Environmental Research and Consultancy Department

Civil Aviation Authority

Noise Exposure Contours for Gatwick Airport 2021

ERCD REPORT 2202

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Summary

1. This report presents the 2021 average summer day and night noise exposure contours generated for London Gatwick Airport. Similar to 2020, the 2021 contours were greatly impacted by the ongoing COVID-19 pandemic.

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. The COVID-19 pandemic continued to have major impacts on aircraft movement numbers at Gatwick in 2021, though they recovered somewhat from 2020 levels over the summer period. Average daily movements for the 16-hour daytime period in 2021 were 181.5, 22% higher than the previous year (2020: 148.5). There were on average 19.4 movements per 8-hour night, a decrease of 5% from 2020 (20.4).

4. There was an unusually high proportion of easterly operations over the 2021 summer period due to changes in prevailing wind patterns. The daytime actual runway modal split was 52% W / 48% E (2020: 76% W / 24% E).

5. The recovery in 2021 summer movements caused increases in contour areas and population counts. The area of the 2021 summer day actual modal split (52% W / 48% E) 54 dB $L_{Aeq,16h}$ contour increased by 38% to 18.3 km^2 (2020: 13.3 km^2). The population count within this contour increased by 100% to 1,000 (2020: 500). The population increase seen here, and also for other contours described below, was partly due to a general population increase in the vicinity of the airport in 2021. Within the 54 dB $L_{Aeq,16h}$ standard contour, this was found to be +12%.

6. Similarly, the area of the 2021 summer day standard modal split (74% W / 26% E) 54 dB $L_{Aeq,16h}$ contour increased by 38% to 18.3 km^2 (2020: 13.3 km^2). The population count within this contour of 1,100 was 120% higher than the previous year (2020: 500).

7. The 38% increase in 54 dB $L_{Aeq,16h}$ standard modal split area can be broken down approximately as follows:

   - 26% due to changes in movement numbers and fleet mix
   - 12% due to noise updates following the 2021 measurements

8. The area of the 2021 summer night actual modal split (50% W / 50% E) 48 dB $L_{Aeq,8h}$ contour was 14.2 km^2, an increase of 8% from the previous year (2020:

13.1 km^2). The contour enclosed a population of 700, which was 40% higher than in 2020 (500).

9. The 2021 summer night 48 dB $L_{Aeq,8h}$ contour area assuming the 10-year average runway modal split (73% W / 27% E) was 14.2 km^2 (2020: 13.1 km^2), enclosing a population of 700 (2020: 500).

10. The area of the 2021 average summer day actual modal split (52% W / 48% E) N65 20-event contour was 78.5 km^2 (2020: 67.2 km^2) and the contour enclosed a population of 9,100 (2020: 8,200).

11. The area of the 2021 average summer night actual modal split (50% W / 50% E) N60 10-event contour was 7.7 km^2 (2020: 32.7 km^2) and the contour enclosed a population of 100 (2020: 1,950).

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 (L_{Aeq}), and in particular $L_{Aeq,16h}$ (07:00-23:00 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 L_{Aeq}, akin to the height contours shown on geographical maps or isobars on a weather chart. Historically in the UK, $L_{Aeq,16h}$ noise contours have been plotted at levels from 57 to 72 dB, in 3 dB steps. However, the Survey of Noise Attitudes, SoNA 2014 (**Ref 2**) found that the degree of annoyance (based on the percentage of respondents highly annoyed) previously occurring at 57 dB, occurs at 54 dB. The $L_{Aeq,16h}$ contours have therefore been plotted down to the lower level of 54 dB since 2016.

1.5 Following the publication of the Aviation Policy Framework in March 2013 (**Ref 3**), night-time (23:00-07:00 local time) $L_{Aeq,8h}$ noise contours have been produced on an annual basis for the designated[1] airports. Night-time $L_{Aeq,8h}$ contours have been calculated for Gatwick from 48 to 72 dB at 3 dB intervals in accordance with standard practice. Average summer night $L_{Aeq,8h}$ contours for Gatwick were first calculated for 2013.

1.6 As for 2020, day and night contours using the supplementary noise metrics N65 16-hour and N60 8-hour respectively have also been produced. N65 and N60

[1] Heathrow, Gatwick and Stansted airports have been designated for the purpose of avoiding, limiting or mitigating the effect of noise from aircraft since 1971. The Secretary of State's powers to designate airports in England and Wales, and to set noise controls, are contained within Section 78 of the Civil Aviation Act 1982. These powers are devolved in Scotland and Northern Ireland.

contours indicate the number of aircraft noise events exceeding a maximum sound level (L_{Amax}) of 65 and 60 dB respectively at a given location.

1.7 The objectives of this report are to explain the noise modelling methodology used to produce the 2021 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.

Gatwick Airport

1.8 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** of **Appendix B**).

1.9 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 is used when 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]

1.10 In the 2021 calendar year there were approximately 56,000 aircraft movements at Gatwick (2020: 80,000) and the airport handled 6.3 million passengers (2020: 10.2 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

[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 to produce 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 were 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. The current ANOMS NTK system was installed in April 2019, replacing the previous Casper Noise NTK system. A study of the flight path information from the new ANOMS system confirmed that it continues to provide reliable flight data for the types of studies carried out by ERCD (**Ref 7**).

2.4 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 profiles were based on summer 2021 radar data.

Flight tracks

2.5 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**.

2.6 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.

2.7 Mean flight tracks were modelled with in-house software using 24-hour radar data extracted from the Gatwick NTK system over the 92-day summer period, 16 June to 15 September. Mean departure flight tracks and associated lateral dispersions for each NPR/SID, and arrival tracks for Runways 08R and 26L using evenly spaced 'spurs' about the extended runway centrelines, were calculated. At GAL's request, separate sets of mean tracks for the day and night periods were produced for 2021.

2.8 Over the 2021 summer night period, the standby runway 08L/26R was used by 10% of arrivals, so this was accounted for in the night contour modelling.

2.9 **Figure B4** shows a 24-hour sample of radar flight tracks from 21 August 2021.

2.10 Based on a visual inspection of the radar flight tracks for 2021, the majority of arriving aircraft during the daytime period joined the runway centrelines at distances between 14 and 24 km (7.6 and 13.0 nm) from threshold for Runway 26L, and between 15 and 25 km (8.1 and 13.5 nm) from threshold for Runway 08R. In the night-time period, most arrivals joined between 15 and 27 km (8.1 and 14.6 nm) for Runway 26L and between 15 and 26 km (8.1 and 14.0 nm) for Runway 08R.

Flight profiles

2.11 For each ANCON type, average flight profiles of height, speed and thrust versus track distance (for departures and arrivals separately) were reviewed and updated where necessary, using 2021 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.

2.12 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

2.13 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 an array of mobile monitors that can be deployed anywhere within the NTK radar coverage area.[5]

2.14 The noise data collected were screened by ERCD with reference to several criteria so that only reliable data were used in the analysis.

- 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[6].
- 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).
- 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.[7]
- At a given noise monitor location, flight operations with valid noise measurements had to account for at least 75% of total overflights. This ensured that the resulting average noise level was not biased higher than the true average noise level due to missing measurements for quieter flights.

2.15 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.

2.16 The most significant SEL noise database updates following noise measurements undertaken in 2021 were as follows:

- **B738** – on arrival, around 0.5 to 1 dB noisier at most distances up to about 16 km from threshold.

[5] Further information on the noise monitors can be found in CAP 1149 (**Ref 8**).

[6] Wind speeds above 10 m/s, in accordance with ISO 20906 (**Ref 9**).

[7] *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.

- **EA319C** – 1 dB noisier on departure at most distances. On arrival, around 0.5 to 1 dB noisier at most distances.
- **EA320C** – up to about 1 dB noisier on departure between about 6 and 13 km from start-of-roll. On arrival, around 0.5 to 1 dB noisier up to about 10 km from threshold.
- **EA320NEO** – around 0.5 dB noisier on arrival between 2 and 6 km from threshold.

2.17 Validation of L_{Amax} levels, which are the basis of the N65 and N60 contours (but not the L_{Aeq} contours), was also carried out. The most significant L_{Amax} noise database updates following noise measurements undertaken in 2021 were as follows:

- **EA319C** – around 0.5 to 1.0 dB noisier between about 5 and 12 km from start-of-roll. On arrival, around 1 dB noisier beyond 12 km from threshold.
- **EA320C** – up to 1 dB noisier on departure at distances between 5 and 12 km from start-of-roll. On arrival, around 0.5 dB noisier at most distances beyond 5 km from threshold.
- **EA320NEO** – up to around 1 dB noisier on departure beyond 10 km from start-of-roll.

2.18 The noise increases seen above were possibly due to higher passenger load factors, lower flight profiles of aircraft height and higher engine thrust settings, and approximately offset the noise decreases observed in 2020 when load factors would have been lower due to the global pandemic.

Daytime traffic distributions by Noise Class

2.19 The L_{Aeq} contours were based on the daily average movements that took place during the 16-hour day (07:00-23:00 local time) and 8-hour night (23:00-07:00 local time), over the 92-day summer period from 16 June to 15 September inclusive. The source of this information was the Gatwick 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[8] and close agreement was found.

2.20 The average number of daily movements at Gatwick over the 2021 summer day period was 181.5, 22% higher than the previous year (2020: 148.5). From mid-June to mid-July, total daytime movements averaged around 90. After mid-July, when international travel restrictions were eased, average movements rose markedly to around 220 per day.

2.21 **Table C1** of **Appendix C** lists the average summer day movements by aircraft 'Noise Classes' (A to E), which are ranked in ascending order of noise emission, i.e. from least to most noisy. Starting from 2019, Noise Class C, D and E have been subdivided into 3rd and 4th generation subclasses (denoted 'C3' and 'C4' etc), with the 4th generation subclass covering the more modern, quieter aircraft as follows:

- Noise Class C4 = B738MAX, EA223, EA320NEO, EA321NEO
- Noise Class D4 = B789, B7810, EA33NEO, EA359, EA3510
- Noise Class E4 = EA38GP, EA38R

2.22 In 2021, 95% of movements were within Noise Class C3/C4 (i.e. narrow-body ICAO Chapter 3/4 jet aircraft[9]), which was 1% less than in 2020. The proportion of Noise Class C3 movements rose from 66% in 2020 to 70% in 2021. Noise Class C4 accounted for 25% of total movements, a fall of 5% from 2020.

2.23 Wide-body twin-engine aircraft (Noise Class D3/D4) represented 5% of total movements in 2021, 2% higher than in 2020 (3%). Noise Class D4 comprised 2% of total movements.

[8] 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.

[9] 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.

2.24 Wide-body 4-engine aircraft (Noise Class E3/E4) movements were insignificant in 2021, similar to 2020.

2.25 Movements by small and large propeller aircraft (Noise Classes A and B) represented 0.1% and 0.3% of the total respectively.

2.26 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.

2.27 It is estimated that almost 100%[10] of aircraft movements in the 2021 summer day period were compliant with the ICAO Chapter 4 noise standard. In addition, it is estimated that around 65% of the aircraft movements during the 2021 summer day met the latest ICAO Chapter 14 noise standard.

2.28 **Figure B5** illustrates the changing distribution of traffic among the 8 Noise Classes over the summer day period from 1988 to 2021 inclusive. The shift over the years to increasingly higher proportions of narrow-body jet aircraft (i.e. Noise Class C) can be clearly seen.

Night-time traffic distributions by Noise Class

2.29 The average number of movements over the 2021 summer night period was 19.4, a 5% decrease from the previous year (2020: 20.4). Night departures reduced by 18%, but night arrivals, which accounted for 52% of total summer night movements in 2021, increased by 11%.

2.30 **Table C2** lists the average summer night movements by aircraft Noise Class, ranked in ascending order of noise emission. Additional subclasses were introduced from 2019 for Noise Class C, D and E (see section 2.20).

2.31 Narrow-body jet aircraft (Noise Classes C3/C4) were responsible for 97% of movements at night in 2021, 2% higher than in 2020. Noise Class C4 accounted for 41% of total night movements, a 7% fall from the 2020 figure of 48%.

2.32 Wide-body twin-engine aircraft (Noise Classes D3/D4) accounted for 3% of movements, 2% less than in 2020. Noise Class D4 made up 2% of total movements.

2.33 There were no wide-body 4-engine aircraft movements (Noise Classes E3/E4) at night in 2021.

2.34 There were insignificant propeller aircraft movements (Noise Classes A and B) and no movements within Noise Classes F, G and H.

[10] 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.

2.35 It is estimated that 100% of aircraft in the 2021 summer night period were compliant with the ICAO Chapter 4 noise standard. It is also estimated that approximately 72% of the aircraft movements at night met the ICAO Chapter 14 noise standard.

Daytime traffic distributions by ANCON type

2.36 A breakdown of the 2021 average summer day movements by ANCON type is provided in **Table C3**. The largest daily increases in movements were for the ANCON types EA320C (+12.5) and EA319V (+10.2) (note: descriptions of all the ANCON types can be found in **Table D1** of **Appendix D**). The largest reduction was for the EA321NEO (-4.9).

2.37 The Airbus A320[11] and A320neo[12] aircraft families together accounted for 74% of total daytime movements in 2021.

2.38 **Figure B6** illustrates the movements by ANCON type for the 2021 average summer day. The most frequent ANCON types were the EA320C (52.5 movements), EA319C (38.5) and EA320NEO (26.8).

2.39 The noise dominant ANCON types on departure were, in descending order, the EA320C, B738 and EA319C. On arrival the noise dominant ANCON types were the EA320C, EA319C and EA320NEO. 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 type

2.40 A breakdown of the 2021 average summer night movements by ANCON type is provided in **Table C4**. The largest night-time movement increase was for the B738MAX (+1.4) and the largest decrease was for the EA320NEO (-2.4).

2.41 **Figure B7** illustrates the numbers of movements by ANCON aircraft type for the 2021 average summer night. The most frequent types were the EA320C (5.8), EA320NEO (3.5) and EA321NEO (3.0).

2.42 The noise dominant ANCON types on departure were the EA320C, EA319C and B738. On arrival, the noise dominant types were the EA320C, EA320NEO and EA321NEO. They were responsible for the highest contributions of 'noise energy', which is a function of both aircraft noise level and movement numbers.

[11] A319/A320/A321 (there were no A318 movements in the 2021 summer day)

[12] A320neo/A321neo (there were no A319neo movements in the 2021 summer day)

Daytime traffic distributions by NPR/SID route

2.43 **Figure B8** shows the percentage distribution of aircraft departures by NPR/SID route for the 2021 average summer day period, with distribution figures from 2020 for comparison. Route loadings were heavily influenced by the unusually higher proportion of easterly operations in 2021. The 'wrap-around' route 26LAM (Route 4) still had the highest loading of departure traffic in 2021 (19%), though this was a reduction of 16% from the previous year. The 26BOG (Route 7) loading reduced by 8%. The Runway 08R routes saw some relatively large increases in loading, with 08KEN, 08DTY and 08SFD up by 11%, 9% and 6% respectively.

2.44 The 2021 summer day departure traffic total was 77% lower than in 2019, so routes with percentage increases in loadings still have many fewer flights than 2019.

Night-time traffic distributions by NPR/SID route

2.45 **Figure B9** shows the percentage distribution of aircraft departures by NPR/SID route for the 2021 average summer night period, with distribution figures from 2020 for comparison. Similar to daytime, distributions were greatly affected by the unusually higher proportion of easterly operations in 2021. All the easterly routes saw increases in loadings, with 08CLN and 08SFD up by 9% and 8% respectively. 08CLN had the highest overall loading of 21%. Most of the westerly routes saw decreases in loading, with 26LAM down by 12% to 20% (the second highest overall loading) and 26BOG down by 7%.

2.46 The 2021 summer night departure traffic total was 85% lower than in 2019, so routes with percentage increases in loadings still have many fewer flights than 2019.

Runway modal splits

2.47 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.

2.48 Two sets of contours have been produced for the 2021 summer day:

(a) Using the 'actual' modal split over the $L_{Aeq,16h}$ day period; and

(b) Assuming the 'standard' modal split over the $L_{Aeq,16h}$ day period, i.e. the long-term modal split calculated from the 20-year rolling average. For 2021,

this is the 20-year period from 2002 to 2021. Use of the standard modal split enables year-on-year comparisons without the runway usage significantly affecting the contour shape.

2.49 The actual and standard daytime west / east (W / E) percentage modal splits for 2021 and 2020 are summarised in **Table 1**. There was an unusually high proportion of easterly operations in 2021 due to changes in prevailing wind patterns.

Table 1 Gatwick summer day runway modal splits

Year	Actual (W / E percentage)	Standard (W / E percentage)
2021	52 / 48	74 / 26
2020	76 / 24	75 / 25

2.50 The daytime actual modal split in 2021 (52% west / 48% east) had a 24% higher proportion of easterly operations compared to 2020, giving rise to the highest easterly percentage split over the past 20 years. The 2021 standard modal split of 74% west / 26% east had a 1% higher proportion of easterly operations than 2020. Historical runway modal splits at Gatwick for the past 20 years are summarised in **Figure B10**.

2.51 The actual and 10-year average night-time modal splits for 2021 and 2020 are summarised in **Table 2**. The night-time actual runway modal split for the 2021 summer period was 50% west / 50% east. The percentage of easterly operations was 26% higher compared to 2020. The summer night 10-year (2012-2021) average modal split was 73% west / 27% east.

Table 2 Gatwick summer night runway modal splits

Year	Actual (W / E percentage)	10-year average (W / E percentage)
2021	50 / 50	73 / 27
2020	76 / 24	75 / 25

Topography

2.52 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.

2.53 ERCD holds OS terrain height data on a 50-metre grid for the whole of Great Britain. 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

2.54 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 2021 update of the 2011 Census supplied by CACI Limited.

2.55 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**.

2.56 Within the extent of the 2021 average summer day standard 54 dB $L_{Aeq,16h}$ contour, the population count using the 2021 population database was 12% higher compared to using the 2020 database. This provides an indication of the effect of any population changes in the vicinity of the airport on the results presented in Chapter 3.

