22.150.09 • March 2023

Noise contours around Brussels Airport

for the year 2022

Noise contours around Brussels Airport

for the year 2022

Report

Brussels Airport Company

Brussels National Airport 1M

1930 Zaventem, Belgium

To70 België B.V.

Haag 74

3930 Hamont-Achel, Belgium

tel. +32 470 11 79 28

Email: info@to70.be

By:

Kjeld Vinkx – Recognised expert for environment, noise and vibration

Rik Graas

Brussels, March 2023

Table of contents

List of figures

List of tables

1 Introduction

1.1 Background

The Government imposes an obligation on Brussels Airport Company to annually calculate noise contours in order to perform an assessment of the noise impact caused by departing and landing aircraft on the area surrounding the airport. For Brussels Airport, these calculations are imposed in the Environmental Legislation (VLAREM).

These noise contours are calculated according to a strictly-defined methodology (see §1.3) and reflect evolutions in the number of movements and fleet changes, as well as the actual use of runways and flight paths. Weather conditions and other events in the year affect this actual use.

To check their accuracy of the calculations, the noise contours are compared with the sound measurements at a number of locations around the airport.

Between 1996 and 2014, these contours were calculated by the Acoustics and Thermal Physics Laboratory of the Belgian university KU Leuven. Between 2015 and 2020, this assignment was carried out by the WAVES research group of the Ghent University (UGent). From 2021, these calculations have been carried out by To70. The calculations are commissioned by the airport operator, Brussels Airport Company.

1.2 Disclaimer

This assignment is performed by recognised sound experts working at To70 with the explicit assignment to submit a report in compliance with the legal obligations imposed on Brussels Airport Company pertaining to the applicable legislation. The recognised sound experts at To70 are responsible for the conformity of this result, but are not responsible for the quality and comprehensiveness of the raw data provided to them.

This report contains no information, judgement or opinion about the applicable (environmental) legislation at federal or regional level, and is not suitable to be used for this purpose.

1.3 Compulsory calculations

In accordance with the VLAREM environmental legislation, the operator of an airport categorised as class 1[1] must have the following noise contours calculated annually:

- L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) to show noise impact over 24 hours, and to determine the number of people who are potentially seriously inconvenienced;
- L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) to show noise impact during the day from 07:00 to 19:00;
- $L_{evening}$ noise contours of 50, 55, 60, 65, 70 and 75 dB(A) to show noise impact during the evening from 19:00 to 23:00;
- L_{night} noise contours of 45, 50, 55, 60, 65 and 70 dB(A) to show noise impact at night from 23:00 to 07:00;

[1] Class 1 airports: airports that meet the definition of the Chicago Convention of 1944 on the establishing of the International Civil Aviation Organisation, and having a runway of at least 800 metres;

The VLAREM environmental legislation stipulates that the noise contours are calculated using a calculation model that is compatible with the methodology, as stated in ECAC Doc. 29, 3rd edition (2005) or a later edition. On 7 December 2016, the 4th edition of ECAC Doc. 29 was adopted. The 4th edition is thus decisive for the method of calculation.

Supplementary to the VLAREM obligations, the environmental permit of Brussels Airport Company imposes extra noise contour calculations for:

- L_{den} and L_{night} noise contours, such as are required by the present VLAREM obligation;
- Frequency contours for 70 dB(A) and 60 dB(A). As in preceding years, Brussels Airport Company asked To70 to discuss the following frequency contours:
    - Frequency contours for 70 dB(A) during the daytime period (07:00 to 23:00) with frequencies 5x, 10x, 20x, 50x and 100x
    - Frequency contours for 70 dB(A) at night (07:00 to 23:00) with frequencies 1x, 5x, 10x, 20x and 50x
    - Frequency contours for 60 dB(A) during the daytime period (07:00 to 23:00) with frequencies 50x, 100x, 150x, and 200x
    - Frequency contours for 60 dB(A) at night (23:00 to 07:00) with frequencies 10x, 15x, 20x, and 30x

The number of people who are potentially seriously inconvenienced within the various L_{den} contour zones must be determined on the basis of the dose-response relationship laid down in VLAREM.

The noise zones must be shown on a 1/25 000 scale map.

1.4 History of noise contours

The annual calculation of noise contours started in 1996. Until VLAREM was amended to comply with the European guideline on environmental noise (2002/49/EG) in 2005, the following division of the operational day was used (day: 06:00 – 23:00; night: 23:00 – 06:00). Since VLAREM was adjusted in accordance with the guideline, the official noise contour reports are calculated according to the breakdown of the day in the guideline (day: 07:00 – 19:00; evening: 19:00 – 23:00; night: 23:00 – 07:00).

Since 2011 the INM 7 model (sub-version INM 7.0b) has been used for the calculation of the noise contours. Model version 6.0c was used for the officially-reported noise contours every year from 2000 to 2010. Because the model used and the related aircraft database have an impact on the calculation of the noise contours, the noise contours for the year 2000 and from 2006 to 2010 were recalculated using version 7.0b[2]. In this way, it is possible to assess the evolution of the noise contours since 2000 without being influenced by the calculation model used.

From the beginning of 2021, the calculations are made with the Echo calculation model, developed by AerLabs B.V. With Echo, the calculations are performed according to the methodology stated in ECAC Doc.

[2] With regard to the frequency contours of 60 and 70 dB(A), only the year 2010 was calculated with version 7.0b of the INM calculation model.

29 4th edition. In addition to this, refinements have been implemented since 2021 with respect to previous annual calculations in the data used and the input data in the calculations. Further explanations on the changes in the calculation method, and the effects on the calculated noise levels, are given in Bijlage F.

1.5 Noise calculation model: Echo

From 2021, the calculation of the noise contours has been performed with the Echo noise calculation model. Echo is configured according to the specifications of ECAC Doc. 29, 4th edition (2016). Echo has been verified on the basis of the verification framework of ECAC Doc. 29, 4th edition, Volume 3. Echo makes use of ANP database version 2.3.

This software meets the conditions stated in Vlarem: "The noise contours are calculated using a calculation model that is compatible with the methodology, as stated in ECAC Doc. 29, 3rd edition (2005) or a later edition." The software also meets the European directive for ambient noise 2002/49/EG.

1.6 Population data

The most recent population data available is used to determine the number of residents living inside the contour zones and the number of people who are potentially seriously inconvenienced. For the calculation of the exposure figures in this report use is made of the population data on 1 January 2023. By using the population data on 1 January 2023 instead of those on 1 January 2022, the analysis takes into account the general increase in the number of people living in the vicinity of the airport.

In the past, the exposed population was determined on the basis of a homogeneous distribution of the number of residents over the surface area of the statistical sector. From 2017, the calculation method was refined, whereby the actual location of the address points were included. Based on the address files in the Brussels-Capital Region and Flanders, in combination with the population information per statistic sector, the number of persons is calculated for each address location. This is done by uniformly distributing the number of persons per statistic sector over the number of address locations. In Flanders, address locations on business estates were excluded, unless there are several address locations in a statistical sector on business estates. The above is only applicable to locations in Flanders since an address file for industrial parks within the Brussels-Capital Region was not available.

1.7 Source data

For the calculation of the noise contours, and in order to be able to compare the results against those of the noise monitoring network, Brussels Airport Company has made source data available. A comprehensive summary of these source data carrying references to the corresponding files has been included in Bijlage G.

