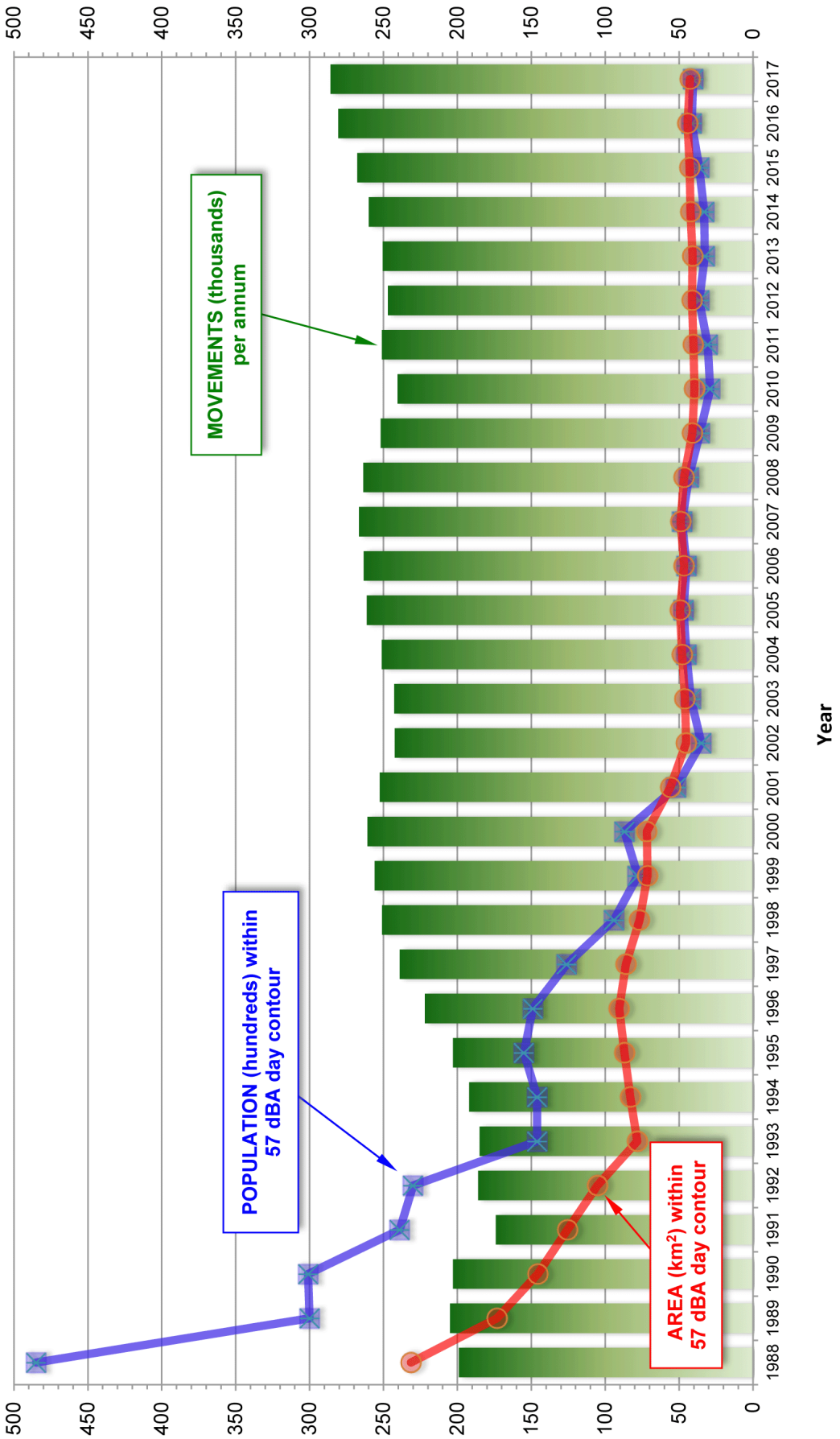


Figure B20 Gatwick annual traffic and summer day Leq noise contour area/population trend 1988-2017