2.57 Estimates have also been made of the numbers of noise sensitive buildings situated within the contours, using the PointX 'Points of Interest' (2021) 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

2021 summary day actual $L_{Aeq,16h}$ contours

3.1 The Gatwick 2021 summer day $L_{Aeq,16h}$ noise contours generated with the actual runway modal split (52% W / 48% E) are shown in **Figure B13**. The contours are plotted from 54 to 72 dB at 3 dB intervals.

3.2 Cumulative estimates of the areas, populations and households within the 2021 summer day actual contours are provided in **Table 3**.

Table 3 Gatwick 2021 summer day actual $L_{Aeq,16h}$ contours – area, population and household estimates

$L_{Aeq,16h}$ (dB)	Area (km^2)	Population	Households
> 54	18.3	1,000	400
> 57	9.7	400	100
> 60	5.2	100	< 100
> 63	2.7	< 100	0
> 66	1.6	0	0
> 69	1.0	0	0
> 72	0.6	0	0

Note: Populations and households are given to the nearest 100.

3.3 The 2021 summer day actual 54 dB $L_{Aeq,16h}$ contour enclosed an area of 18.3 km^2 and a population of 1,000.

3.4 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer day actual $L_{Aeq,16h}$ contours are provided in **Table 4**.

Table 4 Gatwick 2021 summer day actual $L_{Aeq,16h}$ contours – noise sensitive building estimates

$L_{Aeq,16h}$ (dB)	Community buildings	Hospitals	Schools	Places of worship
> 54	0	0	2	3
> 57	0	0	1	3
> 60	0	0	0	1
> 63	0	0	0	0
> 66	0	0	0	0
> 69	0	0	0	0
> 72	0	0	0	0

2021 summer night actual $L_{Aeq,8h}$ contours

3.5 The Gatwick 2021 summer night $L_{Aeq,8h}$ noise contours generated with the actual runway modal split (50% W / 50% E) are shown in **Figure B14**. The contours are plotted from 48 to 66 dB at 3 dB intervals (note: the 69 and 72 dB contours have been omitted for clarity).

3.6 Cumulative estimates of the areas, populations and households within the 2021 summer night actual $L_{Aeq,8h}$ contours are provided in **Table 5**.

3.7 The 2021 summer night actual 48 dB $L_{Aeq,8h}$ contour enclosed an area of 14.2 km^2 and a population of 700.

3.8 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer night actual $L_{Aeq,8h}$ contours are provided in **Table 6**.

Table 5 Gatwick 2021 summer night actual $L_{Aeq,8h}$ contours – area, population and household estimates

$L_{Aeq,8h}$ (dB)	Area (km^2)	Population	Households
> 48	14.2	700	200
> 51	7.5	200	100
> 54	4.0	< 100	< 100
> 57	2.1	< 100	0
> 60	1.3	0	0
> 63	0.8	0	0
> 66	0.5	0	0
> 69	0.3	0	0
> 72	0.2	0	0

Note: Populations and households are given to the nearest 100.

Table 6 Gatwick 2021 summer night actual $L_{Aeq,8h}$ contours – noise sensitive building estimates

$L_{Aeq,8h}$ (dB)	Community buildings	Hospitals	Schools	Places of worship
> 48	0	0	1	3
> 51	0	0	1	3
> 54	0	0	0	1
> 57	0	0	0	0
> 60	0	0	0	0
> 63	0	0	0	0
> 66	0	0	0	0
> 69	0	0	0	0
> 72	0	0	0	0

2021 summary day standard $L_{Aeq,16h}$ contours

3.9 The Gatwick 2021 summer day $L_{Aeq,16h}$ noise contours generated with the standard runway modal split (74% W / 26% E) are shown in **Figure B15**. The contours are plotted from 54 to 72 dB at 3 dB intervals.

3.10 Cumulative estimates of the areas, populations and households within the 2021 summer day standard $L_{Aeq,16h}$ contours are provided in **Table 7**.

Table 7 Gatwick 2021 summer day standard $L_{Aeq,16h}$ contours – area, population and household estimates

$L_{Aeq,16h}$ (dB)	Area (km^2)	Population	Households
> 54	18.3	1,100	400
> 57	9.7	300	100
> 60	5.2	100	< 100
> 63	2.7	< 100	0
> 66	1.6	0	0
> 69	1.0	0	0
> 72	0.6	0	0

Note: Populations and households are given to the nearest 100.

3.11 The 2021 summer day standard 54 dB $L_{Aeq,16h}$ contour enclosed an area of 18.3 km^2 and a population of 1,100.

3.12 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer day standard $L_{Aeq,16h}$ contours are provided in **Table 8**.

Table 8 Gatwick 2021 summer day standard $L_{Aeq,16h}$ contours – noise sensitive building estimates

$L_{Aeq,16h}$ (dB)	Community buildings	Hospitals	Schools	Places of worship
> 54	0	0	1	3
> 57	0	0	1	3
> 60	0	0	0	1
> 63	0	0	0	0
> 66	0	0	0	0
> 69	0	0	0	0
> 72	0	0	0	0

2021 summer night 10-year average modal split $L_{Aeq,8h}$ contours

3.13 The Gatwick 2021 summer night $L_{Aeq,8h}$ noise contours generated with the 10-year average (2012-2021) summer night period runway modal split (73% W / 27% E) are shown in **Figure B16**. The contours are plotted from 48 to 66 dB at 3 dB intervals (note: the 69 and 72 dB contours have been omitted for clarity).

3.14 Cumulative estimates of the areas, populations and households within the 2021 summer night 10-year average modal split $L_{Aeq,8h}$ contours are provided in **Table 9**.

3.15 The 2021 summer night 10-year average modal split 48 dB $L_{Aeq,8h}$ contour enclosed an area of 14.2 km^2 (2020: 13.1 km^2) and a population of 700 (2020: 500).

3.16 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer night 10-year average modal split $L_{Aeq,8h}$ contours are provided in **Table 10**.

Table 10 Gatwick 2021 summer night 10-year average modal split $L_{Aeq,8h}$ contours – area, population and household estimates

$L_{Aeq,8h}$ (dB)	Area (km^2)	Population	Households
> 48	14.2	700	200
> 51	7.5	200	100
> 54	3.9	100	< 100
> 57	2.1	< 100	0
> 60	1.3	0	0
> 63	0.8	0	0
> 66	0.5	0	0
> 69	0.3	0	0
> 72	0.1	0	0

Note: Populations and households are given to the nearest 100.

Table 10 Gatwick 2021 summer night 10-year average modal split $L_{Aeq,8h}$ contours – noise sensitive building estimates

$L_{Aeq,8h}$ (dB)	Community buildings	Hospitals	Schools	Places of worship
> 48	0	0	1	3
> 51	0	0	1	3
> 54	0	0	0	1
> 57	0	0	0	0
> 60	0	0	0	0
> 63	0	0	0	0
> 66	0	0	0	0
> 69	0	0	0	0
> 72	0	0	0	0

2021 summer day actual $L_{Aeq,16h}$ contours – comparison with 2020

3.17 The Gatwick 2021 and 2020 summer day actual modal split $L_{Aeq,16h}$ contours are compared in **Figure B17**. For clarity, the 2021 and 2020 contours are only plotted at the levels 54, 60 and 66 dB.

3.18 **Table 11** summarises the areas, populations and percentage changes from 2020 to 2021.

Table 11 Gatwick 2020 and 2021 summer day actual $L_{Aeq,16h}$ contours – area and population estimates

$L_{Aeq,16h}$ (dB)	2020 area (km^2)	2021 area (km^2)	Area change	2020 population	2021 population	Population change
> 54	13.3	18.3	+38%	500	1,000	+100%
> 57	7.0	9.7	+39%	150	400	+167%
> 60	3.6	5.2	+44%	50	100	+100%
> 63	2.0	2.7	+35%	0	< 100	(-)
> 66	1.2	1.6	+33%	0	0	(-)
> 69	0.8	1.0	+25%	0	0	(-)
> 72	0.5	0.6	+20%	0	0	(-)

Note: The 2020 and 2021 summer day actual runway modal splits were 76% W / 24% E and 52% W / 48% E respectively.

3.19 The 54 dB $L_{Aeq,16h}$ contour area increased by 38% in 2021 and area increases of up to 44% were also found at the higher contour levels. This resulted predominantly from the 22% rise in movements, and to a lesser extent from aircraft noise changes following the 2021 measurements.

3.20 The population count for the 54 dB contour increased by 100% in 2021 and there were similar increases at the 57 and 60 dB contour levels. The population database changes in 2021 described in section 2.56 account for some of the population increases seen here.

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.

2021 summer night actual $L_{Aeq,8h}$ contours – comparison with 2020

3.22 The Gatwick 2021 and 2020 summer night actual modal split $L_{Aeq,8h}$ contours are compared in **Figure B18**. For clarity, the 2021 and 2020 contours are only plotted at the levels 48, 54 and 60 dB.

3.23 **Table 12** summarises the areas, populations and percentage changes from 2020 to 2021.

Table 12 Gatwick 2020 and 2021 summer night actual $L_{Aeq,8h}$ contours – area and population estimates

$L_{Aeq,8h}$ (dB)	2020 area (km^2)	2021 area (km^2)	Area change	2020 population	2021 population	Population change
> 48	13.1	14.2	+8%	500	700	+40%
> 51	6.9	7.5	+9%	150	200	+33%
> 54	3.5	4.0	+14%	50	< 100	(-)
> 57	1.9	2.1	+11%	0	< 100	(-)
> 60	1.2	1.3	+8%	0	0	(-)
> 63	0.8	0.8	0%	0	0	(-)
> 66	0.5	0.5	0%	0	0	(-)
> 69	0.3	0.3	0%	0	0	(-)
> 72	0.1	0.2	+100%	0	0	(-)

Note: The 2020 and 2021 summer night actual runway modal splits were 76% W / 24% E and 50% W / 50% E respectively.

3.24 The 48 dB $L_{Aeq,8h}$ contour area in 2021 increased by 8% compared to 2020, despite the movement decrease of 5%. This was mainly due to aircraft noise changes to reflect 2021 measurements. Area increases of up to 14% were present at the contour levels from 51 to 60 dB.

3.25 The population count increased by 40% within the 48 dB $L_{Aeq,8h}$ contour and by 33% at the 51 dB contour level. The population database changes in 2021 described in section 2.56 account for some of the population increases seen here.

2021 summer day standard $L_{Aeq,16h}$ contours – comparison with 2020

3.26 The Gatwick 2021 and 2020 summer day standard modal split $L_{Aeq,16h}$ contours are compared in **Figure B19**. For clarity, the 2021 and 2020 contours are only plotted at the levels 54, 60 and 66 dB.

3.27 **Table 13** summarises the areas, populations and percentage changes from 2020 to 2021.

3.28 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 2020 and 2021 summer day standard $L_{Aeq,16h}$ contours – area and population estimates

$L_{Aeq,16h}$ (dB)	2020 area (km^2)	2021 area (km^2)	Area change	2020 population	2021 population	Population change
> 54	13.3	18.3	+38%	500	1,100	+120%
> 57	7.0	9.7	+39%	150	300	+100%
> 60	3.6	5.2	+44%	50	100	+100%
> 63	2.0	2.7	+35%	0	< 100	(-)
> 66	1.2	1.6	+33%	0	0	(-)
> 69	0.8	1.0	+25%	0	0	(-)
> 72	0.5	0.6	+20%	0	0	(-)

Note: The 2020 and 2021 summer day standard runway modal splits were 75% W / 25% E and 74% W / 26% E respectively.

3.29 The 2021 standard modal split 54 dB $L_{Aeq,16h}$ contour area increased by 38% compared to 2020 and area increases of up to 44% were seen at the higher contour levels.

3.30 The 38% increase in the 54 dB $L_{Aeq,16h}$ area can be broken down approximately as follows:

- 26% due to changes in movement numbers and fleet mix
- 12% due to noise updates following the 2021 measurements

3.31 There was a 120% population increase in 2021 at the 54 dB contour level and similar increases at the 57 and 60 dB contour levels. The population database changes in 2021 described in section 2.56 account for some of the population increases seen here.

Daytime $L_{Aeq,16h}$ noise contour historical trend

3.32 **Figure B20** shows how the 57 dB $L_{Aeq,16h}$ 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.

Movements

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 reduction in charter flights at Gatwick. However, movement numbers increased from 2013 through to 2017 as demand returned. Movements then reduced by 1% in 2018, caused in part by serious disruptions in December 2018 following drone sightings at the airport. Movements rose slightly (by 0.4%) in 2019.

3.35 The COVID-19 global pandemic in 2020 caused a 72% fall in annual movements at Gatwick. There was a further 30% drop in annual movements in 2021 as the pandemic severely reduced flights in the first half of the year and international travel restrictions only started to ease at the start of the summer.

Areas

3.36 From 1988 to 1993, the area within the 57 dB $L_{Aeq,16h}$ 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, which at the time was the smallest ever area calculated for Gatwick, as the global recession impacted upon the aviation industry.

3.37 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 (Fuel Over Pressure Protector) modification to reduce approach noise. In 2018 the area fell again, this time by 6%, primarily because noise measurements showed that the noise dominant aircraft types were quieter on arrival. The area decreased for the third year running in 2019 (by 3%) to its lowest ever level of 38.7 km^2, as the proportion of more modern, quieter types (such as the Airbus A320neo and A321neo) in the fleet mix increased.

3.38 The COVID-19 pandemic had unprecedented impacts on air travel in 2020, causing a 72% drop in annual movements at Gatwick and an 82% reduction in the 57 dB contour area, which fell to an all-time low of 7.0 km^2. In 2021, the contour area increased by 38% as movements recovered during the summer.

Populations

3.39 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. The population also fell in 2018 (this time by 31%) as quieter aircraft on arrival and a 10% reduction in westerly movements shifted the contour away from Lingfield. The population count decreased (by 9%) for the third year running in 2019 to its lowest ever level of 2,550 as the contour area also fell to its lowest level since 1988.

3.40 The 82% contour area reduction in 2020 meant the population within the 57 dB contour also fell to the lowest level ever recorded (150). In 2021, the 38% increase in contour area caused the population to increase by 100%.

Supplementary noise metric – N65 day contours

3.41 Contours using the supplementary noise metric N65[13] have been produced for the 2021 summer day period, using the same modelling input data as the $L_{Aeq,16h}$ day actual modal split (52% W / 48% E) contours. The contours are shown in **Figure B21**, plotted at levels 20, 50, and 100 events, and overlaid onto the 2020 results plotted at the same levels. Estimates of area, population and households are summarised in **Table 14**.

Table 14 Gatwick 2021 summer day actual modal split N65 contours – area, population and household estimates

N65	Area (km^2)	Population	Households
> 20	78.5	9,100	3,600
> 50	47.1	4,900	2,100
> 100	3.8	< 100	< 100
> 200	0.0	0	0
> 500	0.0	0	0

Note: Populations and households are given to the nearest 100. The 2021 summer day actual runway modal split was 52% W / 48% E.

3.42 The 2021 summer day actual N65 20-event contour enclosed an area of 78.5 km^2 (2020: 67.2 km^2) and a population of 9,100 (2020: 8,200).

3.43 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer day actual N65 contours are provided in **Table 15**.

Table 15 Gatwick 2021 summer day actual modal split N65 contours – noise sensitive building estimates

N65	Community buildings	Hospitals	Schools	Places of worship
> 20	5	0	14	11
> 50	4	0	8	7
> 100	0	0	1	1
> 200	0	0	0	0
> 500	0	0	0	0

[13] N65 contours show the number of aircraft noise events exceeding 65 dB L_{Amax}.

3.44 N65 contours have also been produced for the 2021 summer day period with the standard modal split (74% W / 26% E). The contours are shown in **Figure B22**, plotted at levels 20, 50 and 100 events, and overlaid onto the 2020 results plotted at the same levels. Estimates of area, population and households are summarised in **Table 16**.

Table 16 Gatwick 2021 summer day standard modal split N65 contours – area, population and household estimates

N65	Area (km^2)	Population	Households
> 20	78.3	10,100	4,000
> 50	53.7	5,900	2,300
> 100	3.8	100	< 100
> 200	0.0	0	0
> 500	0.0	0	0

Note: Populations and households are given to the nearest 100. The 2021 summer day standard runway modal split was 74% W / 26% E.

3.45 The 2021 summer day standard N65 20-event contour enclosed an area of 78.3 km^2 (2020: 67.2 km^2) and a population of 10,100 (2020: 8,250).

3.46 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer day standard N65 contours are provided in **Table 17**.

Table 17 Gatwick 2021 summer day standard modal split N65 contours – noise sensitive building estimates

N65	Community buildings	Hospitals	Schools	Places of worship
> 20	6	0	16	11
> 50	4	0	10	10
> 100	0	0	1	1
> 200	0	0	0	0
> 500	0	0	0	0

Supplementary noise metric – N60 night contours

3.47 Contours using the supplementary noise metric N60[14] have been produced for the 2021 summer night period, using the same modelling input data as the $L_{Aeq,8h}$ night actual modal split (50% W / 50% E) contours.

3.48 **Figure B23** shows the 2021 N60 contour plotted at the 10-event level only (as there were fewer than 20 movements in total at night). Also overlaid are the 2020 results plotted at the 10 and 20-event levels. Estimates of area, population and households are summarised in **Table 18**.

Table 18 Gatwick 2021 summer night actual modal split N60 contours – area, population and household estimates

N60	Area (km^2)	Population	Households
> 10	7.7	100	< 100
> 20	0.0	0	0
> 50	0.0	0	0
> 100	0.0	0	0

Note: Populations and households are given to the nearest 100. The 2021 summer night actual runway modal split was 50% W / 50% E.

3.49 The 2021 summer night actual N60 10-event contour enclosed an area of 7.7 km^2 (2020: 32.7 km^2) and a population of 100 (2020: 1,950).

3.50 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer night actual N60 contours are provided in **Table 19**.