2 Definitions

2.1 Explanation of a few frequently-used terms

2.1.1 Noise contours

As a result of flight traffic, noise impact is either observed or calculated for every point around the airport. Due to a difference in distance from the noise source, these values may vary sharply from one point to another. Noise contours are isolines or lines of equal noise impact. These lines connect together points where equal noise impact is observed or calculated.

The noise contours with the highest values are those situated closer to the noise source. Farther away from the noise source, the value of the noise contours is lower.

2.1.2 Frequency contours

The acoustic impact of overflight by an aircraft can be characterised at every point around the airport by, for example, the maximum noise level observed during overflight. This maximum noise level can be determined, for example, as the maximum of the equivalent sound pressure levels over 1 second ($L_{Aeq,1s,max}$) during this overflight.

The number of times that the maximum sound pressure level exceeds a particular value can be calculated for the passage of all aircraft overflights during a year. The number of times on average that this value is exceeded each day is the excess frequency. Frequency contours connect locations where this number is equal.

2.1.3 Noise zones

A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

2.1.4 The A-weighted equivalent sound pressure level $L_{Aeq,T}$

The noise caused by overflying aircraft is not a constant noise, but has the characteristic of rising sharply to a maximum level and thereafter declining sharply again. Noise impact at a specific place resulting from fluctuating sounds over a period is represented by the A-weighted equivalent sound pressure level $L_{Aeq,T}$.

The A-weighted equivalent sound pressure level $L_{Aeq,T}$, over a period T, is the sound pressure level of the constant sound containing the same acoustic energy in that same period as the fluctuating sound. The unit for an A-weighted equivalent sound pressure level is the dB(A).

The designation A-weighted (index A) means that an A-filter is used to determine the sound pressure levels. This filter reflects the pitch sensitivity of the human ear. Sounds at frequencies to which the ear is sensitive are weighted more than sounds at frequencies to which our hearing is less sensitive. Internationally, A-weighting is accepted as the standard measurement for determining noise impact around airports. This A-weighting is also applied in the VLAREM legislation on airports.

Three types of $L_{Aeq,T}$ contours are calculated in this report, namely:

- L_{day}: the A-weighted equivalent sound pressure level for the daytime period, defined as the period between 07:00 and 19:00;
- $L_{evening}$: the A-weighted equivalent sound pressure level for the evening period, defined as the period between 19:00 and 23:00;
- L_{night}: the A-weighted equivalent sound pressure level for the night period, defined as the period between 23:00 and 07:00.

2.1.5 L_{den}

The European directive on the control and assessment of environmental noise (transposed in VLAREM II), recommends using the L_{den} parameter to determine the exposure to noise over a longer period. The L_{den} (**L**evel **D**ay-**E**vening-**N**ight) is the A-weighted equivalent sound pressure level over 24 hours, with a (penalty) correction of 5 dB(A) applied for noise during the evening period (equivalent to an increase of the number of evening flights by a factor of 3.16), and 10 dB(A) during the night (equivalent to an increase of the number of night flights by a factor of 10). For the calculation of the L_{den} noise contours, the day is divided as per section 57 of VLAREM II, with the evening period from 19:00 to 23:00 and the night period from 23:00 to 07:00. L_{den} is the weighted energetic sum of these three periods with a weighting according to the number of hours for each period (12 hours for the day, 4 hours for the evening, and 8 hours for the night).

2.2 Link between annoyance and noise impact

An exposure-effect relationship is imposed by VLAREM II to determine the number of people who are potentially seriously inconvenienced within the L_{den} noise contour of 55 dB(A). This equation shows the percentage of the population that is potentially seriously inconvenienced by the noise impact expressed in L_{den} (Figure 1).

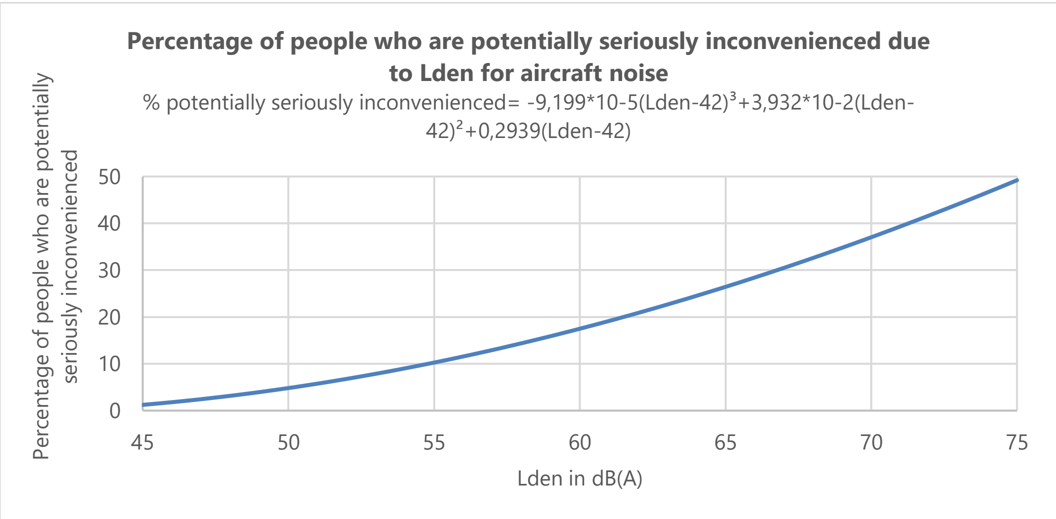


Figure 1: Percentage of people who are potentially seriously inconvenienced due to L_{den} for aircraft noise

(Source: VLAREM – environmental legislation based on Miedema 2000)

The aforementioned equation was established from a synthesis/analysis of various noise annoyance studies at various European and American airports carried out by Miedema[3], and was adopted by the WG2 Dose/Effect of the European Commission[4]. Note that L_{den} only determines around 30% of the variation in reported severe inconvenience[5'6].

European environmental noise directive

In October 2018, a WHO report appeared in which new exposure-effect relationships were proposed. The target value for observed health effects was set at 45 dB L_{den} and 40 dB L_{night}[7]. In a recent expansion to the Environmental Noise Directive (EU-Directive 2002/49/EC)[8] the new WHO exposure-effect relationships were adopted in the EU. With a decision of the Government of Flanders dated 28/01/2022 this was transposed to the Flemish legislation with regard to the reporting in the framework of the European environmental noise directive. No changes were implemented to the provisions in Vlarem II Chapter 5.57 Airports. For this reporting, the same exposure-effect relationship for determining the number of potentially seriously inconvenienced thus remains applicable (Figure 1).

---

[3] Miedema H.M.E., Oudshoorn C.G.M., Elements for a position paper on relationships between transportation noise and annoyance, TNO Report PG/VGZ/00.052, July 2000.

[4] European Commission, WG2 – Dose/Effect, Position paper on dose response relationships between transportation noise and annoyance, 20 February 2002

[5] van Kempen EEMM et al. Selection and evaluation of exposure-effect relationships for health impact assessment in the field of noise and health, RIVM Report No. 630400001/2.005. Bilthoven: RIVM; 2005.