APPENDIX C

Tables

Table C1 Gatwick 2017 average summer day movements by Noise Class

Noise Class	Description	2017 movements	2017 percentage	2016 percentage
A	Small propeller aircraft	0.3	0%	0%
B	Large propeller aircraft	3.8	0%	1%
C	Narrow-body aircraft	703.6	90%	91%
D	Wide-body twin-engine aircraft	58.5	7%	7%
E	Wide-body 3 or 4-engine aircraft	14.6	2%	2%
F	1st generation wide-body 3 or 4-engine aircraft *(Chapter 2/3)*	0.0	0%	0%
G	Narrow-body twin-engine aircraft *(including Ch.2 and hush-kitted versions)*	0.0	0%	0%
H	1st generation narrow-body 3 or 4-engine aircraft *(including hush-kitted versions)*	0.0	0%	0%
	TOTAL	**780.8**	100%	100%

Table C2 Gatwick 2017 average summer night movements by Noise Class

Noise Class	Description	2017 movements	2017 percentage	2016 percentage
A	Small propeller aircraft	0.0	0%	0%
B	Large propeller aircraft	0.0	0%	0%
C	Narrow-body aircraft	117.2	91%	92%
D	Wide-body twin-engine aircraft	10.1	8%	7%
E	Wide-body 3 or 4-engine aircraft	0.8	1%	1%
F	1st generation wide-body 3 or 4-engine aircraft *(Chapter 2/3)*	0.0	0%	0%
G	Narrow-body twin-engine aircraft *(including Ch.2 and hush-kitted versions)*	0.0	0%	0%
H	1st generation narrow-body 3 or 4-engine aircraft *(including hush-kitted versions)*	0.0	0%	0%
	TOTAL	**128.1**	100%	100%

Table C3 Gatwick 2016 and 2017 average summer day movements by ANCON aircraft type

ANCON	2016 deps	2016 arrs	2016 total	2017 deps	2017 arrs	2017 total	Change deps	Change arrs	Change total
B733	2.3	2.5	4.8	1.2	1.5	2.7	-1.1	-0.9	-2.0
B736	3.2	3.1	6.3	2.5	2.6	5.1	-0.7	-0.5	-1.2
B738	65.5	63.3	128.8	59.5	57.5	117.0	-5.9	-5.8	-11.8
B742C2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B744G	4.4	3.5	7.8	4.4	4.1	8.5	0.0	+0.6	+0.6
B744P	0.0	0.0	0.0	0.1	0.3	0.4	+0.1	+0.3	+0.4
B753	2.9	2.2	5.1	5.4	3.2	8.6	+2.4	+1.1	+3.5
B757E	5.8	4.7	10.5	5.6	4.4	10.0	-0.2	-0.3	-0.5
B763G	4.5	4.4	8.9	3.8	3.7	7.5	-0.7	-0.7	-1.3
B763P	0.5	0.9	1.3	0.5	0.5	0.9	0.0	-0.4	-0.4
B772G	7.6	5.2	12.8	8.2	5.1	13.3	+0.5	0.0	+0.5
B772P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B772R	2.5	2.5	5.1	3.2	2.8	6.0	+0.7	+0.2	+0.9
B773G	0.0	0.0	0.0	0.1	0.1	0.1	+0.1	+0.1	+0.1
B788	5.5	4.0	9.5	3.7	2.6	6.3	-1.9	-1.4	-3.2
B789	2.9	2.5	5.4	5.8	5.0	10.8	+2.9	+2.5	+5.4
BA46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRJ	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
CRJ900	0.1	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
CS300	0.0	0.0	0.0	1.5	1.5	3.0	+1.5	+1.5	+3.0
EA31	0.4	0.4	0.8	0.5	0.5	1.0	+0.1	+0.1	+0.2
EA318	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA319C	92.2	88.0	180.2	99.4	96.9	196.4	+7.2	+9.0	+16.2
EA319V	27.7	25.0	52.8	27.4	24.8	52.2	-0.3	-0.3	-0.6
EA320C	90.4	82.8	173.3	92.9	84.0	176.9	+2.5	+1.2	+3.6
EA320V	35.5	29.5	65.1	36.3	31.4	67.7	+0.8	+1.9	+2.7
EA321C	5.5	4.4	9.9	3.6	3.4	7.0	-1.9	-1.0	-2.9
EA321V	21.0	19.2	40.2	20.4	18.7	39.1	-0.7	-0.5	-1.2
EA33	6.5	4.7	11.2	6.3	4.9	11.2	-0.2	+0.2	0.0
EA34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA346	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
EA359	0.1	0.0	0.1	1.0	0.4	1.3	+0.9	+0.3	+1.2
EA38GP	2.9	2.8	5.7	2.9	2.8	5.7	0.0	-0.1	0.0
ERJ	0.1	0.0	0.1	0.1	0.1	0.2	0.0	0.0	+0.1
ERJ170	0.1	0.1	0.2	0.0	0.0	0.0	-0.1	-0.1	-0.2
ERJ190	8.8	9.2	18.0	8.2	8.6	16.8	-0.6	-0.6	-1.2
EXE3	0.4	0.3	0.7	0.4	0.3	0.7	0.0	0.0	0.0
FK10	0.3	0.3	0.7	0.0	0.0	0.0	-0.3	-0.3	-0.6