Table 19 Gatwick 2021 summer night actual modal split N60 contours – noise sensitive building estimates

N60	Community buildings	Hospitals	Schools	Places of worship
> 10	0	0	1	1
> 20	0	0	0	0
> 50	0	0	0	0
> 100	0	0	0	0

3.51 N60 contours have also been produced for the 2021 summer night period with the $L_{Aeq,8h}$ night 10-year average modal split (73% W / 27% E). The contours are

[14] N60 contours show the number of aircraft noise events exceeding 60 dB L_{Amax}.

shown in **Figure B24**, plotted at the 10-event level only, and overlaid onto the 2020 results plotted at the 10 and 20-event levels. Estimates of area, population and households are summarised in **Table 20**.

Table 20 Gatwick 2021 summer night 10-year average modal split N60 contours – area, population and household estimates

N60	Area (km^2)	Population	Households
> 10	7.2	200	< 100
> 20	0.0	0	0
> 50	0.0	0	0
> 100	0.0	0	0

Note: Populations and households are given to the nearest 100. The 2021 summer night 10-year average runway modal split was 73% W / 27% E.

3.52 The 2021 summer night 10-year average N60 10-event contour enclosed an area of 7.2 km^2 (2020: 21.9 km^2) and a population of 200 (2020: 800).

3.53 The above changes in N60 contour area compared to 2020 can be attributed primarily to the 18% reduction in departure movements at night in 2021.

3.54 'Number Above' (N) contours can be highly sensitive to small changes in movement numbers or differences in runway modal splits. Because N-contours are based on counts of aircraft events above a specified maximum noise level threshold, step changes in area can occur if the Number Above count just goes above or below the event level of interest (e.g. 10 events) at a particular location. Changes in area enclosed by L_{Aeq} contours due to such changes, by contrast, are more gradual, due to contour area being proportional to noise energy, i.e. not subject to specific threshold requirements.

3.55 Estimates of the cumulative numbers of noise sensitive buildings within the 2021 summer night 10-year average N60 contours are provided in **Table 21**.

Table 21 Gatwick 2021 summer night 10-year average modal split N60 contours – noise sensitive building estimates

N60	Community buildings	Hospitals	Schools	Places of worship
> 10	0	0	3	1
> 20	0	0	0	0
> 50	0	0	0	0
> 100	0	0	0	0

Chapter 4
Conclusions

4.1 Year 2021 average summer day $L_{Aeq,16h}$ and night $L_{Aeq,8h}$ noise exposure contours have been generated for Gatwick Airport using the ANCON noise model.

4.2 Movements over the 2021 summer day period rose by 22% to 181.5 from 2020 (148.5), though they were still much lower than in 2019 due to the ongoing COVID-19 pandemic. The 2021 summer day actual modal split (52% W / 48% E) 54 dB $L_{Aeq,16h}$ contour area increased by 38% to 18.3 km^2 (2020: 13.3 km^2). The population count within this contour rose by 100% in 2021 to 1,000 (2020: 500). The population increase seen here, and also for other contours described below, was partly due to a general population increase in the vicinity of the airport in 2021. Within the 54 dB $L_{Aeq,16h}$ standard contour, this was found to be +12%.

4.3 The 2021 summer day standard modal split (74% W / 26% E) 54 dB $L_{Aeq,16h}$ contour area also increased by 38% to 18.3 km^2 (2020: 13.3 km^2). The population enclosed by this contour (1,100) was 120% higher than the previous year (2020: 500).

4.4 The 38% increase in the 54 dB $L_{Aeq,16h}$ standard modal split contour area can be broken down approximately as follows:

- 26% due to changes in movement numbers and fleet mix
- 12% due to noise updates following the 2021 measurements

4.5 The 2021 summer 8-hour night traffic decreased by 5% to 19.4 compared to 2020 (20.4). The 2021 summer night actual modal split (50% W / 50% E) 48 dB $L_{Aeq,8h}$ contour area was 14.2 km^2, an increase of 8% from 2020 (13.1 km^2). The population count within this contour was 700, a 40% increase from 2020 (500). The area increase can be attributed primarily to noise changes following the 2021 measurements.

4.6 The 2021 summer night 48 dB $L_{Aeq,8h}$ contour area assuming the 10-year average runway modal split (73% W / 27% E) was 14.2 km^2 (2020: 13.1 km^2), enclosing a population of 700 (2020: 500).

4.7 Contours for the supplementary noise metric N65 have been produced for the 2021 average summer 16-hour day period. The area of the N65 20-event actual modal split (52% W / 48% E) contour was 78.5 km^2 (2020: 67.2 km^2), enclosing a population of 9,100 (2020: 8,200). With the standard modal split (74% W / 26% E), the N65 20-event contour area was 78.3 km^2 (2020: 67.2 km^2), enclosing a population of 10,100 (2020: 8,250).

4.8 Supplementary noise metric N60 contours have also been produced for the 2021 average summer 8-hour night period. The area of the N60 10-event actual modal split (50% W / 50% E) contour was 7.7 km^2 (2020: 32.7 km^2), enclosing a population of 100 (2020: 1,950). With the 10-year average modal split (73% W / 27% E), the N60 10-event area was 7.2 km^2 (2020: 21.9 km^2), enclosing a population of 200 (2020: 800).

APPENDIX A

References

1. Critchley J B, Ollerhead J B, *The Use of Leq as an Aircraft Noise Index*, DORA Report 9023, September 1990.
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9. ISO 20906:2009 *Acoustics - Unattended monitoring of aircraft sound in the vicinity of airports*.

APPENDIX B

Figures

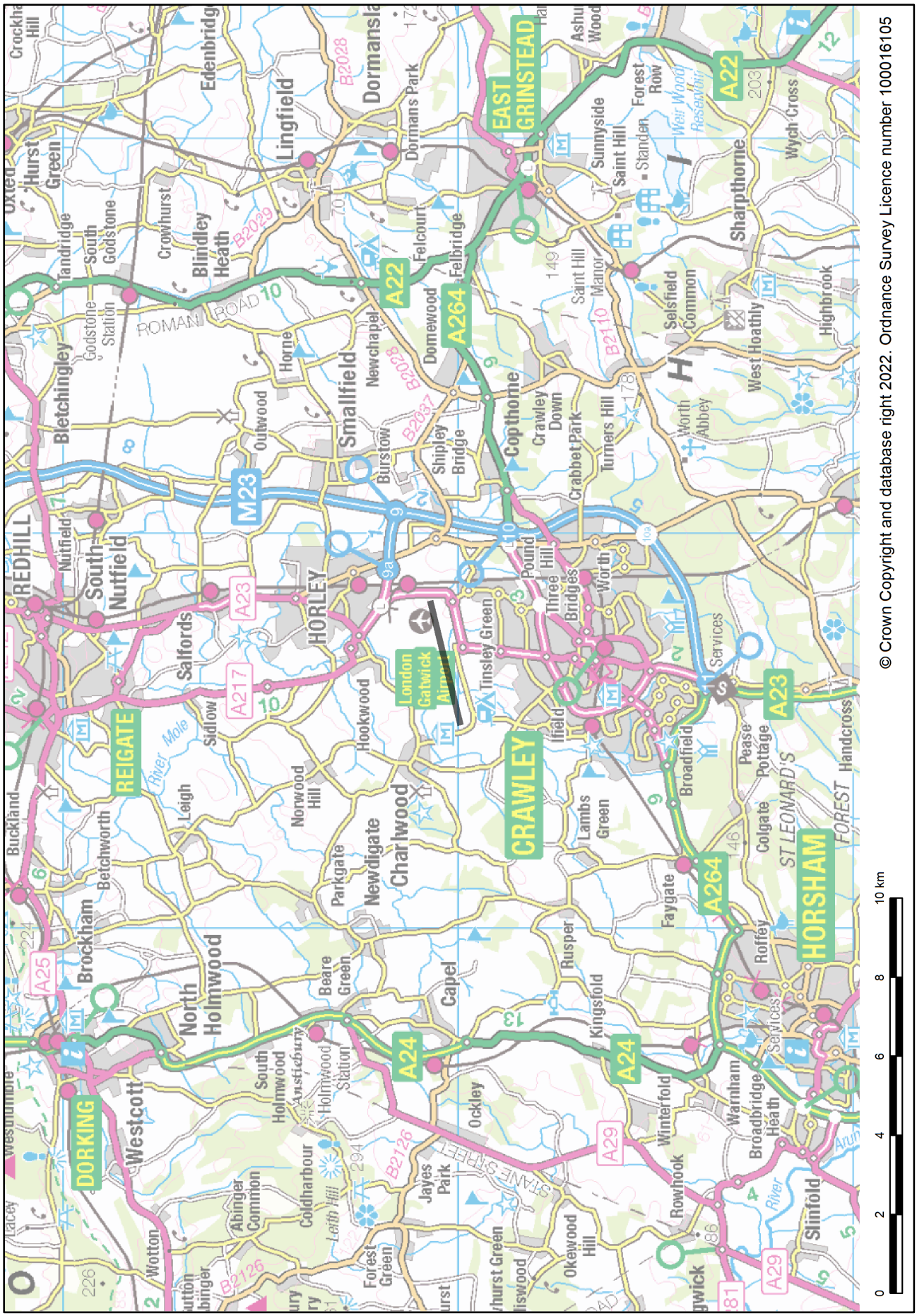


Figure B1 Gatwick Airport and the surrounding area

Figure B2 Gatwick Airport layout

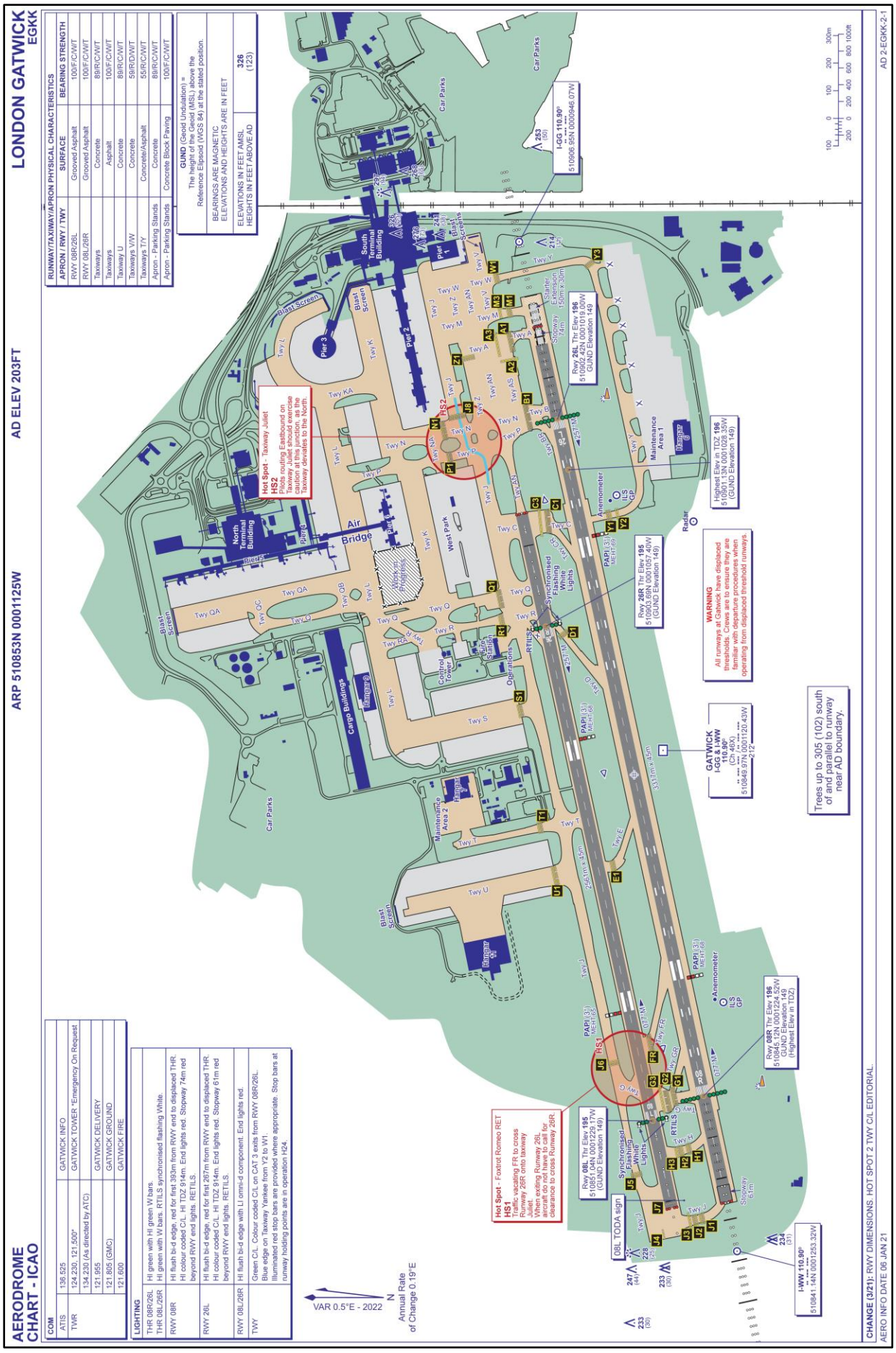
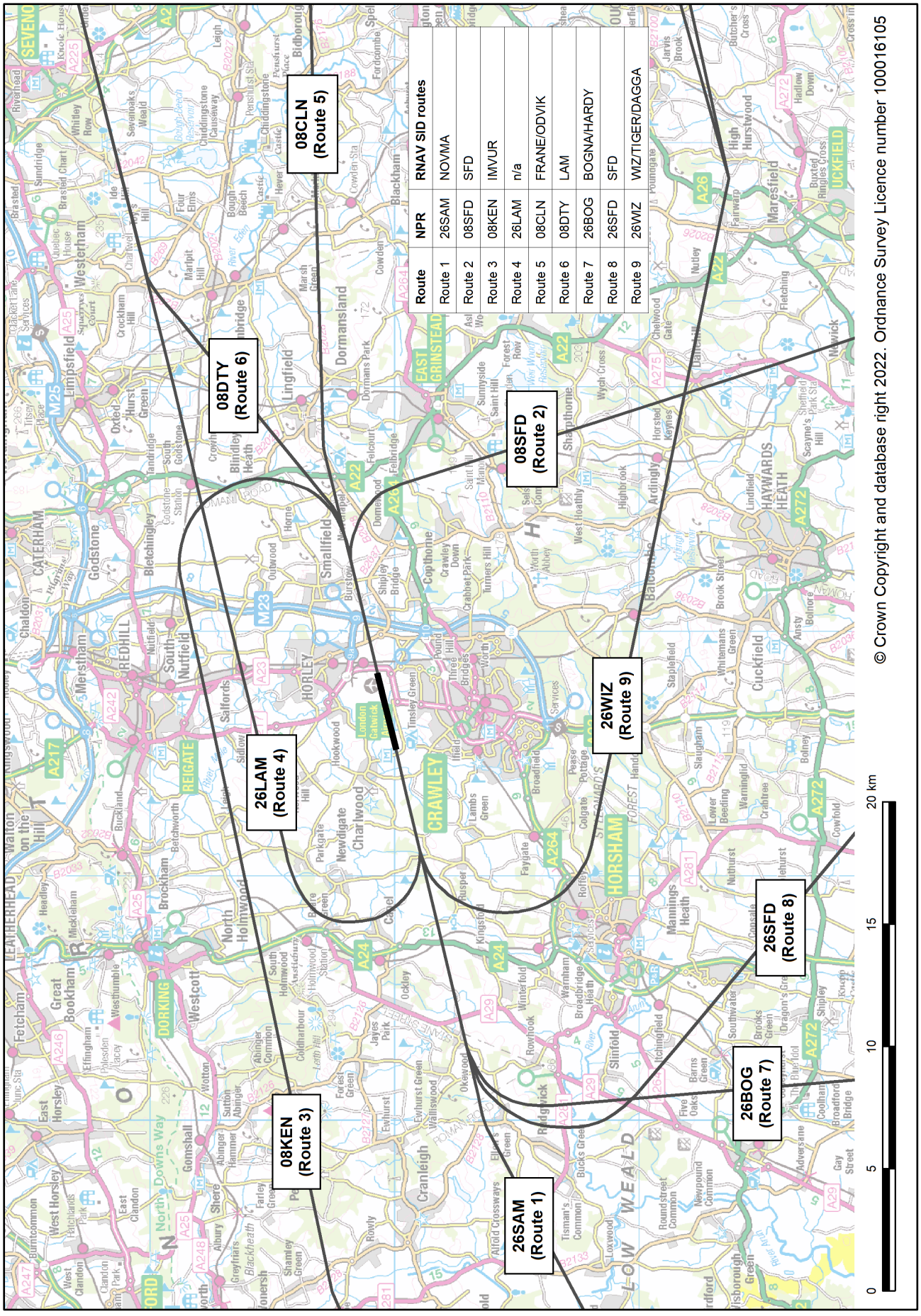


Figure B3 Gatwick NPR/SID routes



Route	NPR	RNAV SID routes
Route 1	26SAM	NOVMA
Route 2	08SFD	SFD
Route 3	08KEN	IMVUR
Route 4	26LAM	n/a
Route 5	08CLN	FRANE/ODVIK
Route 6	08DTY	LAM
Route 7	26BOG	BOGNA/HARDY
Route 8	26SFD	SFD
Route 9	26WIZ	WIZ/TIGER/DAGGA