[6] Kroesen M, Molin EJE, van Wee B. Testing a theory of aircraft noise annoyance: a structural equation analysis. J Acoust Soc Am 2008;123:4250–60.

[7] WHO Europe, Environmental Noise Guidelines for the European Region (2018), ISBN 978 92 890 5356 3http://www.euro.who.int/en/publications/abstracts/environmental-noise-guidelines-for-the-european-region-2018,

[8] COMMISSION DIRECTIVE (EU) 2020/367 of 4 March 2020 amending annex III to directive 2002/49/EG of the European Parliament and the Council concerning the method of determining the damaging effects of ambient noise.

3 Methodology

From the start of 2021, use has been made for the calculation of noise contours of the Echo calculation model, developed by AerLabs B.V. This model and the methodology used comply with the methodology prescribed in the VLAREM legislation (Chapter 5.57 Airports). 29, 4th edition (2016). Supplementary to this, several details have been implemented in the calculation method distinguishing these from previous year calculations. This chapter gives a description of the working method.

The procedure for calculating noise contours consists of three phases:

- Collection of information concerning the flight movements, the routes flown, aircraft characteristics and meteorological data.
- Performing the noise calculations with the Echo calculation model.
- Processing of the contours using a Geographic Information System (GIS).

3.1 Data input

The year calculations are based on the actual number of flights, divided into the number of flights during the day (07:00 - 19:00), evening (19:00 - 23:00) and night (23:00 - 07:00).

The following data is required to specify aircraft movements:

- Aircraft type
- Time
- Nature of the movement (departure/arrival)
- Destination or origin
- Landing/take-off runway used
- Flight path followed

The flight information is provided by Brussels Airport Company as an export of the flight movements from the central database (CDB). All the necessary information is stored in this database. The quality of the data is very good.

Each aircraft type is linked to an aircraft type for which the noise and performance data needed for noise calculations are included in the Aircraft Noise and Performance (ANP) database, see §3.2. In most cases, the aircraft type is present in the ANP database. For a small fraction of aircraft that cannot be directly linked, a suitable type is sought based on number of type of engines and starting weight.

Helicopters are not included specifically in the calculations, but they are added proportionally to the flight movement type (landing/take-off) and the time of day. In 2022, helicopter flights were responsible for about 1.4% of movements.

3.1.1 Radar data

Aircraft follow certain routes which are essentially determined by the runway used and the SID flown (Standard Instrument Departure) for take-offs, or by the runway used and the STAR ('Standard Arrival Route') for arrivals. The existing SIDs and STARs are shown in the AIP ('Aeronautical Information

Publication'). This official documentation specifies the procedures to be followed for the flight movements at a specific airport.

These departure descriptions are not strict spatial stipulations, but are laid down as procedures. They must be performed when a manoeuvre is made when a certain height or geographical location is reached. Reaching this height and/or geographical location depends on the aircraft type, weight (and indirectly on the destination), as well as weather conditions. This may result in a very large geographical distribution of the actual flight paths for the same SID. This creates bundles of movements that use the same or similar SIDs.

In the reporting up to and including 2020, a statistical division of the routes actually flown was used in the noise calculations per bundle based on radar data and translated to representative flights paths with a distribution of the traffic over these paths. For frequently-used SIDs, the calculations are further refined by a more detailed subdivision based on aircraft type. The representation of the flight paths was thus a statistical approach to the actual flight paths.

Since last year, the noise calculations are based on the actual flight paths of the flights, by making direct use of radar data. This radar data gives the position of the aircraft every 4 seconds. Based on these data, the flight path can be accurately represented.

Various start points (position where the aircraft comes onto the runway) are available on one runway. This start point is available for each flight based on information that originates from skeyes and is supplied by Brussels Airport Company. In the noise calculations, take-offs are modelled from the actual start point on the runway. Approaches are modelled on the basis of the runway threshold, whereby a flight height is assumed of 50 foot above the runway threshold.

3.1.2 Meteorological data

For the calculation of the noise contours, the actual average meteorological conditions are used. These meteorological conditions are available for each thirty minutes (METAR) via Brussels Airport Company. The wind direction, wind speed and temperatures are linked to the individual flight movements. The headwind is calculated for each individual flight movement and for the runway used. In this way, an annual averaged meteorological condition, which is weighted for the number of flights under each meteorological condition, is obtained.

The wind speed is provided in accordance with the calculation method and converted to knots (kn). The meteorological parameters for 2022 are:

- Average headwind (annual average across all runways, take-off and landing): 6.8kn.
- Average temperature: 12.1°C.
- Average humidity: 72%.
- Average air pressure: 1017.24 mBar.

3.1.3 Take-off profile

The weight of the aircraft at departure influences the take-off profile. Given that this actual weight is not available in the CDB, a method proposed by ECAC Doc. 29 is used to take into account this effect ('stage length'). The Aircraft Noise and Performance (ANP) database gives an assumed take-off weight per stage length. It is assumed that the greater the distance from Brussels Airport to the destination, the more this aircraft will operate at its maximum take-off weight. This is justified, among other things, by the fact that the kerosene constitutes an important part of the total weight of an aircraft. This complies with the methodology of the preceding annual reports.

The coordinates of all airports can be found on the website 'http://openflights.org/data.html'. This list is used to calculate the distance to Brussels Airport from any airport.

The profiles for take-offs are modelled according to the Noise Abatement Departure Procedure (NADP) 1, with acceleration at a height of 3000 foot. This corresponds with the stipulated take-off procedure on Brussels Airport.

3.1.4 Approach profiles

Flights approaching Brussels Airport descend in practice from a great height in a continuous descent to the runway or fly before the final approach for a while at a fixed height. Until 2020, one standard approach profile for approaching traffic was used in the noise calculations. In order to take the impact on noise of different ways of approach into account, three approach profiles have been made available since 2021, and therefore also this year, for approaching traffic for use in the calculations:

- An approach profile with a continuous descent.
- An approach profile with a horizontal segment at c. 560 metres above the airport. This corresponds with an approach altitude of 2,000 foot above sea-level.
- An approach profile with a horizontal segment at c. 870 metres above the airport. This corresponds with an approach altitude of 3,000 foot above sea-level.

The allocations of the most appropriate approach profile for a flight is based on the radar data. Based on this, 38.1% of the approaching traffic is linked to a continuous descent, 40.0% to a descent with a horizontal segment at 2,000 foot and 21.9% to a descent with a horizontal segment at 3,000 foot.

3.2 Aircraft source data

Alongside the relevant data about aircraft movements, runway use and flight paths, the calculation of the noise impact also demands appropriate noise and performance data for the aircraft concerned. The source of the information is the international Aircraft Noise and Performance (ANP) databased, approved by the ECAC.

The ANP database gives noise and performance data of aircraft. The data in the database cover most larger, modern aircraft models and variants. Aircraft models and variants that are not included in the ANP database must be represented by substitutes (often designated as 'proxy' aircraft): aircraft with comparable noise and performance characteristics that are included in the ANP database, whereby a correction is applied based on the difference in noise impact based on noise certification data.

For the year calculation, use is made of ANP version 2.3 (October 2020). In 2022, seven aircraft types were added as 'proxy' aircraft to the ANP database, including NEO variants of the A320 and A321. These types are also taken into consideration in the performance of the year calculations of 2022.