ANCON	2016 deps	2016 arrs	2016 total	2017 deps	2017 arrs	2017 total	Change deps	Change arrs	Change total
L4P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LTT	2.1	2.1	4.2	1.9	1.9	3.8	-0.2	-0.2	-0.4
MD80	0.3	0.3	0.6	0.0	0.0	0.1	-0.3	-0.3	-0.5
MD90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SP	0.0	0.0	0.0	0.1	0.1	0.3	+0.1	+0.1	+0.3
STP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
Total	**402.2**	**368.4**	**770.6**	**407.0**	**373.8**	**780.8**	**+4.7**	**+5.5**	**+10.2**
							(+1%)	**(+1%)**	**(+1%)**

Note: Totals may not sum exactly due to rounding. Changes have been calculated before rounding.

Table C4 Gatwick 2016 and 2017 average summer night movements by ANCON aircraft type

ANCON	2016 deps	2016 arrs	2016 total	2017 deps	2017 arrs	2017 total	Change deps	Change arrs	Change total
B733	0.2	0.0	0.2	0.3	0.0	0.4	+0.1	0.0	+0.2
B736	0.4	0.4	0.8	0.2	0.0	0.2	-0.2	-0.4	-0.6
B738	8.1	10.6	18.8	7.9	10.0	17.9	-0.3	-0.6	-0.9
B744G	0.0	0.9	0.9	0.0	0.4	0.4	0.0	-0.5	-0.5
B744P	0.0	0.0	0.0	0.3	0.0	0.3	+0.2	0.0	+0.3
B753	0.8	1.5	2.3	1.0	2.7	3.7	+0.2	+1.2	+1.4
B757E	1.2	2.3	3.5	0.9	2.3	3.2	-0.3	0.0	-0.3
B763G	0.0	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.0
B763P	0.4	0.1	0.5	0.0	0.0	0.0	-0.4	-0.1	-0.5
B772G	0.0	2.5	2.5	0.0	3.0	3.0	0.0	+0.6	+0.6
B772P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B772R	0.0	0.0	0.0	0.0	0.5	0.5	0.0	+0.5	+0.5
B773G	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B788	0.7	2.2	2.9	0.7	1.7	2.4	0.0	-0.5	-0.4
B789	0.0	0.4	0.4	0.2	1.2	1.4	+0.2	+0.7	+0.9
CRJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA318	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA319C	10.6	14.8	25.5	12.2	14.5	26.7	+1.5	-0.3	+1.2
EA319V	0.7	3.5	4.2	0.7	3.4	4.1	0.0	-0.1	-0.1
EA320C	14.7	22.4	37.1	14.7	24.0	38.7	0.0	+1.6	+1.6
EA320V	2.3	8.3	10.6	3.4	8.4	11.8	+1.1	+0.1	+1.2
EA321C	1.5	2.5	4.0	0.5	1.2	1.8	-0.9	-1.3	-2.3
EA321V	3.9	5.8	9.6	3.2	5.0	8.2	-0.7	-0.8	-1.4
EA33	0.1	1.9	2.0	0.2	1.6	1.8	+0.1	-0.3	-0.2
EA34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA346	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA359	0.0	0.1	0.1	0.0	0.6	0.7	+0.0	+0.6	+0.6
EA38GP	0.1	0.2	0.3	0.0	0.1	0.2	-0.1	0.0	-0.1
ERJ	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	+0.1
ERJ190	0.4	0.0	0.4	0.4	0.0	0.4	0.0	0.0	0.0
EXE3	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	-0.1
FK10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LTT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**46.3**	**80.7**	**127.1**	**47.0**	**81.1**	**128.1**	**+0.7**	**+0.3**	**+1.1**
							(+2%)	**(0%)**	**(+1%)**