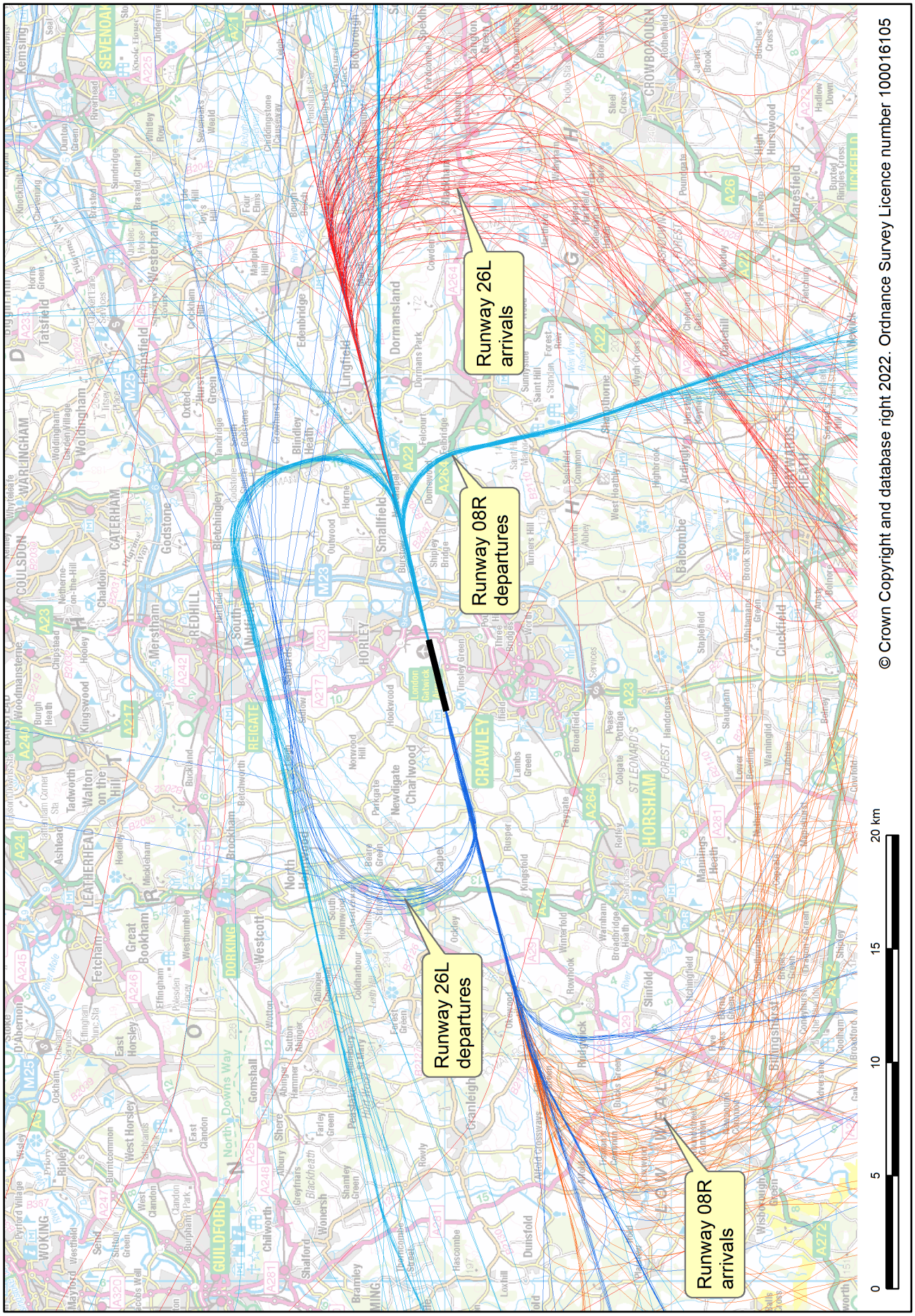
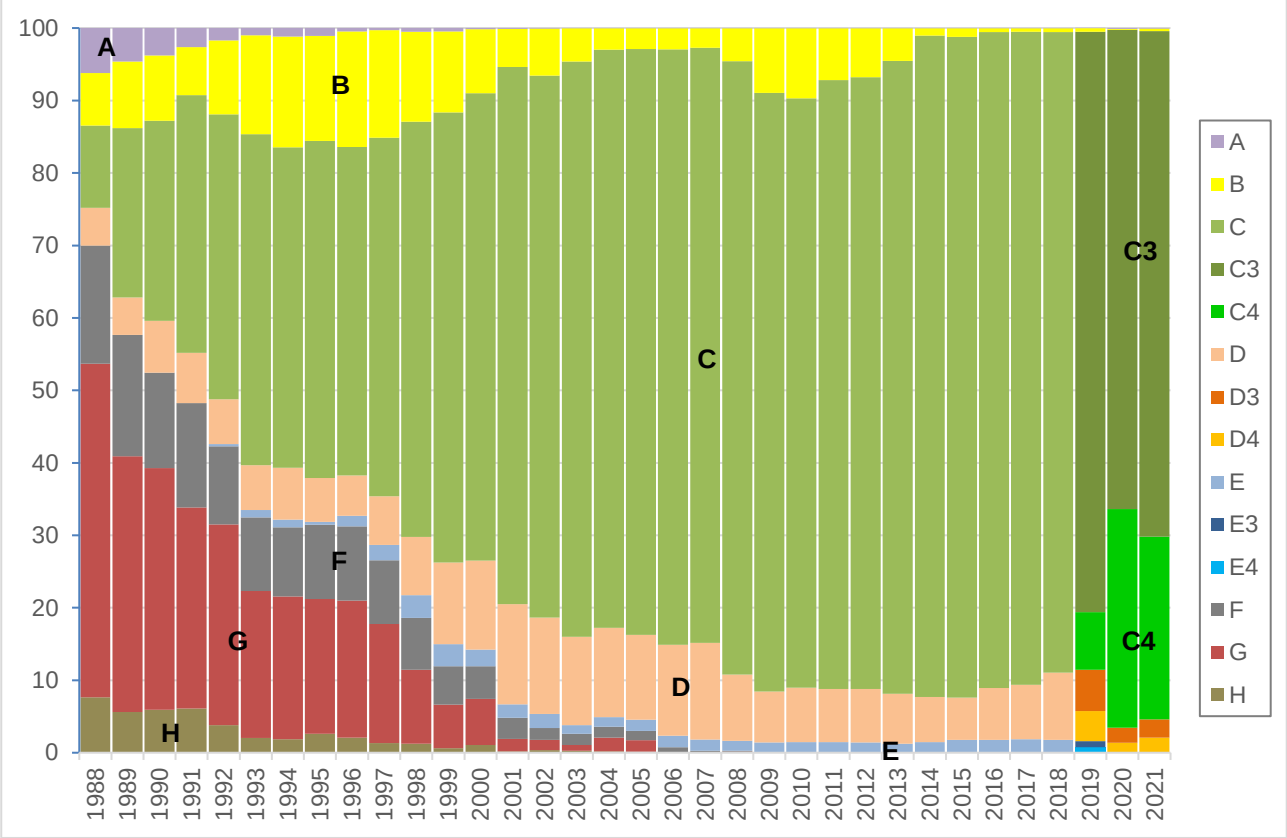


Figure B4 Typical arrival and departure radar tracks at Gatwick

Figure B5 Gatwick Noise Class trend 1988-2021



Note: The percentages from 1990 onwards relate to the average 16-hour L_{eq} day; before 1990 the percentages relate to the average 12-hour NNI day (07:00-19:00 local time). Also, the percentages before 1992 are based on departures only, from 1992 they relate to total movements.

Key to Noise Classes

Noise Class	Description
A	Small propeller (single/twin piston and turboprop light aircraft)
B	Large propeller (twin and 4-propeller aircraft), e.g. ATR-42, BAe ATP
C	Narrow-body aircraft (up to 2018), e.g. Airbus A319, Boeing 737-800
C3	3rd generation narrow-body aircraft (from 2019), e.g. Airbus A319, Boeing 737-800
C4	4th generation narrow-body aircraft (from 2019), e.g. Airbus A320neo
D	Wide-body twins (up to 2018), e.g. Airbus A330, Boeing 777-200
D3	3rd generation wide-body twins (from 2019), e.g. Airbus A330, Boeing 777-200
D4	4th generation wide-body twins (from 2019), e.g. Airbus A350-900, Boeing 787-9
E	Wide-body 3 or 4-engine aircraft (up to 2018), e.g. Airbus A380, Boeing 747-400
E3	3rd generation wide-body 4-engine aircraft (from 2019), e.g. Boeing 747-400
E4	4th generation wide-body 4-engine aircraft (from 2019), e.g. Airbus A380
F	1st generation wide-body 3 or 4-engine aircraft, e.g. Boeing 747-200
G	2nd generation narrow-body twins (including Ch.2 and hush-kitted versions), e.g. Boeing 737-200
H	1st generation narrow-body 3 or 4-engine aircraft (including hush-kitted versions), e.g. Boeing 707