For the year calculation, all registered passages are linked to a 'proxy' based on the 'ANP Aircraft Substitution Tables' for heavy aircraft (take-off weight from 136 tonnes).[9] The link is made based on aircraft type and engine type. A number of aircraft types cannot be linked on the basis of the substitution list. For those types, the allocation of the proxy aircraft is done based on the number and type of engines and start weight.

With regard to the proxy aircraft, a correction factor is applied in the noise calculations for the difference in noise impact between the actual aircraft type and the proxy aircraft. This correction is made on the basis of noise certification data. For most movements (99.96%), Brussels Airport Company has the noise certification data of the aircraft concerned. For the movements for which this is not the case, the correction is based on the correction in the ANP substitution list. That correction is each time based on the most noisy model variant of the aircraft concerned.

3.3 Match between measurements (NMS) and calculations (INM)

Echo enables calculations at specific locations around the airport. To check the assumptions concerning the input data and the accuracy of Echo, the calculated noise impact is compared with sound measurements taken at 31 locations.

The comparison with measurements provides a validation of the calculations. Both the noise calculations as well as the noise measurements imply limitations and uncertainties. The noise calculations do not, for example, take the actual height at which an aircraft flies overhead into account (this is determined by the assigned standard departure and approach profiles, not by the actual radar data). The measuring stations are unmanned because they are monitored continuously throughout the year. Local deviations caused by local noise events or background noise, for example, may affect the measured levels. Although these are removed as far as possible from the measurements (for example, through an automatic link between noise events and aircraft, based on the radar data), such contributions to the measured levels cannot be completely excluded.

Reliability of the calculation method can, however, be achieved when there is sufficient matching between the annual averages of the measured noise events and the annual average forecast based on the average day, across a sufficient number of measuring stations.

[9] The ANP substitution list is drawn up for ANP version 2.2. In ANP version 2.3, the noise and performance data has been added for several new aircraft types. These types were added to the substitution list by To70.

3.4 Technical data

The calculations are performed with Echo within a grid of 70 x 70 kilometres around the airport, with a mesh size of the grid of 250 metres. The altitude of the airport reference measuring point in relation to sea level is 175 ft.

3.5 Changes in the calculation method in respect to previous years

A summary of the most important changes in the calculation method which have been applied in the calculations performed since 2021 and the effects they have on the results is given in Bijlage F.

4 Results

4.1 Background information about interpreting the results

This section describes a number of statistics of the air traffic in order to gain a better idea of the evolution in the traffic picture of 2022 compared to previous years. For this, information such as the number of movements, the evolution of the fleet, and runway usage has been mapped. In addition to the comparison with 2021, the traffic picture of 2019 is also sketched in order to compare the past calendar year with the traffic situation on Brussels Airport prior to the worldwide pandemic.

4.1.1 Number of flight movements

One of the most important factors for the annual noise contours around an airport is the number of movements which occurred during the past year. Following the decline of the number of movements between 2011 and 2013, there was an increase of 6.9% in 2014 and a further increase of 3.4% in 2015. In 2016 the number of aircraft movements fell to 223.688 (-6.5%). This is largely a result of a temporary closure following the attacks on the airport on 22 March 2016. In 2017, the number of movements increased by 6.3% to 237.888. In 2018, the number of movements increased by 1.0% to 235.459. In 2019 there was one again a slight decline of 0.4% and the total number of movements was 234.460. In 2020, the picture was entirely defined by the impact of the global pandemic and the consequences for international travel. The number of flight movements fell by 59.1% to 95,811. In 2021 there were 118,733 airport movements, which is an increase of 23.9% compared to 2020. With 178,930 movements in 2022, the increase has continued but the 2019 level has not been equalled. The number of movements is still 23.7% lower than in 2019.

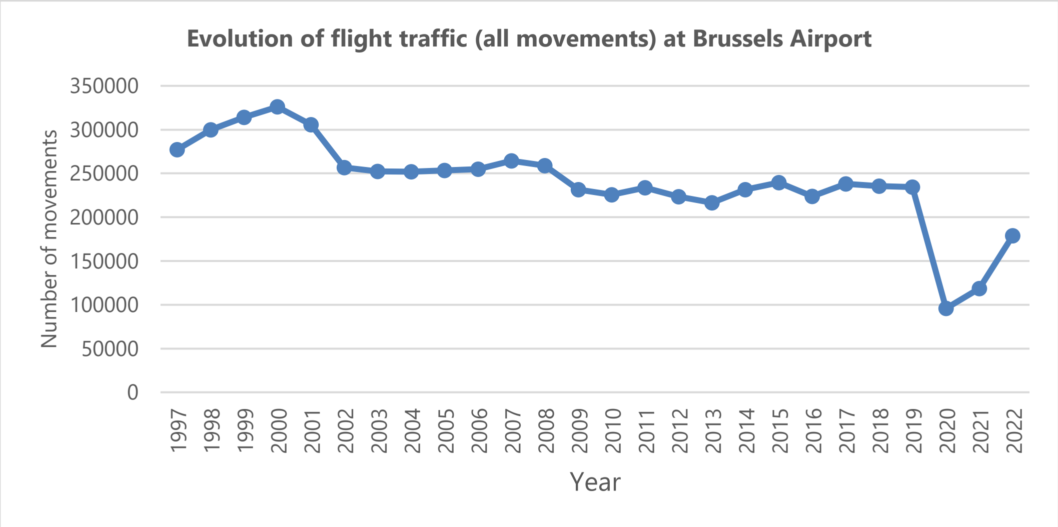


Figure 2: Evolution of flight traffic (all movements) at Brussels Airport.

The number of night-time movements (23:00-06:00) rose by 27.4 % from 13,273 in 2021 to 16,916 in 2022, illustrated in Figure 3. Due to this increase, the number of night-time movements is still slightly below the total in 2019 (17,347 night-time movements). In 2022, there were 5,359 night-time departures. This includes helicopter movements and flight movements exempt from slot coordination, such as government and military flights.

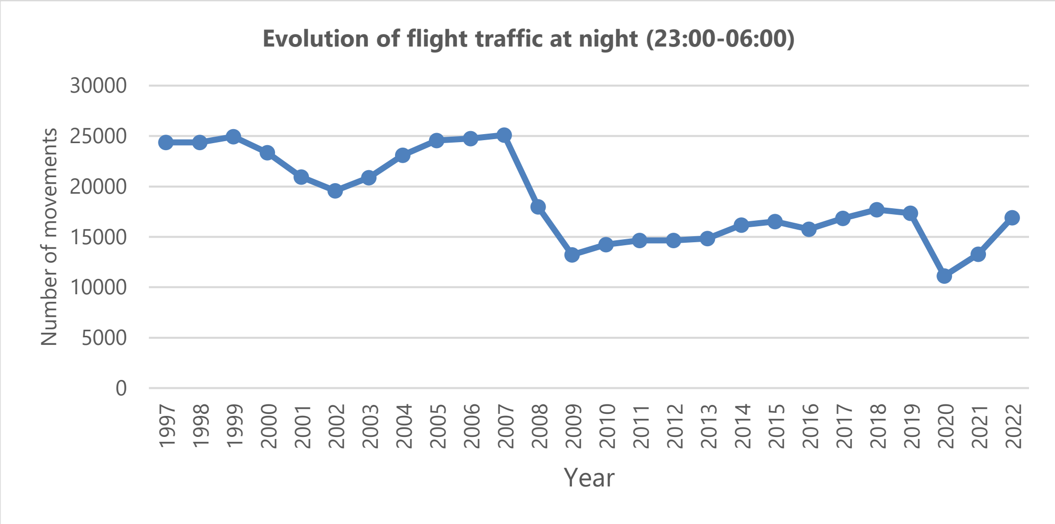


Figure 3: Evolution of flight traffic during the night (23:00-06:00) at Brussels Airport.