APPENDIX D

ANCON type descriptions

Table D1 ANCON type descriptions

ANCON type	Description
B717	Boeing 717
B727	Boeing 727 (Chapter 2&3)
B732	Boeing 737-200 (Chapter 2&3)
B733	Boeing 737-300/400/500
B736	Boeing 737-600/700
B738	Boeing 737-800/900
B747	Boeing 747-100 & 200/300 series (certificated to Chapter 3)
B744G	Boeing 747-400 with General Electric CF6-80F engines
B744P	Boeing 747-400 with Pratt & Whitney PW4000 engines
B744R	Boeing 747-400 with Rolls-Royce RB211 engines
B747SP	Boeing 747SP
B748	Boeing 747-8
B753	Boeing 757-300
B757C	Boeing 757-200 with Rolls-Royce RB211-535C engines
B757E	Boeing 757-200 with Rolls-Royce RB211-535E4/E4B engines
B757P	Boeing 757-200 with Pratt & Whitney PW2037/2040 engines
B762	Boeing 767-200
B763G	Boeing 767-300 with General Electric CF6-80 engines
B763P	Boeing 767-300 with Pratt & Whitney PW4000 engines
B763R	Boeing 767-300 with Rolls-Royce RB211 engines
B764	Boeing 767-400
B772G	Boeing 777-200 with General Electric GE90 engines
B772P	Boeing 777-200 with Pratt & Whitney PW4000 engines
B772R	Boeing 777-200 with Rolls-Royce Trent 800 engines
B773G	Boeing 777-200LR/300ER with General Electric GE90 engines
B773P	Boeing 777-300 with Pratt & Whitney PW4000 engines
B773R	Boeing 777-300 with Rolls-Royce Trent 800 engines
B788	Boeing 787-8
B789	Boeing 787-9
BA46	BAe 146/Avro RJ series
CRJ	Bombardier CRJ100/200 series
CRJ700	Bombardier CRJ700 series
CRJ900	Bombardier CRJ900 series

ANCON type	Description
DC10	McDonnell Douglas DC-10
EA30	Airbus A300
EA31	Airbus A310
EA318	Airbus A318
EA319C	Airbus A319 with CFM56 engines
EA319V	Airbus A319 with IAE V2500 engines
EA320C	Airbus A320 with CFM56 engines
EA320NEO	Airbus A320neo
EA320V	Airbus A320 with IAE V2500 engines
EA321C	Airbus A321 with CFM56 engines
EA321V	Airbus A321 with IAE V2500 engines
EA33	Airbus A330
EA34	Airbus A340-200/300
EA346	Airbus A340-500/600
EA359	Airbus A350-900
EA38GP	Airbus A380 with Engine Alliance GP7000 engines
EA38R	Airbus A380 with Rolls-Royce Trent 900 engines
ERJ	Embraer ERJ 135/145
ERJ170	Embraer E-170/175
ERJ190	Embraer E-190/195
EXE2	Chapter 2 executive jets
EXE3	Chapter 3 executive jets
FK10	Fokker 70/100
L101	Lockheed L-1011 TriStar
L4P	Large four-engine propeller
LTT	Large twin-turboprop
MD11	McDonnell Douglas MD-11
MD80	McDonnell Douglas MD-80 series
SP	Single piston
STP	Small twin-piston
STT	Small twin-turboprop
TU54	Tupolev Tu-154

Glossary

Glossary	
AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
ANCON	The UK civil aircraft noise contour model, developed and maintained by ERCD.
ATC	Air Traffic Control
CAA	Civil Aviation Authority
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
FOPP	Fuel Over Pressure Protector
GAL	Gatwick Airport Limited
ICAO	International Civil Aviation Organization
Leq	Equivalent sound level of aircraft noise in dBA, often called ‘equivalent continuous sound level’.
NPD	Noise-Power-Distance
NPR	Noise Preferential Route
NTK	Noise and Track Keeping monitoring system
OS	Ordnance Survey, the national mapping agency of Great Britain
SEL	Sound Exposure Level – the steady noise level, which over a period of one second contains the same sound energy as the whole aircraft noise event. It is equivalent to the Leq of the noise event normalised to one second.
SID	Standard Instrument Departure