Figure B6 Gatwick 2021 summer day movements by ANCON type

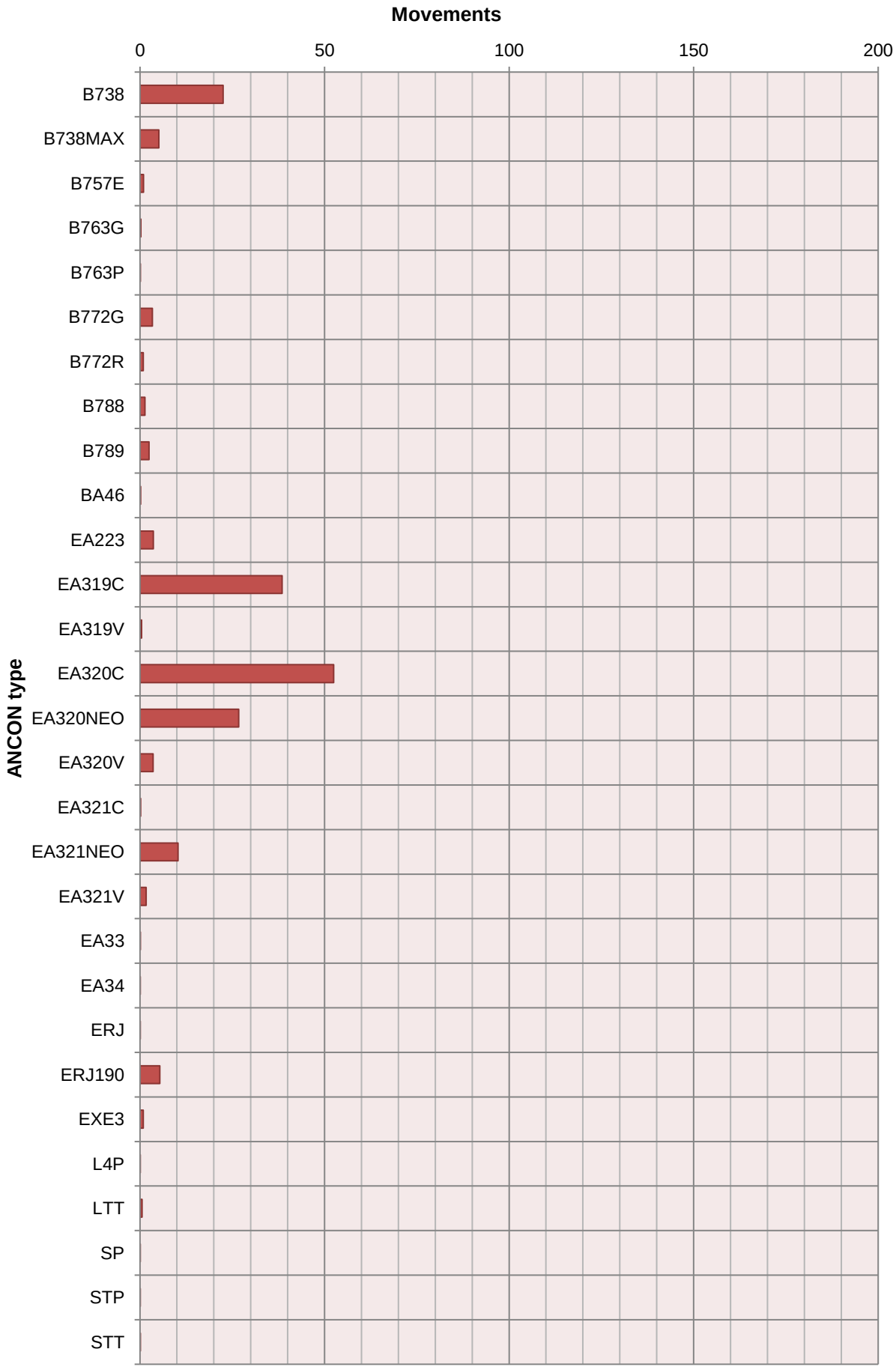


Figure B7 Gatwick 2021 summer night movements by ANCON type

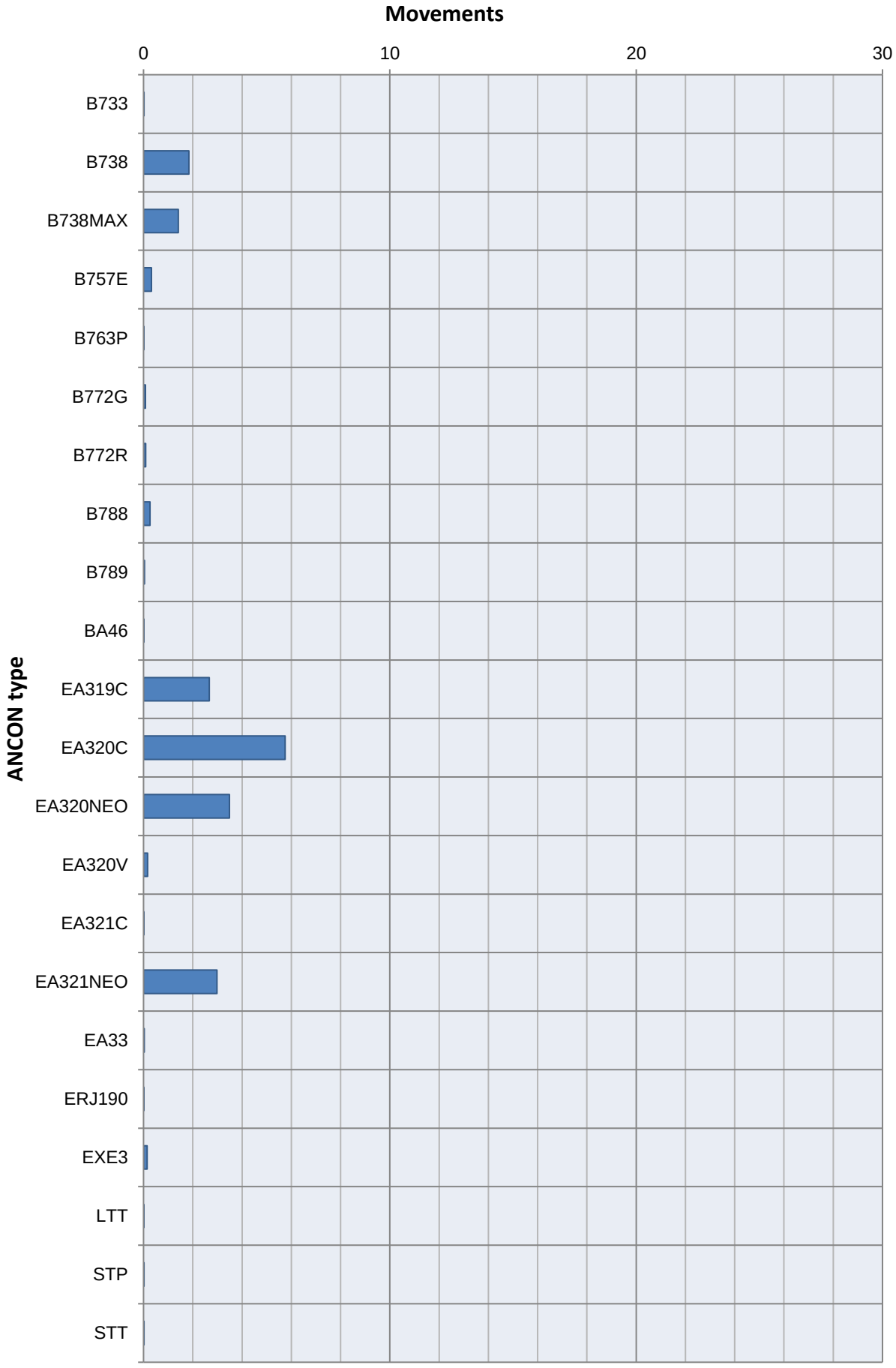


Figure B8 Gatwick 2021 summer day departure traffic distributions by NPR/SID

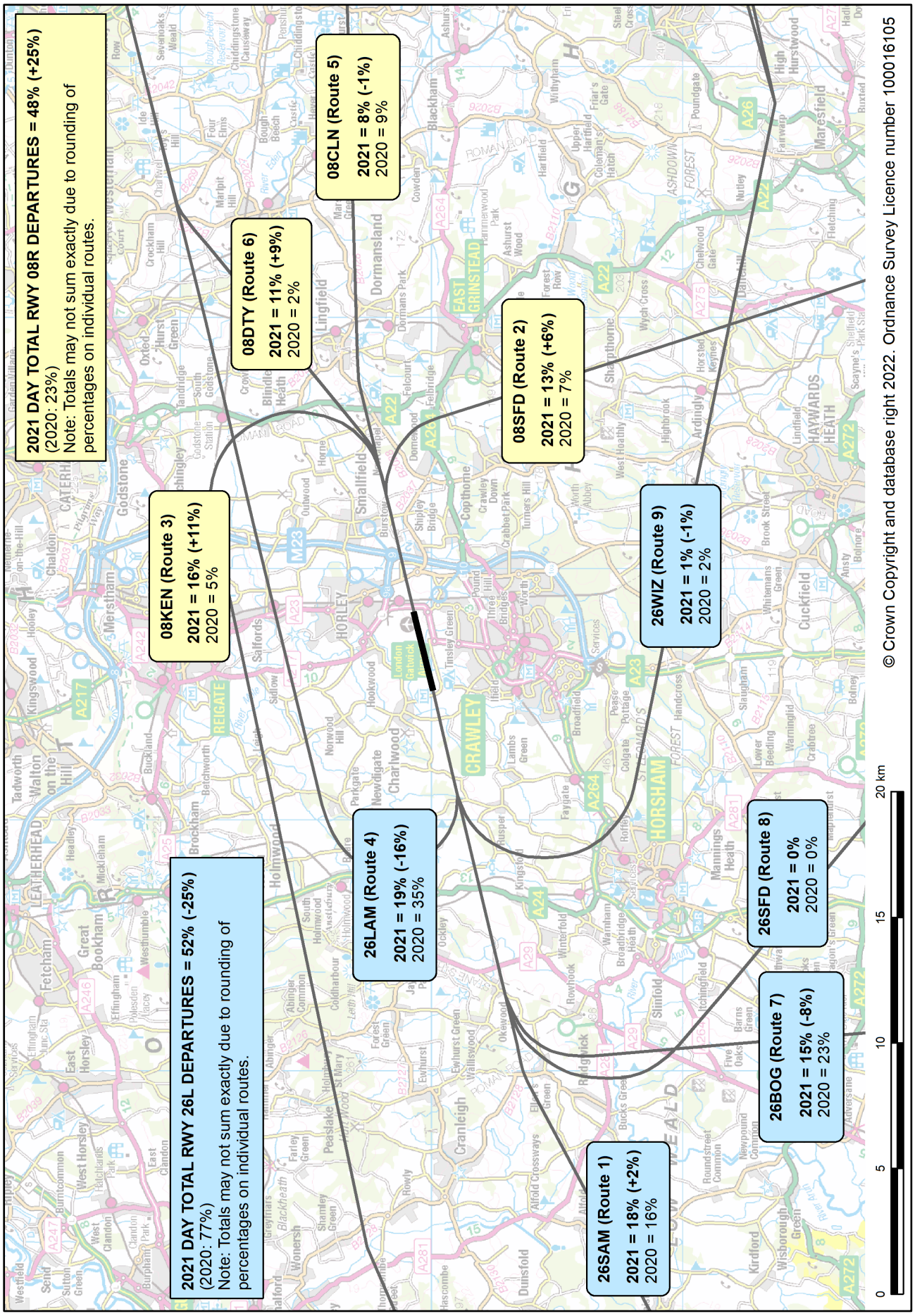


Figure B9 Gatwick 2021 summer night departure traffic distributions by NPR/SID

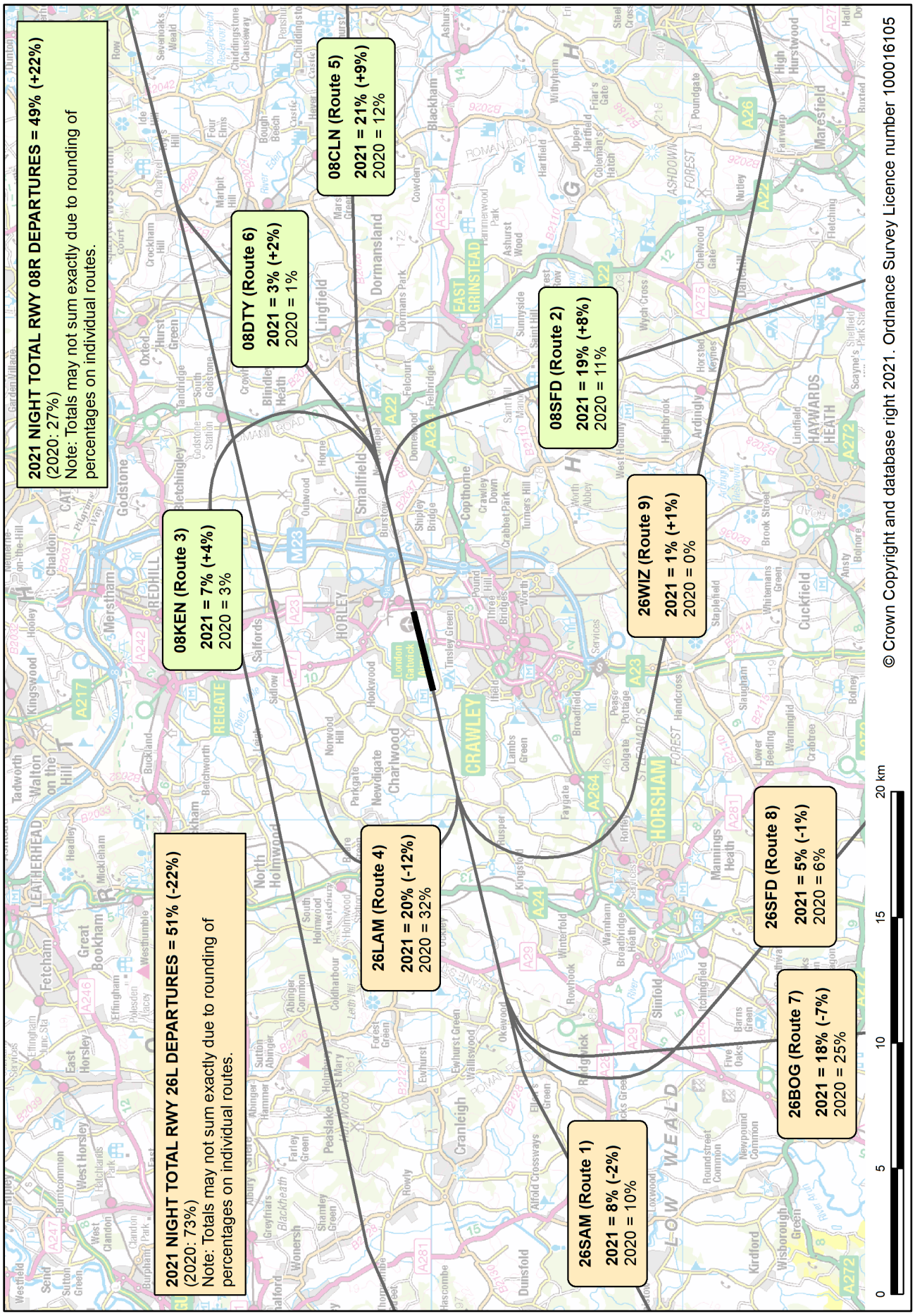
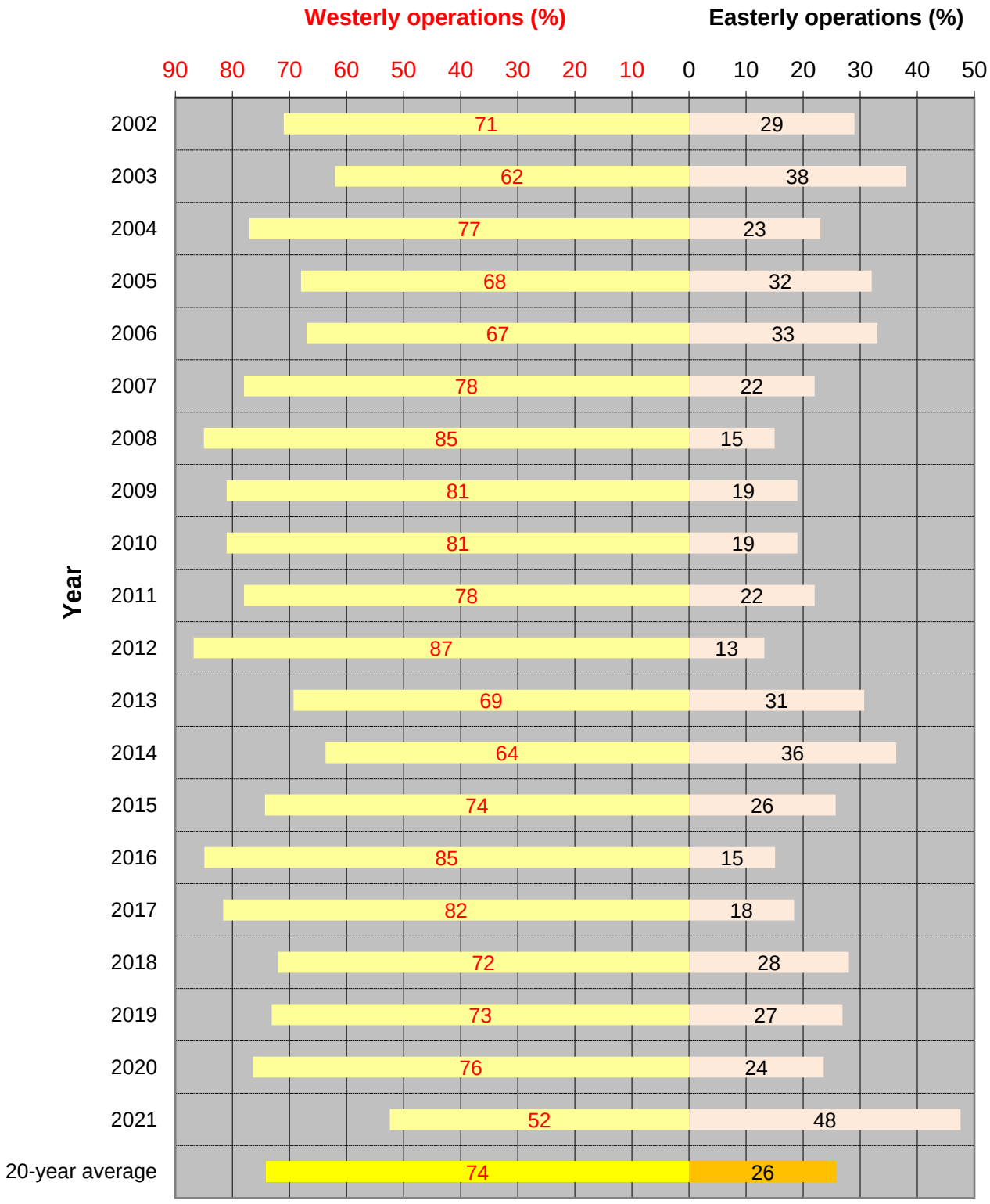