In 2022, the number of assigned night slots[10] for aircraft movements remained at 15.773 (13.325 in 2021), including 4.732 for departures (4.709 in 2021), within the limitations imposed on the slot coordinator of Brussels Airport, who since 2009 has been authorised to distribute a maximum of 16.000 night slots, of which a maximum of 5.000 may be allocated to departures (MD 21/01/2009, official amendment to the environmental permit).

The number of movements during the operational day period (06:00 to 23:00) rose by 53.6% from 105,460 in 2021 to 162,014 in 2022.

The number of movements in 2022, the data for 2021 and 2019 and the evolution are shown in Table 1. The numbers for the night period are further broken down into operational night (23:00 - 06:00) and the morning period (06:00 - 07:00).

Table 1: Number of movements (incl. helicopter movements) for the years 2019, 2021 and 2022 and the evolution of 2022 compared to 2021

	2019			2021			2022			Evolution compared to 2021		
Period	Landings	Take-offs	total	Landings	Take-offs	total	Landings	Take-offs	total	Landings	Take-offs	total
Day (07:00 - 19:00)	74.788	78.564	153.352	37.805	39.194	76.999	57.981	58.694	116.675	+53,4%	+49,8%	+51,5%
Evening (19:00 - 23:00)	27.756	25.976	53.732	11.623	11.425	23.048	18.097	19.438	37.535	+55,7%	+70,1%	+62,9%
Night (23:00 - 07:00)	14.689	12.688	27.377	9.926	8.760	18.686	13.385	11.335	24.720	+34,8%	+29,4%	+32,3%
00:00 - 24:00	117.233	117.228	234.461	59.354	59.379	118.733	89.463	89.467	178.930	+50,7%	+50,7%	+50,7%
06:00 - 23:00	105.205	111.908	217.113	50.951	54.509	105.460	77.906	84.108	162.014	+52,9%	+54,3%	+53,6%
23:00 - 06:00	12.028	5.320	17.348	8.403	4.870	13.273	11.557	5.359	16.916	+37,5%	+10,0%	+27,4%
06:00 - 07:00	2.661	7.368	10.029	1.523	3.890	5.413	1.828	5.976	7.804	+20,0%	+53,6%	+44,2%

The general increase of 50.7% in the number of movements on an annual basis between 2022 and 2021 is evenly distributed throughout the day (+51.5%) and evening (+62.9%). The relative increase in the number of night-time flights (between 23:00 and 07:00) is considerably lower (+32.3%). Compared to

[10] night slot: permission given by the coordinator of the Brussels National Airport, pursuant to Regulation (EEC) No. 95/93 of the Council of 18 January 1993 concerning common rules for the allocation of slots at community airports, to use the entire infrastructure required for the exploitation of an air service at the Brussels National Airport on a specified date and at a specified landing and take-off time during the night, as assigned by the coordinator;

2019, the total number of movements in the operational day period (between 06:00 and 23:00) in 2022 is still 25.4% lower. In the operational night-time period (23:00 - 06:00), the total number of movements is 2.5% lower than in 2019, with a slight increase (+0.7%) of the number of departures in this period.

4.1.2 Other important evolutions

In addition to the number of flight movements, there are a number of other parameters that also determine the size and the position of the noise contours, such as the runway and the route used, flight procedures and the deployed fleet. The most important changes are summarised in the following paragraphs.

Fleet changes during the day and in the evening (07:00 and 23:00).

Figure 4 shows the evolution of the most frequently used aircraft types during the day and evening (07:00 - 23:00) for heavy aircraft (take-off weight from136 tonnes, 'heavies') and in Figure 5 for lighter aircraft (a take-off weight up to136 tonnes). Shown are the aircraft types in 2021 and 2022 that on average have flown 1x per day.

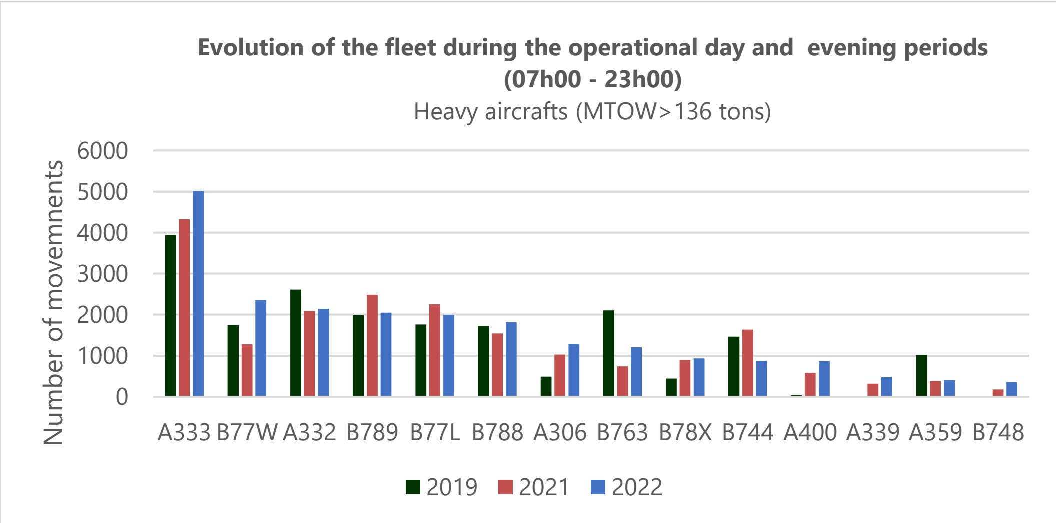


Figure 4: Evolution of the number of aircraft movements with heavy aircraft between 07:00 and 23:00.

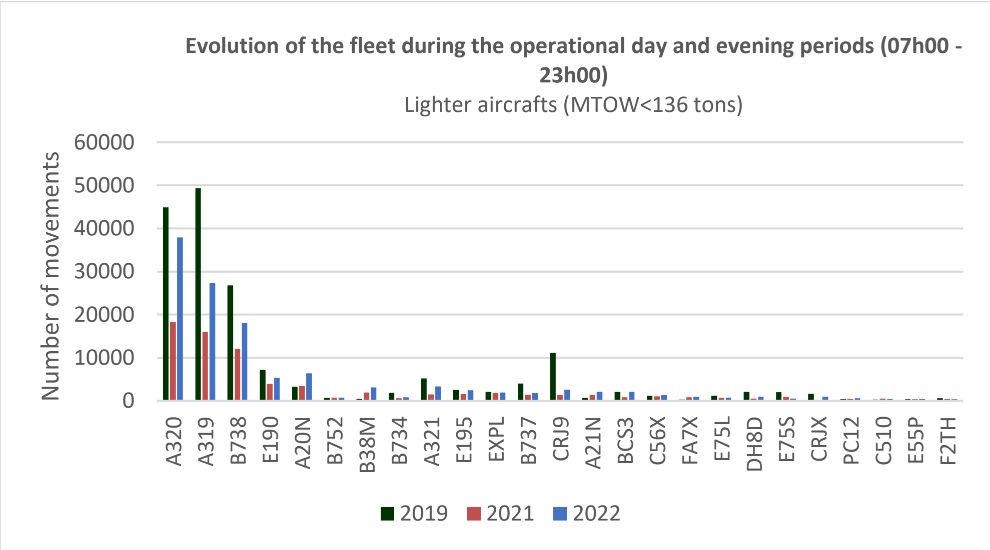


Figure 5: Evolution of the number of aircraft movements with lighter aircraft between 07:00 and 23:00.

In 2019, the A319 was the most prevalent aircraft; in 2022, the A320 was the most frequently used aircraft between 07:00 and 23:00. In general, the most-used aircraft were the A320, the A319 and the B738 (together responsible for 54% of all movements in 2022 between 07:00 and 23:00). The number of movements with these aircraft increased with 79.9% compared to 2021. However, the number of movements with these aircraft is still 31.1% lower in comparison with 2019. In addition, the development in the fleet in 2022 compared to 2019 can be seen in the increase in the number of movements with the 'new' aircraft types A204 (3,262 movements in 2019 and 6,366 movements in 2022) and the B38M (436 movements in 2019 and 3,144 movements in 2022). On the other hand, the use of the CRJ9 decreased by 76.7%. The most prevalent heavy aircraft is the A333, followed by the B77W for which the number of movements, percentage wise, has increased most in 2022 compared to 2021: +85%. A drop in the number of movements with heavy aircraft is visible for the B789, the B77L and the B744. In comparison with 2019, an increase in the number of movements with the A306, B78X, A400 and B748 can be seen.

Fleet changes in the night period (from 23:00 to 07:00)

The evolution of the most frequently used aircraft types during the night (between 23:00 and 07:00) is set out in Figure 6 for arrivals and in Figure 7 for departures. Shown are the aircraft types in 2021 and 2022 that on average flew a minimum of 1 flight per week.

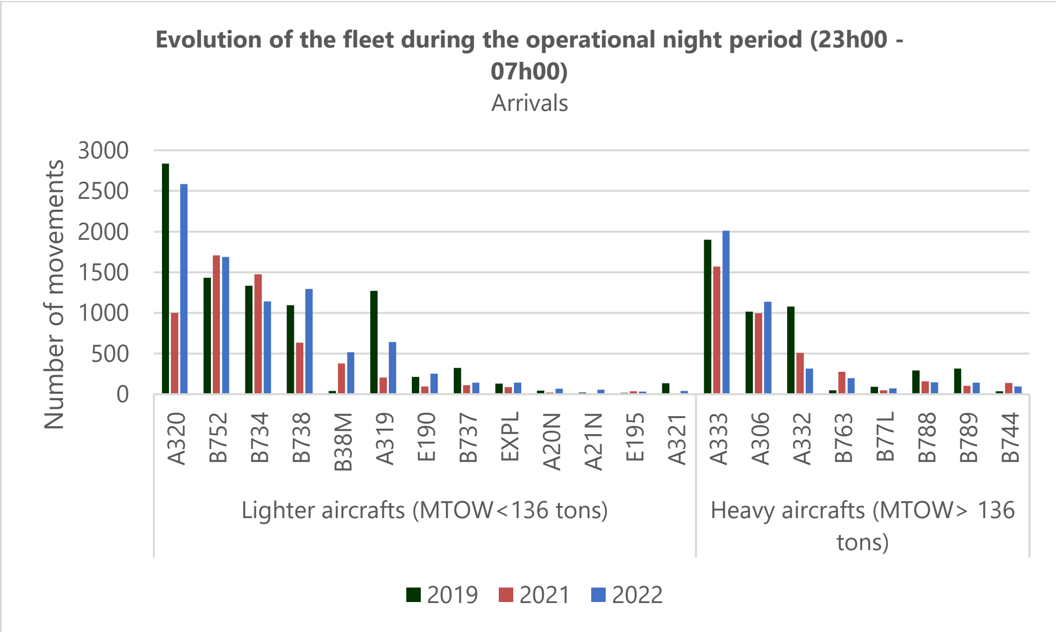


Figure 6: Evolution of the number of arrivals in the night period (from 23:00 to 07:00).

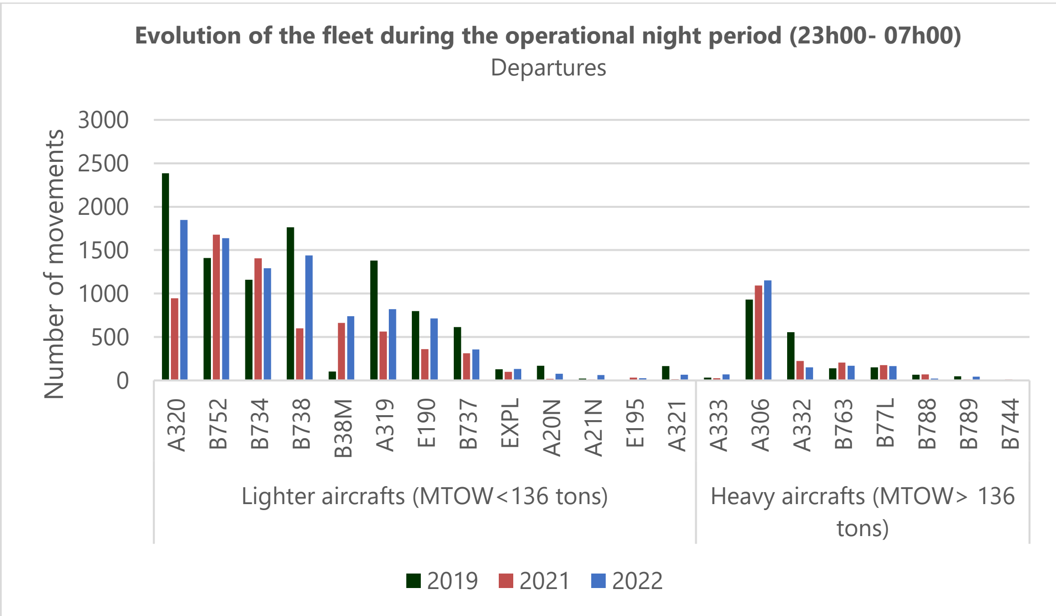


Figure 7: Evolution of the number of departures in the night period (from 23:00 to 07:00).

The number of movements in the night with lighter aircraft increased in comparison with 2021 with 47.3% (arrivals) and 37.7% (departures). This mainly concerns the A320, B738, A319, E190 and the B38M. The most commonly used aircraft in the night is, as it was in 2019, the A320 (17.9% of all movements in 2021 between 23:00 and 07:00), followed by the B752 (13.5%), and the B738 (11.1%). The number of arrivals with heavy aircraft in the night increased by 15.3% compared to 2021, but was still 16.1% lower than in 2019. The A333 has the greatest share in this (1,935 arrivals in 2019 and 2,081 arrivals in 2022). On the other hand, the number of arrivals with the A332 dropped by 71.6% compared to the number in 2019

(1,632 arrivals in 2019 and 464 arrivals in 2022). The number of departures in the night with heavy aircraft rose by 1.8% compared to 2021.