Figure B10 Gatwick summer day runway modal splits 2002-2021



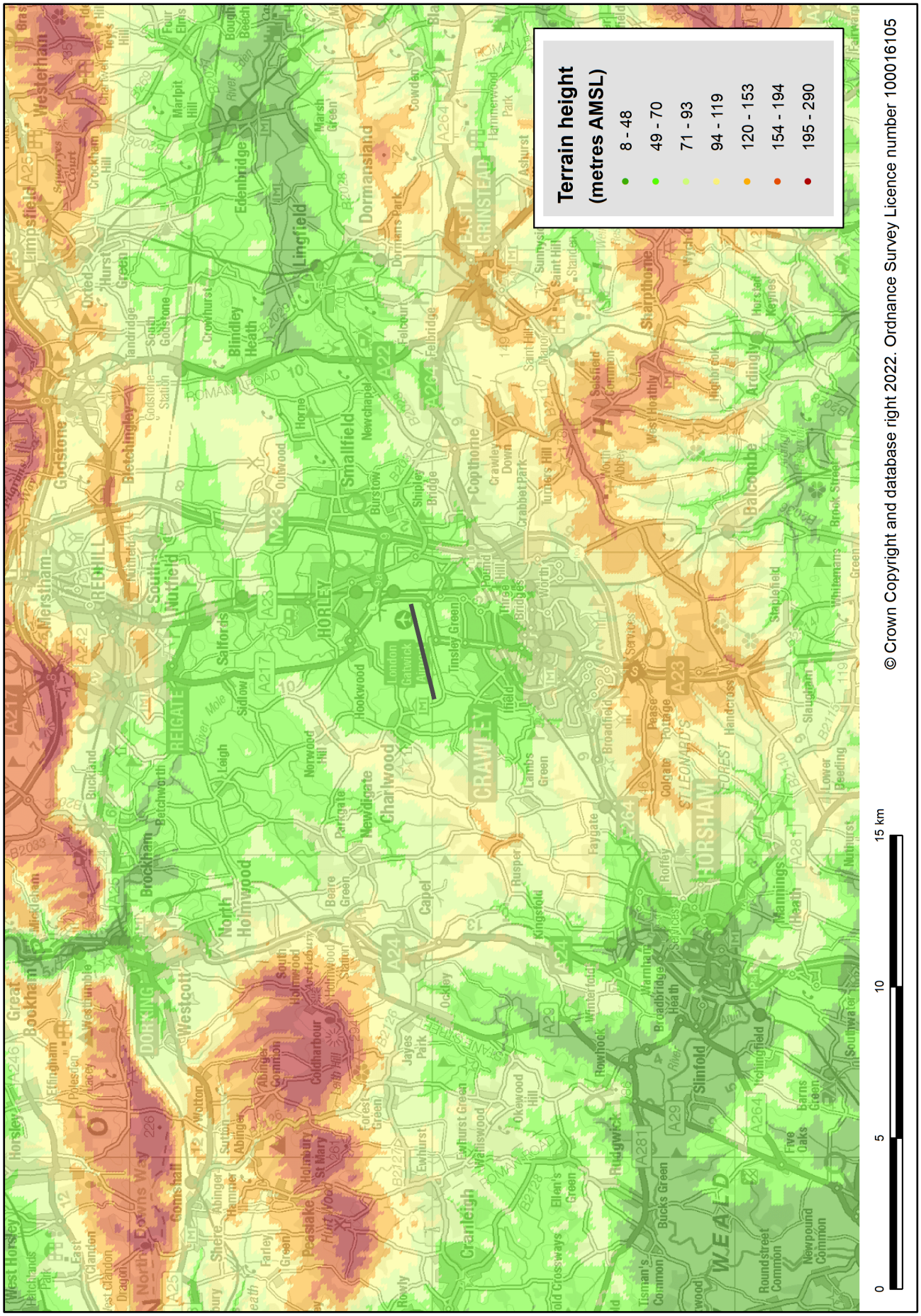


Figure B11 Terrain heights around Gatwick Airport

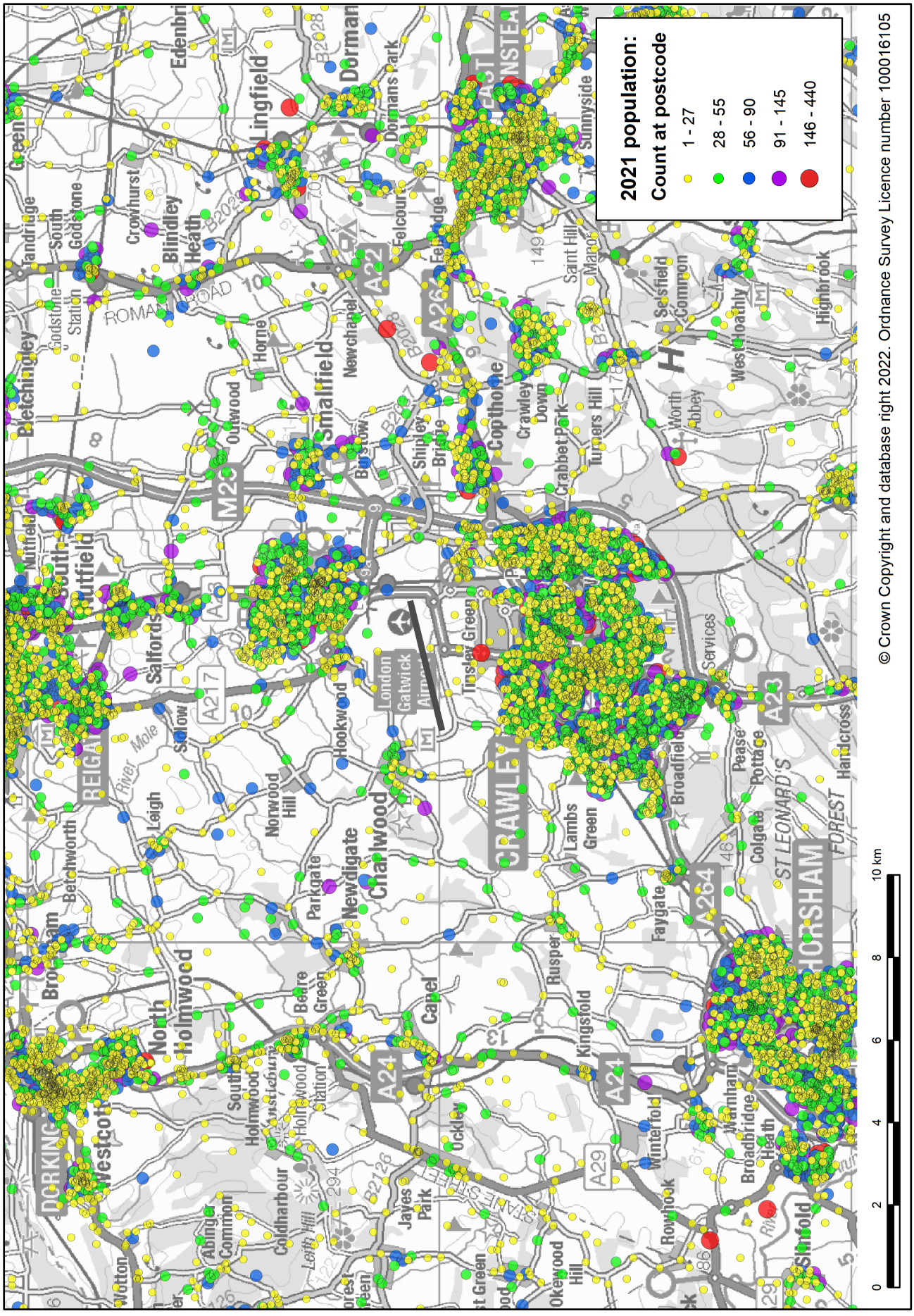


Figure B12 Population data points around Gatwick Airport

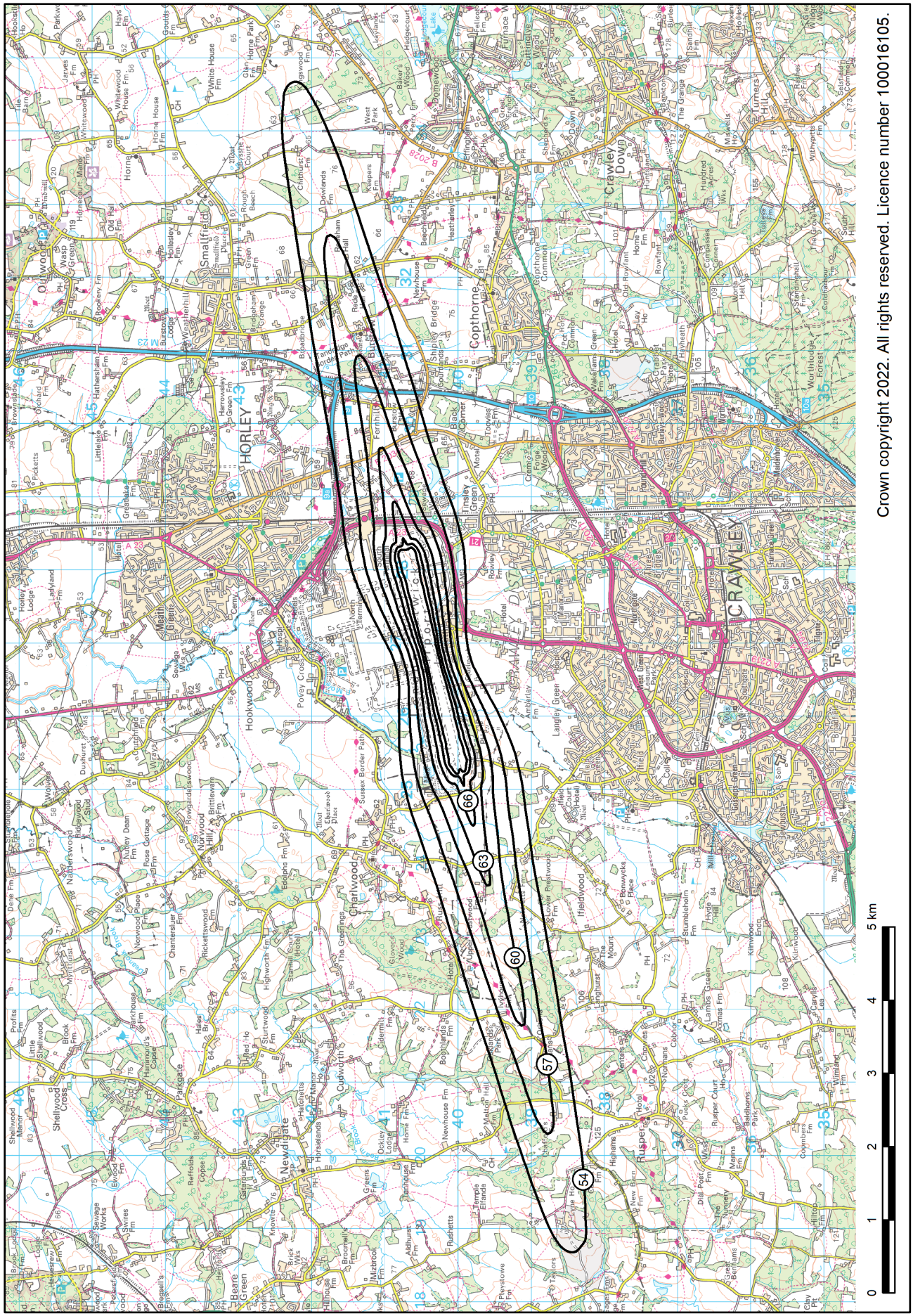


Figure B13 Gatwick 2021 summer day actual modal split (52% W / 48% E) $L_{Aeq,16h}$ contours

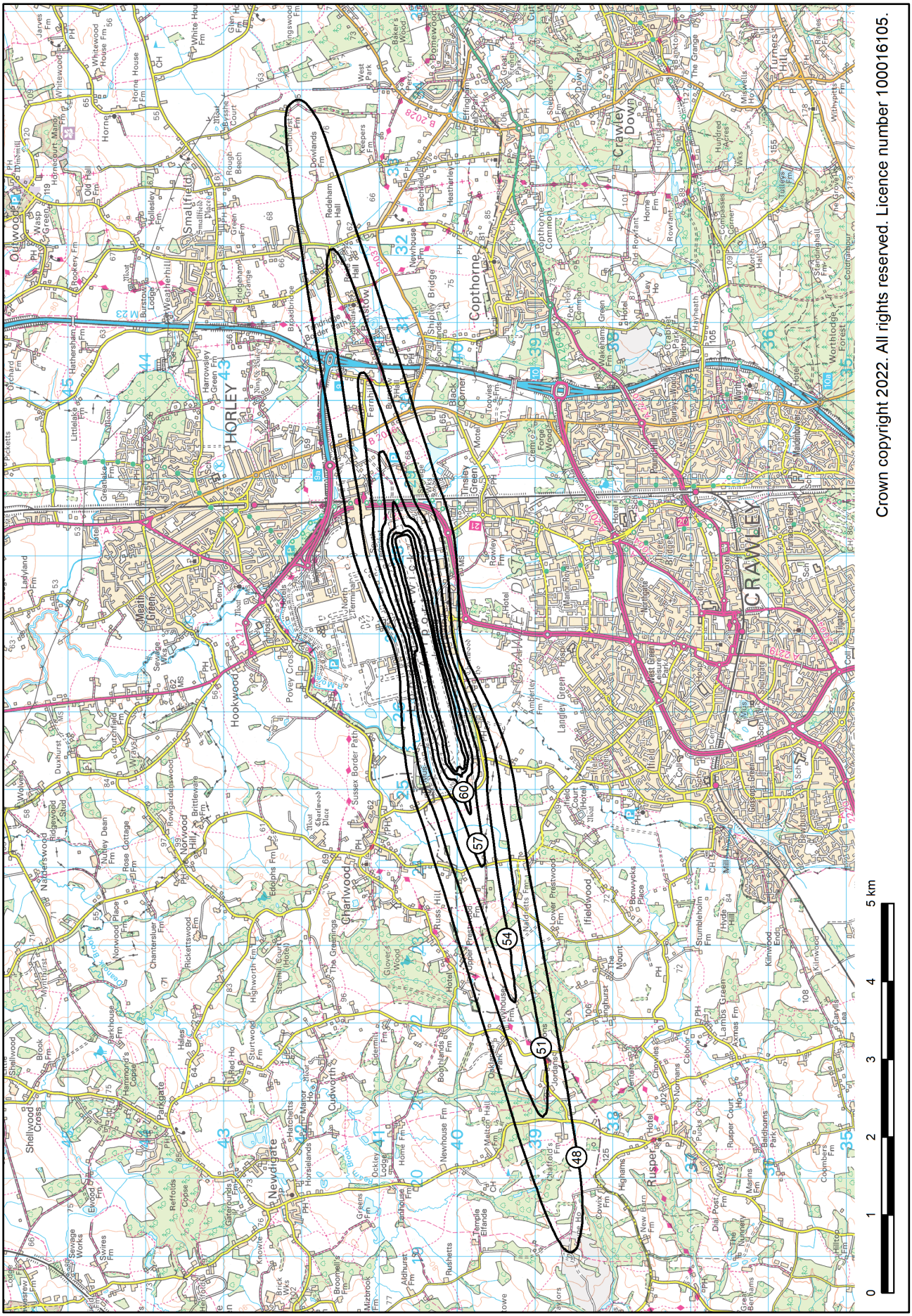


Figure B14 Gatwick 2021 summer night actual modal split (50% W / 50% E) $L_{Aeq,8h}$ contours

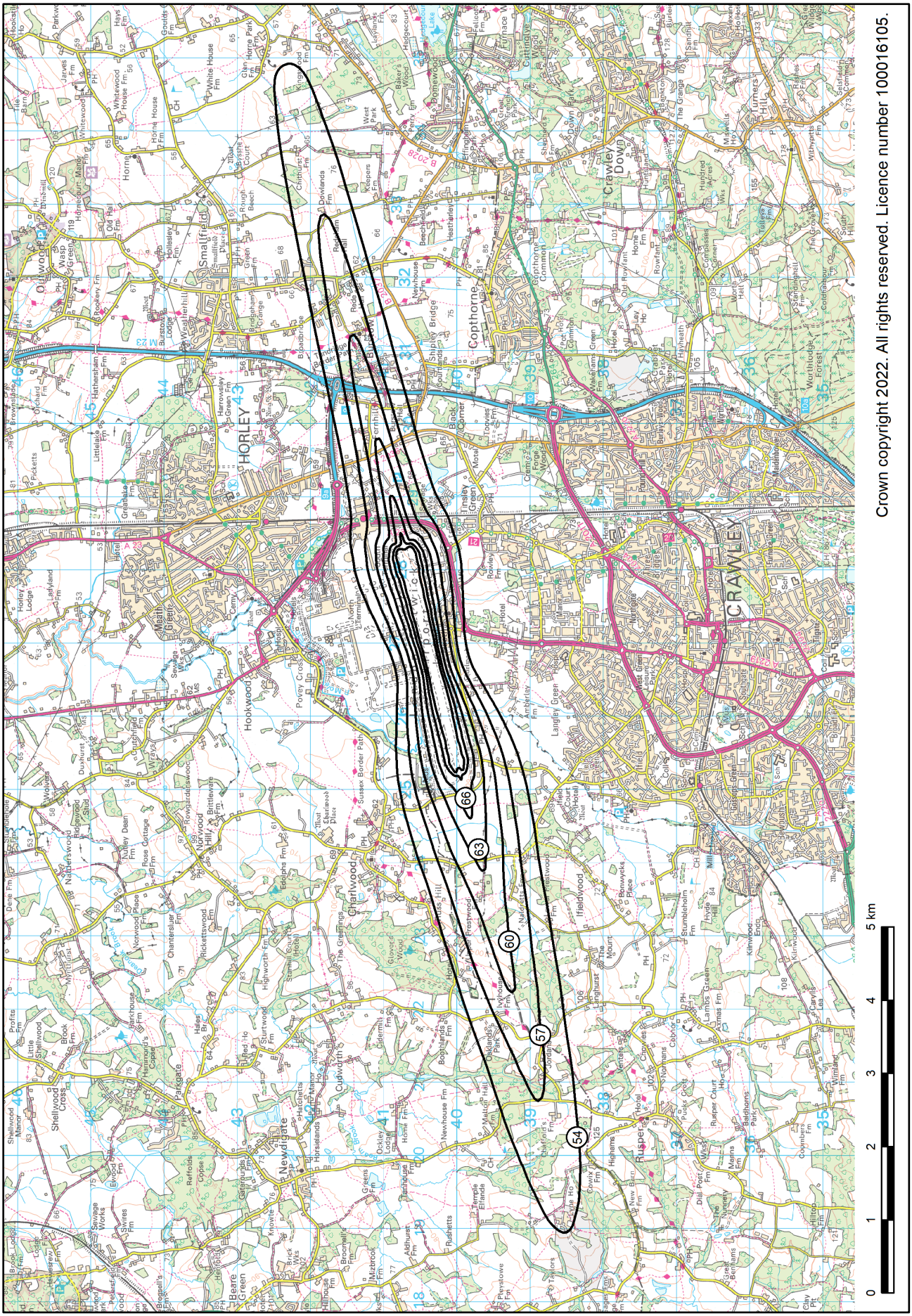


Figure B15 Gatwick 2021 summer day standard modal split (74% W / 26% E) $L_{Aeq,16h}$ contours

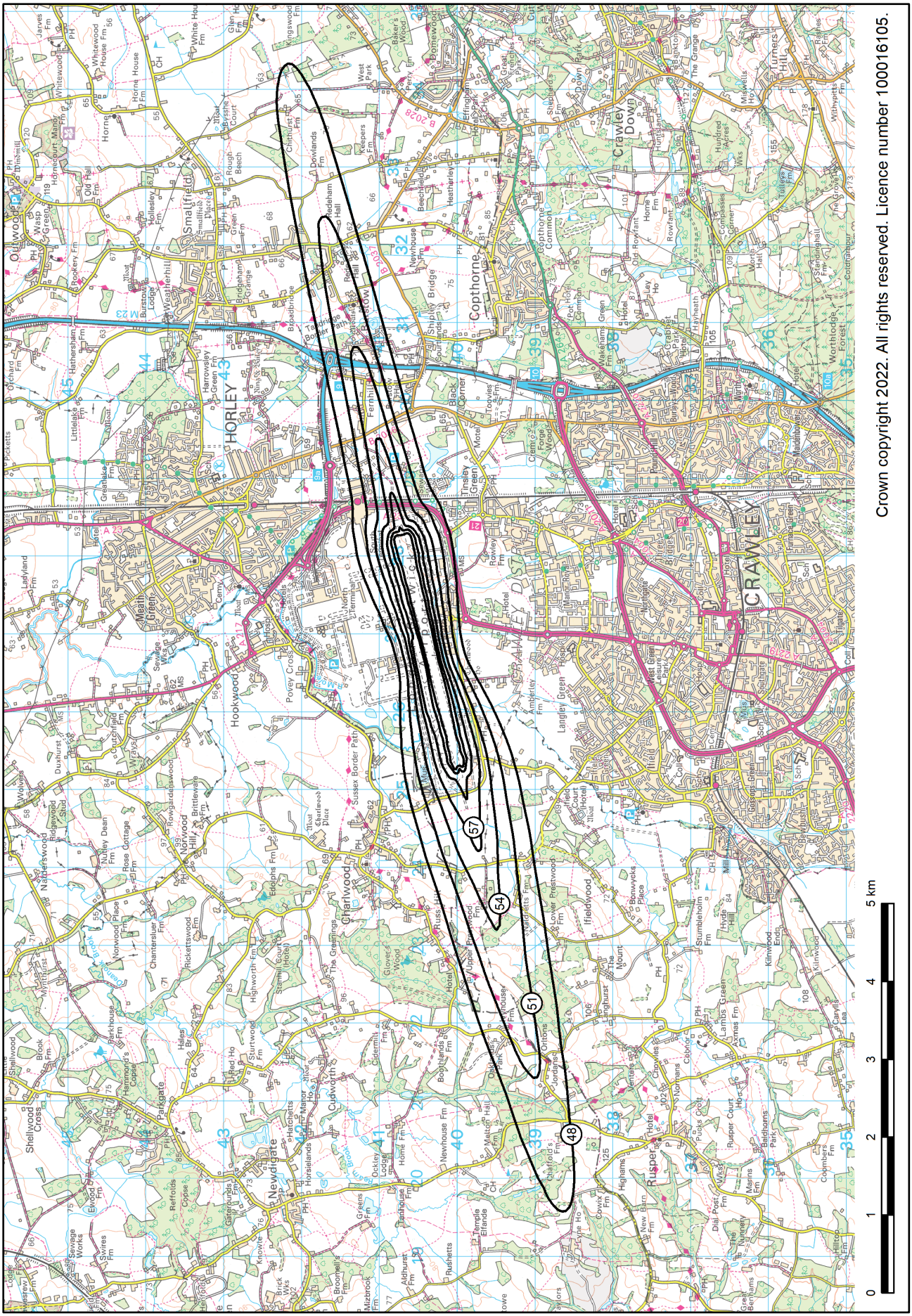


Figure B16 Gatwick 2021 summer night 10-year average modal split (73% W / 27% E) $L_{Aeq,8h}$ contours

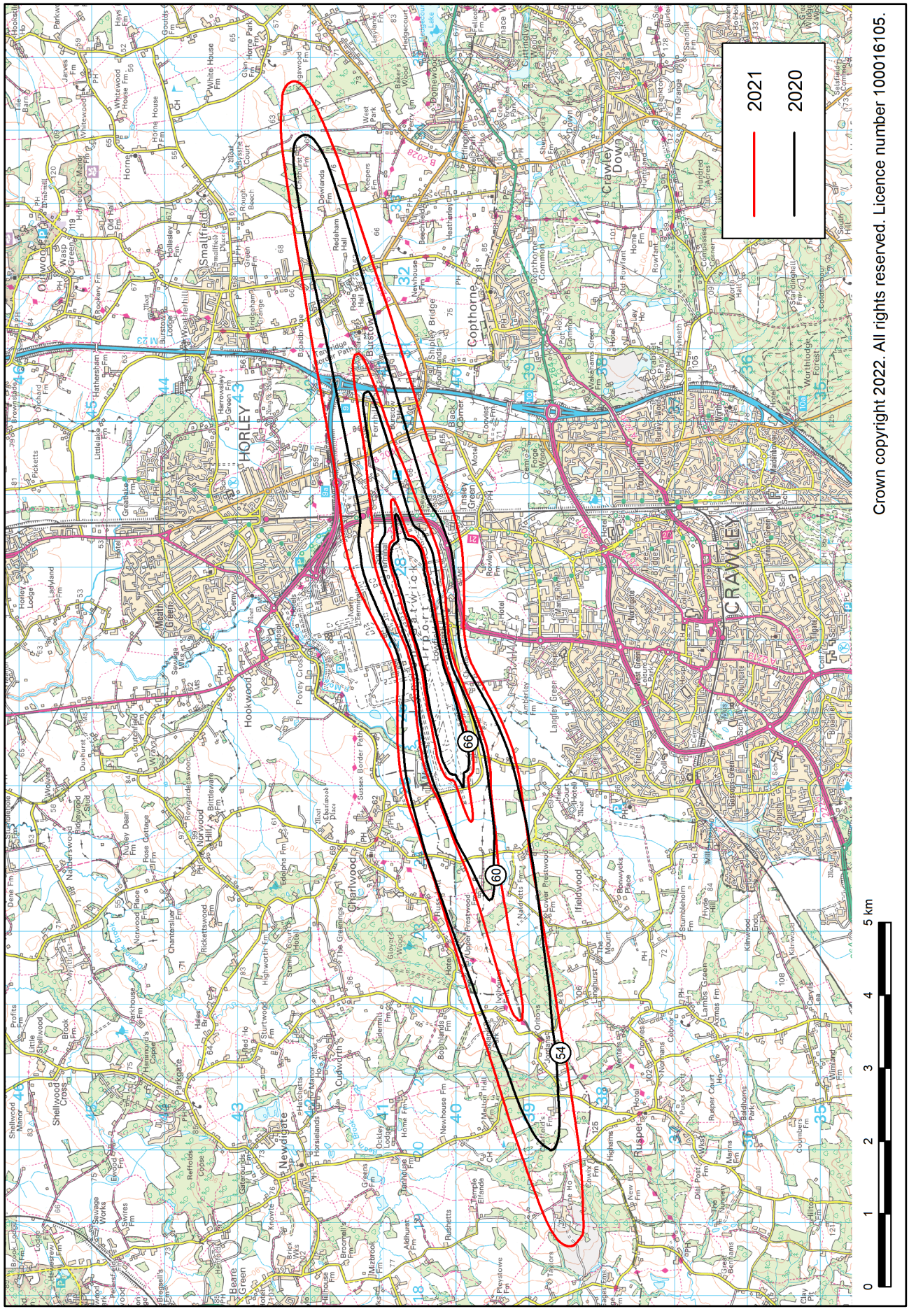


Figure B17 Gatwick summer day actual 2021 (52% W / 48% E) and 2020 (76% W / 24% E) $L_{Aeq,16h}$ contours

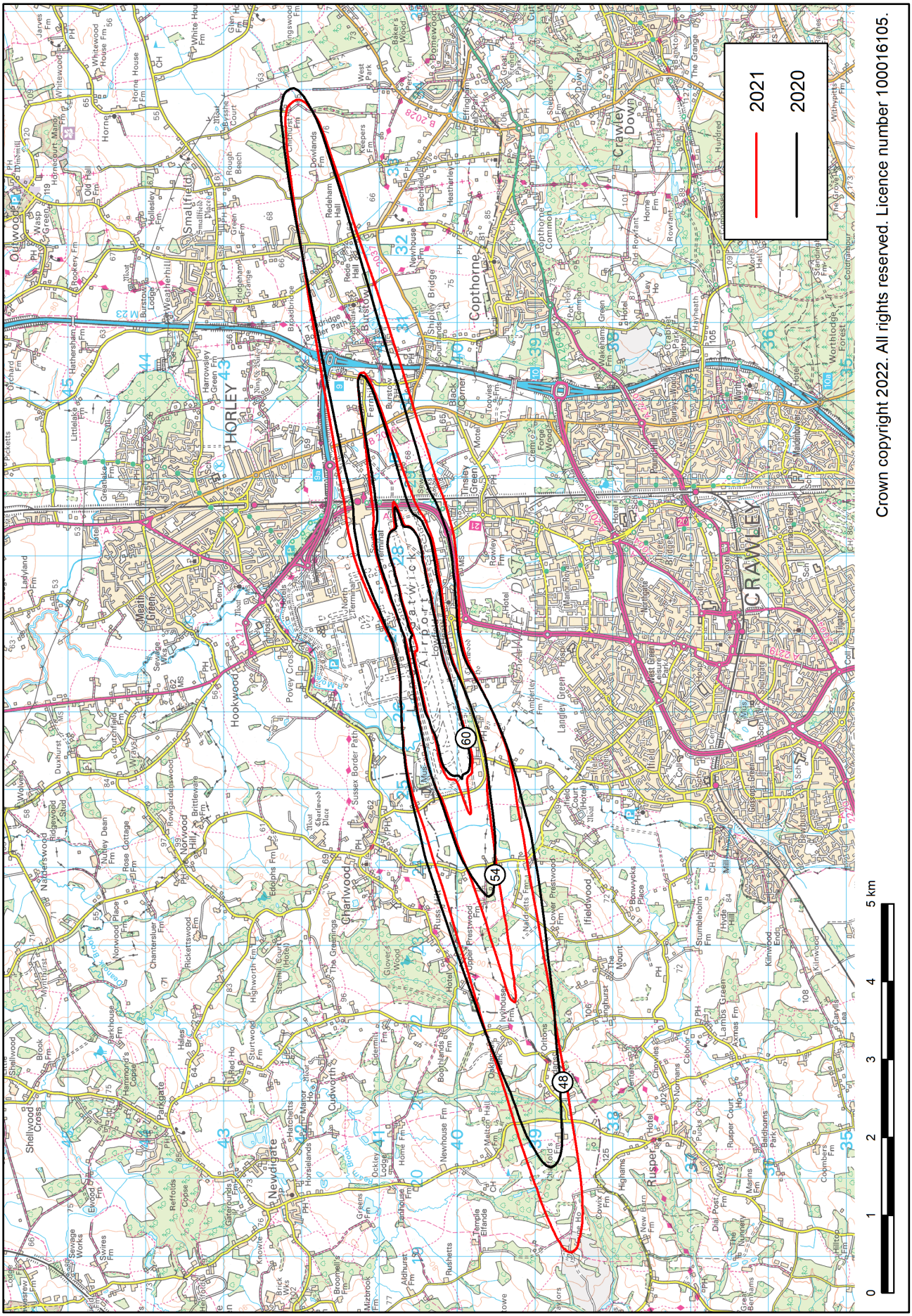


Figure B18 Gatwick summer night actual 2021 (50% W / 50% E) and 2020 (76% W / 24% E) $L_{Aeq,8h}$ contours

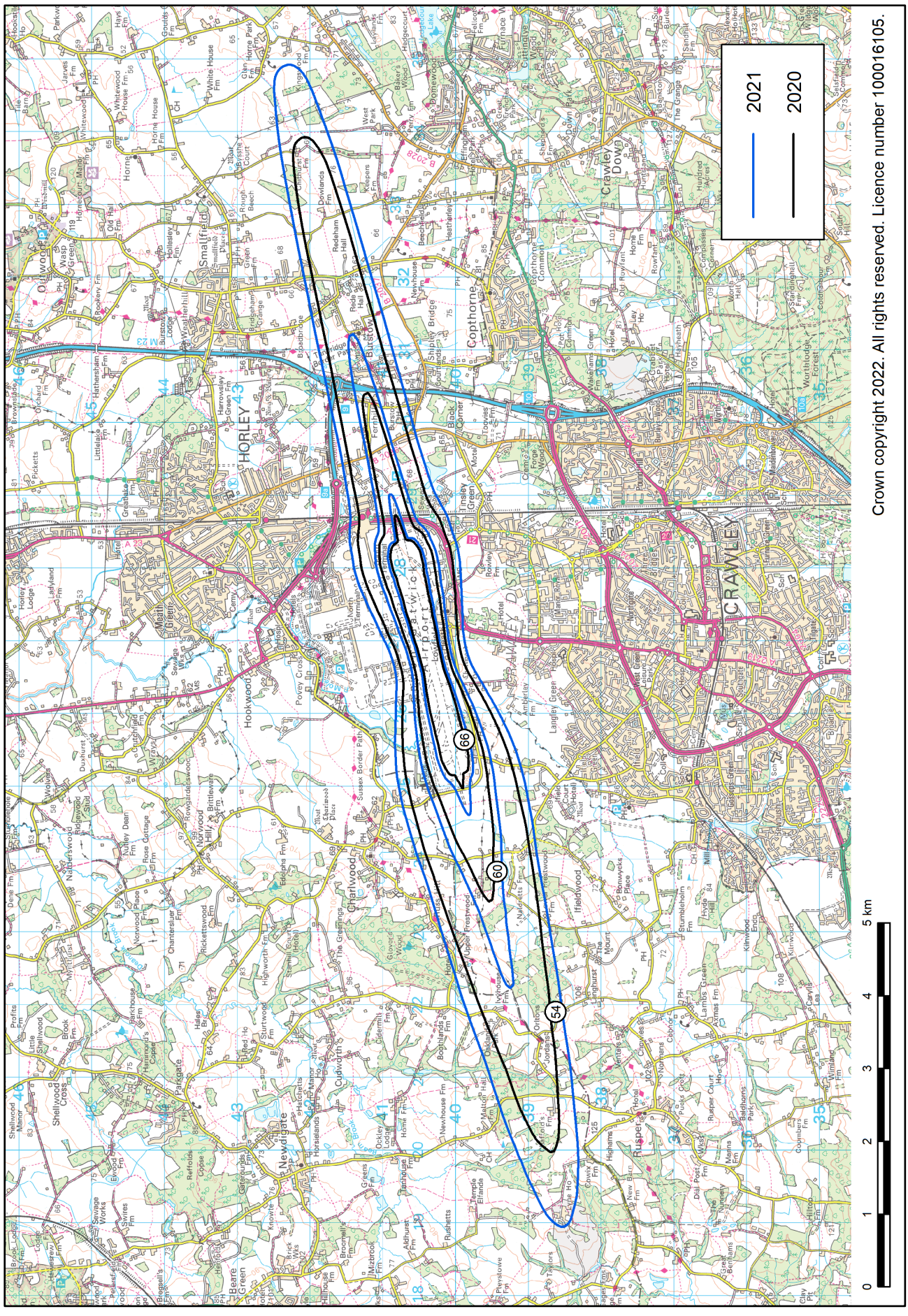


Figure B19 Gatwick summer day standard 2021 (74% W / 26% E) and 2020 (75% W / 25% E) $L_{Aeq,16h}$ contours

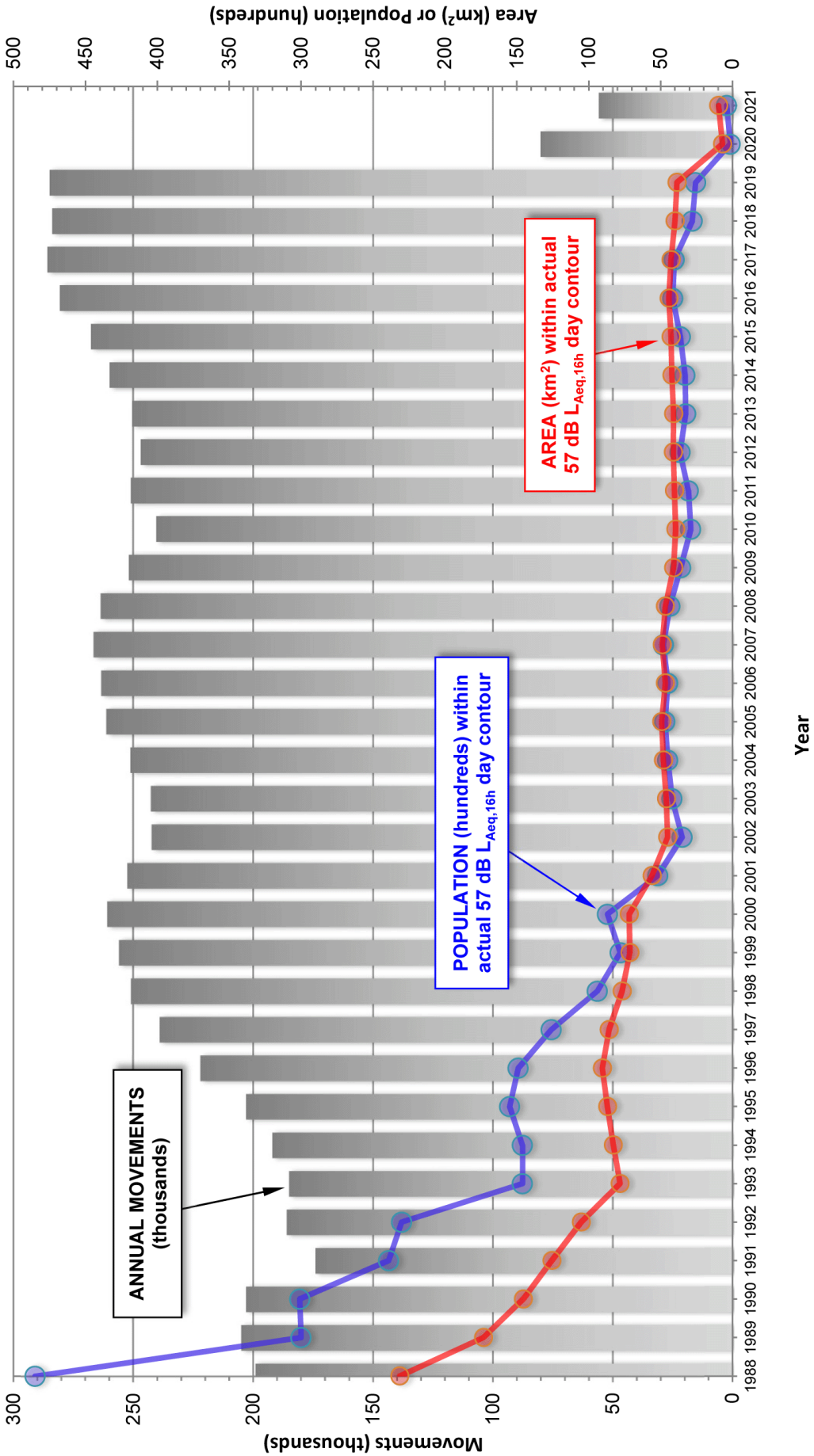


Figure B20 Gatwick 1988-2021 annual traffic and summer day $L_{Aeq,16h}$ noise contour area/population trends

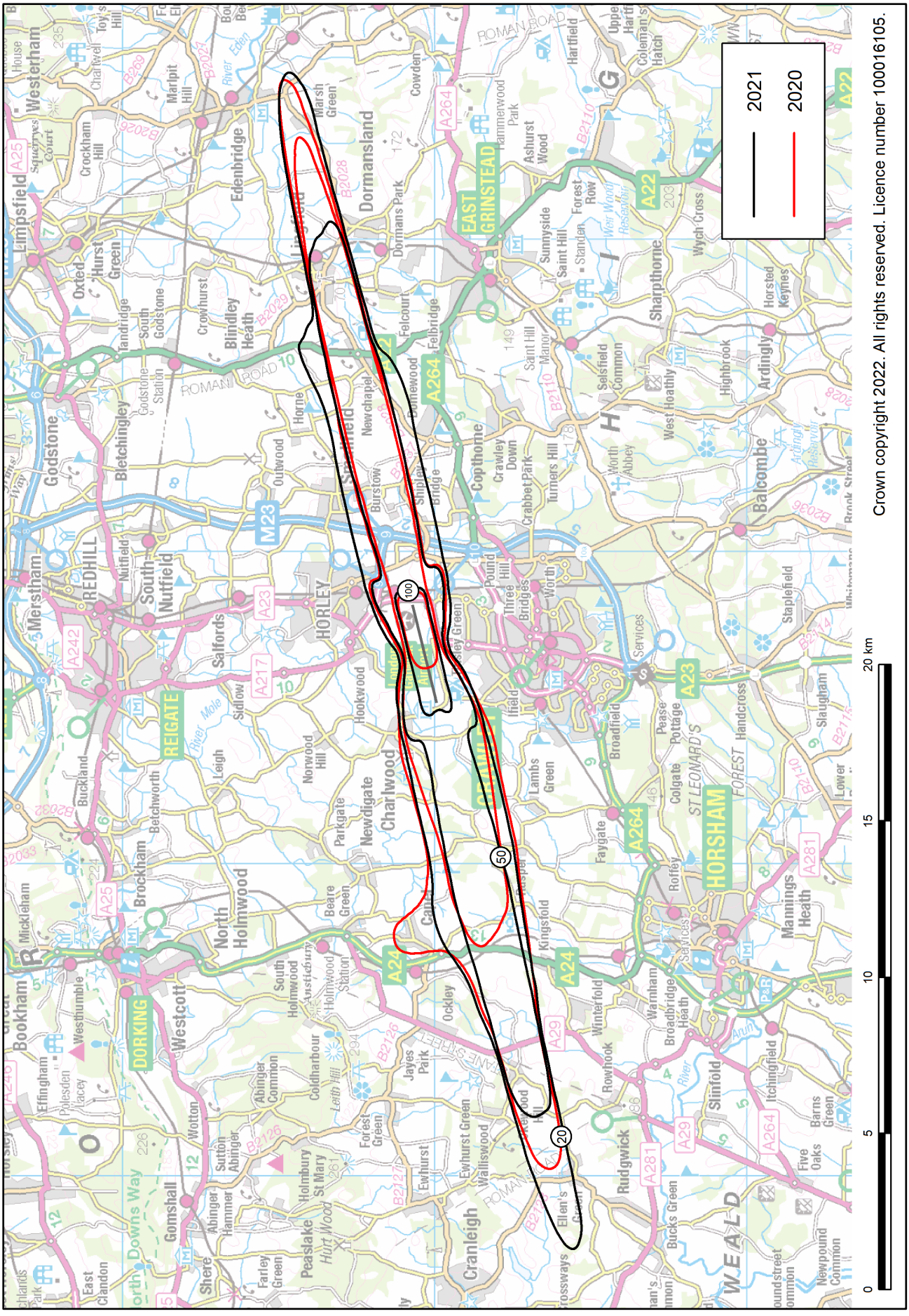


Figure B21 Gatwick 2021 summer day actual modal split (52% W / 48% E) N65 contours