Runway and route usage

Preferential runway usage

The preferential runway usage, published in the AIP (Skeyes), shows which runway should preferably be used, depending on the time that the movement occurs, and in some cases on the destination and the maximum take-off weight of the aircraft. This scheme did not change during the year 2022 (see Table 2).

If the preferential runway configuration cannot be used (for example due to meteorological conditions or maintenance on one of the runways), Skeyes will then choose the most suitable alternative configuration, taking account of factors including the weather conditions, runway equipment and traffic demand. In this respect, conditions are tied to the preferential runway usage arrangements, including wind limits expressed as the maximum crosswind and maximum tailwind at which each runway can be used. To prevent these limits being exceeded, air traffic control must, when the situation arises, switch to an alternative configuration. Under preferential runway usage conditions, the maximum tailwind is 7 kt and the maximum crosswind is 20 kt. In the event of alternative runway usage, the maximum speeds are also 20 kt for crosswind but only 3 kt for tailwind.

Table 2: Preferential runway usage since 19/09/2013 (local time) (source: AIP)

		Day		Night
		06:00 to 15:59	16:00 to 22:59	23:00 to 05:59
Mon, 06:00 – Tues 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Tues, 06:00 – Wedn 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Wed, 06:00 – Thurs 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Thurs, 06:00 – Fri 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Fri, 06:00 – Sat 05:59	Departure	25R		25R(3)
	Landing	25L/25R		25R
Sat, 06:00 – Sun 05:59	Departure	25R	25R/19(1)	25L(4)
	Landing	25L/25R	25R/25L(2)	25L
Sun, 06:00 – Mon 05:59	Departure	25R/19(1)	25R	19(4)
	Landing	25R/25L(2)	25L/25R	19

(1) Runway 25R for traffic via ELSIK, NIK, HELEN, DENUT, KOK and CIV / Runway 19 for traffic via LNO, SPI, SOPOK, PITES and ROUSY (aircraft with MTOW between 80 and 200 tonnes can use runway 25R or 19, aircraft with MTOW > 200 tonnes must use runway 25R, regardless of their destination).
(2) Runway 25L only if air traffic control considers this necessary.
(3) Between 01:00 and 06:00, no slots may be allocated for departures.
(4) Between 00:00 and 06:00, no slots may be allocated for departures.

Use of the runways

In comparison with 2021, the number of movements has increased on virtually all runways. This is shown in Figure 8 for the period during the day and in the evening (from 07:00 to 23:00) and in Figure 9 for the night period (from 23:00 to 07:00). A complete account of the runway use is given in appendix A.1.

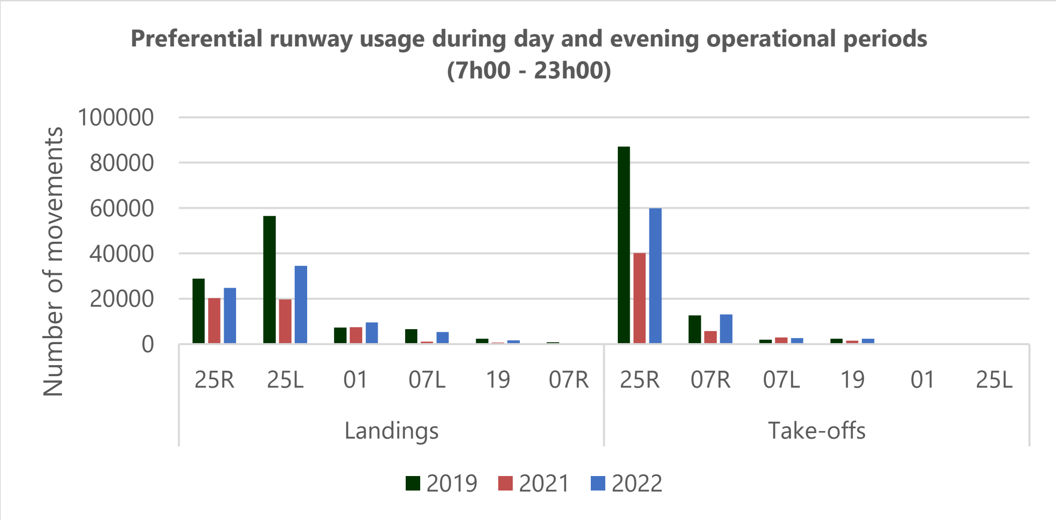


Figure 8: Evolution of the runway use between 07:00 and 23:00.

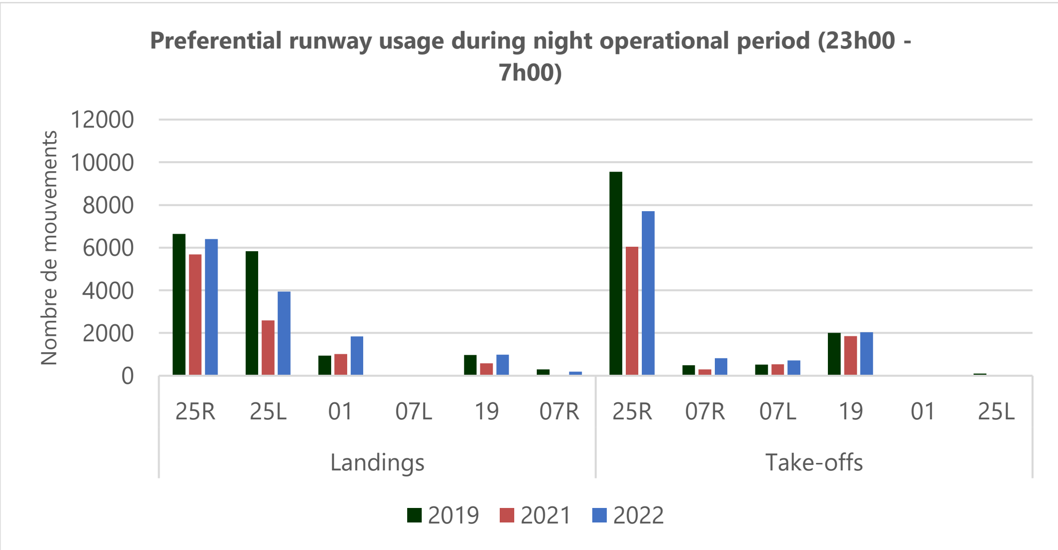


Figure 9: Evolution of the runway use in the night period (from 23:00 to 07:00).

Runway 25R remains, as a consequence of the preferential runway usage and the prevalent wind conditions, the most used runway direction for departures in the night. The use of 07R for departures has increased during the day and evening period with 130% compared to 2021. This means that 07R (and 07L) was used more often in 2022 for departing traffic in the day and evening than in 2019 (14,725 departures in 2019 and 15,774 departures in 2022). Due to meteorological conditions, the PRS could be applied less in 2022 than in 2019.