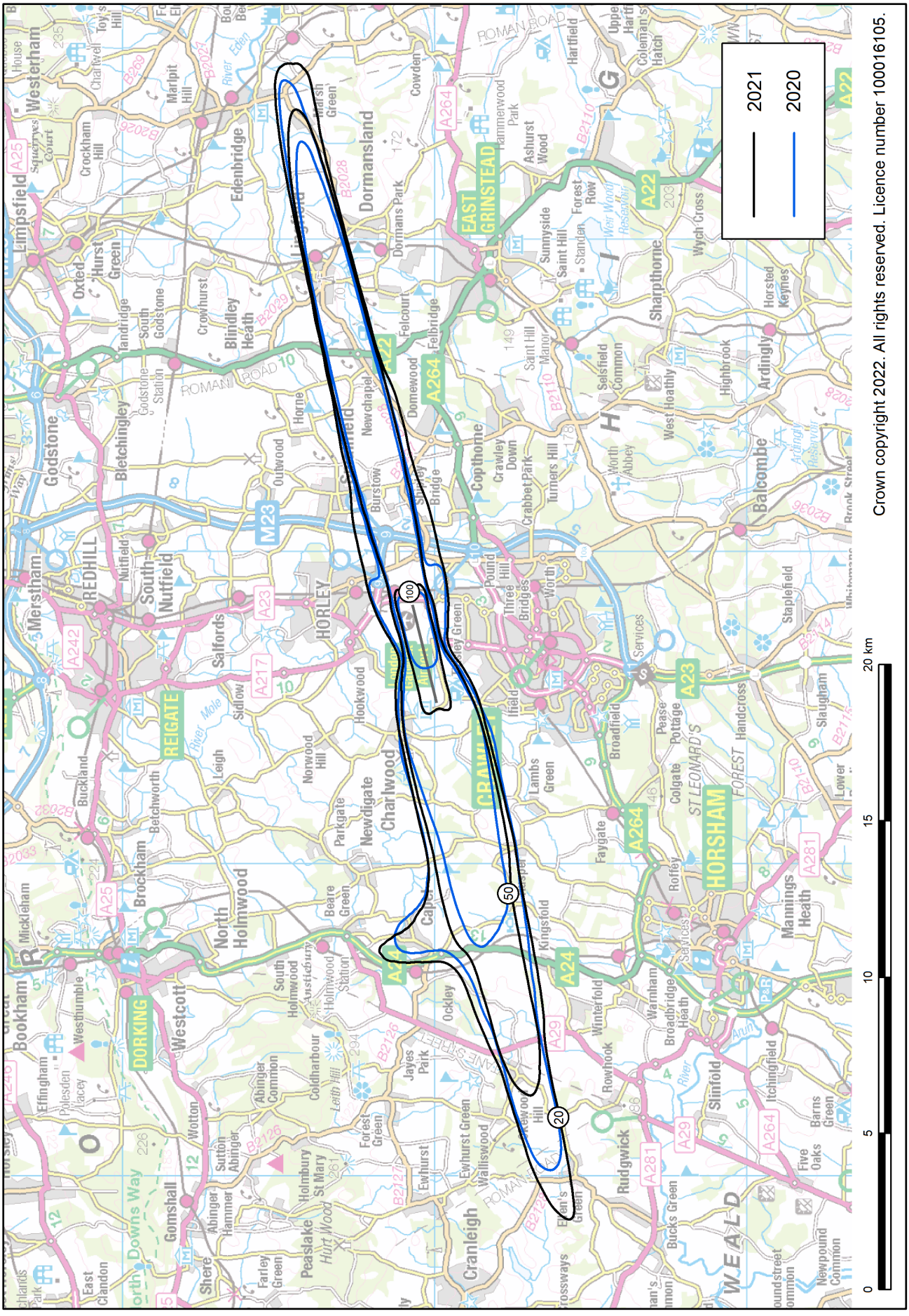


Figure B22 Gatwick 2021 summer day standard modal split (74% W / 26% E) N65 contours

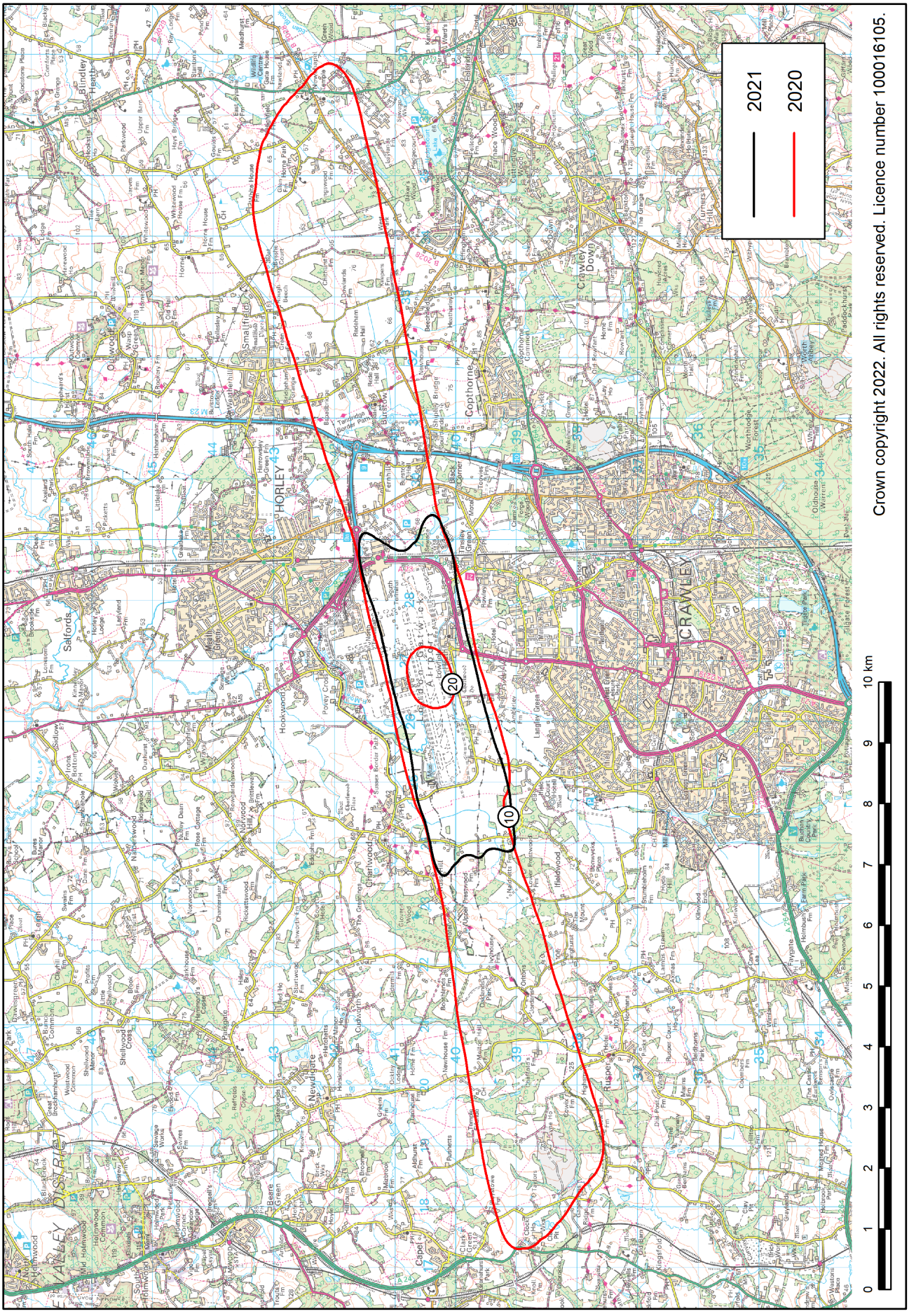


Figure B23 Gatwick 2021 summer night actual modal split (50% W / 50% E) N60 contours

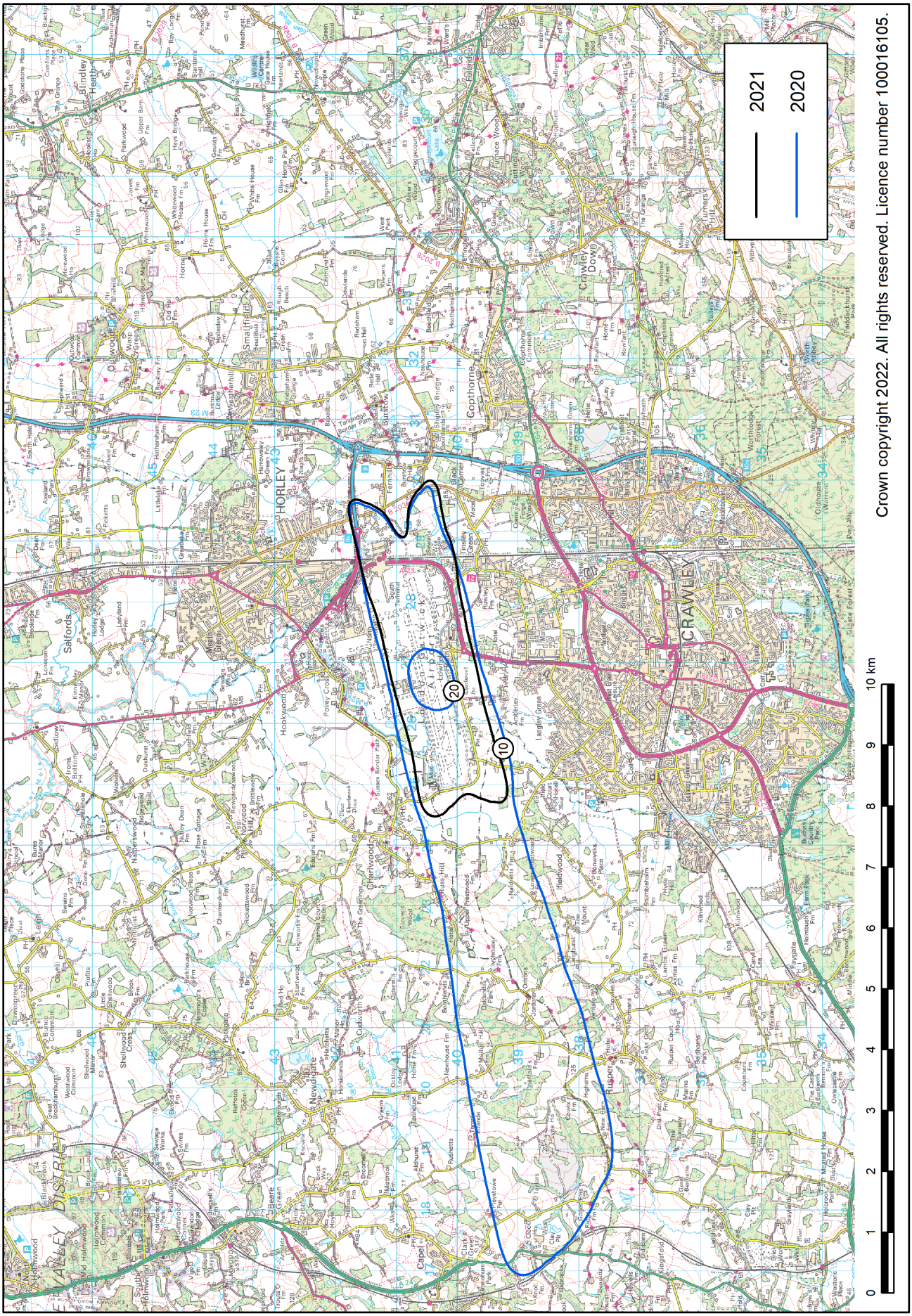


Figure B24 Gatwick 2021 summer night 10-year average modal split (73% W / 27% E) N60 contours

APPENDIX C

Tables

Table C1 Gatwick 2021 average summer day movements by Noise Class

Noise Class	Description	2021 movements	2021 percentage	2020 percentage
A	Small propeller aircraft	0.2	0.1%	0.1%
B	Large propeller aircraft	0.6	0.3%	0.1%
C	Narrow-body aircraft	(172.4)	(95%)	(96%)
↘ **C3**	**3rd generation narrow-body** (e.g. B738)	126.6	70%	66%
↘ **C4**	**4th generation narrow-body** (e.g. EA320NEO)	45.8	25%	30%
D	Wide-body twin-engine aircraft	(8.3)	(5%)	(3%)
↘ **D3**	**3rd generation wide-body twin-engine** (e.g. B763G)	4.6	3%	2%
↘ **D4**	**4th generation wide-body twin-engine** (e.g. B789, EA359)	3.7	2%	1%
E	Wide-body 4-engine aircraft	(< 0.1)	(< 0.1%)	(< 0.1%)
↘ **E3**	**3rd generation wide-body 4-engine** (e.g. B744G)	< 0.1	< 0.1%	< 0.1%
↘ **E4**	**4th generation wide-body 4-engine** (e.g. EA38R)	0.0	0%	0%
	Total	**181.5**	100%	100%

Note: Noise Classes C, D and E have each been subdivided into two separate subclasses since 2019.

Table C2 Gatwick 2021 average summer night movements by Noise Class

Noise Class	Description	2021 movements	2021 percentage	2020 percentage
A	Small propeller aircraft	< 0.1	0.2%	0.1%
B	Large propeller aircraft	< 0.1	0.1%	0%
C	Narrow-body aircraft	(18.8)	(97%)	(95%)
↘ **C3**	3rd generation narrow-body aircraft (e.g. B738)	10.9	56%	(47%)
↘ **C4**	4th generation narrow-body aircraft (e.g. EA320NEO)	7.9	41%	(48%)
D	Wide-body twin-engine aircraft	(0.5)	(3%)	(5%)
↘ **D3**	3rd generation wide-body twin-engine aircraft (e.g. B763G)	0.2	1%	2%
↘ **D4**	4th generation wide-body twin-engine aircraft (e.g. B789, EA359)	0.3	2%	3%
E	Wide-body 4-engine aircraft	(0.0)	(0%)	(0%)
↘ **E3**	3rd generation wide-body 4-engine aircraft (e.g. B744G)	0.0	0%	0%
↘ **E4**	4th generation wide-body 4-engine aircraft (e.g. EA38R)	0.0	0%	0%
	Total	**19.4**	100%	100%

Note: Noise Classes C, D and E have each been subdivided into two separate subclasses since 2019.

Table C3 Gatwick 2020 and 2021 average summer day movements by ANCON type

ANCON type	2020 departures	2020 arrivals	2020 total	2021 departures	2021 arrivals	2021 total	Change departures	Change arrivals	Change total
B733	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B736	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B738	8.4	8.5	17.0	11.4	11.1	22.5	+2.9	+2.6	+5.5
B738MAX	0.0	0.0	0.0	2.6	2.5	5.1	+2.6	+2.5	+5.1
B757E	0.4	0.2	0.6	0.4	0.5	0.9	0.0	+0.3	+0.3
B763G	0.0	0.0	0.0	0.1	0.1	0.3	+0.1	+0.1	+0.3
B763P	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	+0.1
B772G	0.8	0.4	1.2	1.7	1.6	3.3	+0.9	+1.2	+2.2
B772R	0.4	0.4	0.8	0.5	0.4	0.9	+0.1	0.0	+0.1
B773G	0.5	0.5	1.0	0.0	0.0	0.0	-0.5	-0.5	-1.0
B788	0.5	0.3	0.9	0.7	0.6	1.3	+0.2	+0.2	+0.4
B789	0.7	0.4	1.1	1.2	1.2	2.4	+0.6	+0.8	+1.3
BA46	0.1	0.1	0.2	0.1	0.1	0.1	0.0	-0.1	-0.1
EA223	1.8	1.8	3.5	1.8	1.8	3.6	0.0	0.0	+0.1
EA319C	13.1	15.2	28.3	18.6	19.9	38.5	+5.5	+4.7	+10.2
EA319V	0.2	0.1	0.3	0.2	0.2	0.4	0.0	+0.1	+0.2
EA320C	19.7	20.3	40.0	26.6	25.9	52.5	+6.8	+5.7	+12.5
EA320NEO	12.8	13.2	26.0	13.8	12.9	26.8	+1.0	-0.3	+0.7
EA320V	2.6	2.5	5.2	1.9	1.7	3.6	-0.8	-0.8	-1.6
EA321C	0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.0	+0.1
EA321NEO	7.7	7.5	15.2	5.2	5.1	10.3	-2.4	-2.4	-4.9
EA321V	2.4	2.4	4.7	0.8	0.8	1.7	-1.5	-1.6	-3.1
EA33	0.1	0.1	0.2	0.0	0.1	0.1	-0.1	0.0	-0.1
EA33NEO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA359	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ERJ	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
ERJ170	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
ERJ190	0.6	0.6	1.2	2.7	2.7	5.4	+2.1	+2.1	+4.2
EXE3	0.2	0.2	0.4	0.4	0.4	0.9	+0.2	+0.3	+0.5
L4P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LTT	0.1	0.1	0.2	0.3	0.3	0.6	+0.2	+0.2	+0.3
SP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STP	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1
STT	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Total	**73.3**	**75.2**	**148.5**	**91.4**	**90.2**	**181.5**	**+18.1**	**+15.0**	**+33.1**
							(+25%)	(+20%)	(+22%)

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

Table C4 Gatwick 2020 and 2021 average summer night movements by ANCON type

ANCON type	2020 departures	2020 arrivals	2020 total	2021 departures	2021 arrivals	2021 total	Change departures	Change arrivals	Change total
B733	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B738	0.6	0.5	1.2	0.8	1.0	1.8	+0.2	+0.5	+0.7
B738MAX	0.0	0.0	0.0	0.6	0.8	1.4	+0.6	+0.8	+1.4
B757E	0.0	0.2	0.2	0.2	0.1	0.3	+0.2	0.0	+0.1
B763P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B772G	0.0	0.3	0.3	0.0	0.1	0.1	0.0	-0.3	-0.3
B772R	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
B788	0.0	0.2	0.2	0.0	0.2	0.3	0.0	+0.1	+0.1
B789	0.1	0.3	0.4	0.0	0.0	0.0	-0.1	-0.3	-0.4
BA46	0.1	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	-0.1
EA319C	2.4	0.5	3.0	2.0	0.7	2.7	-0.4	+0.2	-0.3
EA320C	2.8	2.3	5.1	2.6	3.2	5.8	-0.3	+0.9	+0.7
EA320NEO	3.2	2.7	5.9	1.3	2.2	3.5	-1.9	-0.5	-2.4
EA320V	0.0	0.0	0.0	0.1	0.1	0.2	+0.1	+0.1	+0.2
EA321C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA321NEO	1.9	2.0	3.9	1.4	1.5	3.0	-0.4	-0.5	-0.9
EA33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ERJ170	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ERJ190	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXE3	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	+0.1
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	**11.2**	**9.2**	**20.4**	**9.3**	**10.1**	**19.4**	**-2.0**	**+1.0**	**-1.0**
							(-18%)	(+11%)	(-5%)

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
B738MAX	Boeing 737 MAX 8
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

ANCON type	Description
CRJ900	Bombardier CRJ900 series
DC10	McDonnell Douglas DC-10
EA221	Airbus A220-100
EA223	Airbus A220-300
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
EA321NEO	Airbus A321neo
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 propeller

ANCON type	Description
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.
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
L_{Aeq}	Equivalent sound level of aircraft noise in dBA, often called ‘equivalent continuous sound level’.
$L_{Aeq,16h}$	Equivalent A-weighted sound level of aircraft noise for the 16-hour daytime period (07:00-23:00 local time)
$L_{Aeq,8h}$	Equivalent A-weighted sound level of aircraft noise for the 8-hour night-time period (23:00-07:00 local time)
L_{Amax}	A-weighted maximum sound level of a noise event.
N60	Number of aircraft noise events above 60 dB L_{Amax}.
N65	Number of aircraft noise events above 65 dB L_{Amax}.
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

Glossary	
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 L_{Aeq} of the noise event normalised to one second.
SID	Standard Instrument Departure