In 2021, the arrivals during the day and evening were distributed equally over 25L and 25R; in 2022, however, more use was made of 25L than 25R. This means that, with the return of the passenger flights after COVID, there has been a return to the situation in 2019, where the number of arrivals on 25L was nearly twice as high as those on 25R. In the night, 25R is the most frequently used runway direction for arrivals, following by runway 25L. In 2022, the number of arrivals on 01 almost doubled compared with 2019, due to the lower applicability of the PRS in 2022, as already indicated above.

4.2 Comparison of measurements and calculations

Echo enables a number of acoustic parameters to be calculated at a specified location around the airport The extent to which the calculated values correspond to the values registered and processed by the measuring system can be evaluated by performing these calculations at the Noise Monitoring System (NMS) measuring station locations. Different data sources are used in the NMS system and are correlated with each other: noise measurements, flight lists (cdb), radar tracks and weather. The comparison between measurements and calculations is performed for the level indicators $L_{Aeq,24h}$, L_{night} and L_{den}.

The calculated values are compared with the values of the aircraft correlated measured noise events. These are noise events whereby an automatic link could be made in the NMS with the flight and radar data.

The system of correlation is imperfect and it is possible for events to be incorrectly attributed to overflying traffic and vice versa. To minimise the contribution of such incorrect classifications, a trigger level is set with a minimum duration time: an event is expected only when the trigger level of 10 s is exceeded. The event ends when the trigger level is not achieved during 5 s. The trigger levels are set for each measuring station and depend on the local noise in the area. These trigger levels were evaluated in the beginning of 2015 and adjusted for several measuring stations. At that time, the maximum duration of an event was increased from 75 s (for 2014) to 125 s. As in previous years, this criterion was retained for 2022. In events of even longer duration, the chance of this being caused by an airplane is quite small. Note that beyond the conditions relating to the event duration and trigger level, a correlation with a registered aircraft movement is also necessary based on its radar track results.

In the table below, a comparison is made between the values simulated with Echo at the different measuring station locations and the values measured/calculated on the basis of the correlated events for the chosen parameters. Aside from data from the measuring stations of Brussels Airport Company, results from the Environment, Nature and Energy Department (LNE) measuring stations (with codes NMT 40-2 and higher) are also recorded. The measurement data from these measuring stations are input and linked to flight data in the NMS of the airport.

For measuring stations of the BIM in the Brussels-Capital Region, the above-mentioned procedure is not possible because the measurement data is not supplied to BAC (until 2009, the measurement data from the BIM for two measuring stations - Haren and Evere - had in fact been made available to BAC). An overview of the locations of all measuring stations can be found in Bijlage B.

The measuring stations NMT01-2, NMT03-3, NMT15-3 and NMT23-1 are situated on the airport site and/or in the immediate vicinity of the runway system and the airport facilities. The flight-correlated noise events comprise contributions from ground noise as well as overflights. The link to specific flight movements is not always equally reliable for these measuring stations. For these reasons, the measured values at these measuring stations are less relevant for assessing noise emission from overflying aircraft, and while they are reported, they are not considered in the assessment of the accuracy of the simulations.

The fraction of time that the measuring system is active (so-called 'uptime') was in 2022 very high for all measuring stations. The minimal uptime was 97.15% and the average uptime was 99.58%. For the comparison of the measurements with the calculations (for a whole year), a correction is made per measuring stations for the uptime fraction. It is also assumed that during the periods lacking measurements, there was the same proportion of exposure to aircraft noise as during the periods in which the measuring station was active. The correction is, as a consequence of the high uptime, virtually negligible.

The comparison between calculations and measurements based on the $L_{Aeq,24h}$ shows that the discrepancy between the calculated values and the measured values across all measuring stations, except NMT09-2 (Perk), NMT20-3 (Machelen), NMT42-2 (Diegem) and NMT48-3 (Bertem), is smaller than 2 dB(A) (after also excluding the measuring points NMT01-2, NMT03-3, NMT15-3 and NMT23-1 as discussed above). Measuring stations Perk and Bertem have few over-flights and have a relatively low registered noise impact level (respectively 42.2 and 25.4 dB(A) $L_{Aeq,24h}$) which results in a higher error margin in the comparison with the calculated noise impact levels. At 9 measuring stations, the deviation is limited to up to 0.5 dB(A). At 16 measuring stations, the measurements are higher than the calculations, at 11 measuring stations the measurements are lower than the calculations (in each case with the abovementioned exclusions). The global discrepancy between simulations and measurements is 1.1 dB(A) (“root-mean-square error” or RMSE), when Perk and Bertem are excluded from this evaluation.

Generally, similar limited deviations between measurements and simulations are obtained for L_{night} (1.6 dB (A) RMSE, excluding measuring points NMT01-2, NMT03-3, NMT15-3, NMT23-1, Perk and Bertem). At 6 measuring stations, the differences are smaller than 0.5 dB(A).

For the noise indicator L_{den} the RMSE is 1.6 dB(A) (excluding NMT01-2, NMT03-3, NMT15-3, NMT23-1, Perk and Bertem). At most of the other measuring stations, the deviations were within 2 dB(A). Twelve measuring stations had a deviation of maximum 0.5 dB(A). At 16 measuring stations the calculations result in an underestimation of the measured levels, at 11 measuring stations they lead to an overestimation (excluding NMT01-2, NMT03-3, NMT15-3, and NMT23-1).

Table 3: Match between calculations and measurements for noise indicator $L_{Aeq,24h}$ (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

Location code	Location name	Measures 2022 (dB(A))	Calculations 2022 (dB(A))	Difference (dB(A))
NMT01-2	STEENOKKERZEEL	56,7	67,5	-10,8
NMT02-2	KORTENBERG	65,9	66,4	-0,6
NMT03-3	HUMELGEM-Airside	61,6	62,5	-0,9
NMT04-1	NOSSEGEM	61,3	61,9	-0,6
NMT06-1	EVERE	50,0	48,9	1,0
NMT07-2	STERREBEEK	48,1	46,9	1,1
NMT08-1	KAMPENHOUT	54,6	54,9	-0,3
NMT09-2	PERK	42,2	46,8	-4,7
NMT10-3	NEDER-OVER-HEEMBE	53,4	52,1	1,3
NMT11-2	SINT-PIETERS-WOLUW	51,7	51,4	0,4
NMT12-1	DUISBURG	45,1	44,5	0,6
NMT13-2	GRIMBERGEN	43,4	44,2	-0,8
NMT14-1	WEMMEL	46,8	45,9	0,9
NMT15-3	ZAVENTEM	44,6	53,1	-8,4
NMT16-2	VELTEM	55,3	55,7	-0,4
NMT19-4	VILVOORDE	50,7	50,5	0,2
NMT20-3	MACHELEN	50,3	52,4	-2,1
NMT21-1	STROMBEEK-BEVER	50,8	48,9	1,9
NMT23-1	STEENOKKERZEEL	64,9	65,7	-0,8
NMT24-1	KRAAINEM	52,9	52,1	0,7
NMT26-2	BRUSSELS	46,4	45,9	0,5
NMT40-2*	KONINGSLO	51,6	50,1	1,5
NMT41-1*	GRIMBERGEN	46,3	46,3	0,0
NMT42-2*	DIEGEM	62,6	60,0	2,6
NMT43-2*	ERPS-KWERPS	55,1	56,5	-1,5
NMT44-2*	TERVUREN	44,8	44,9	0,0
NMT45-1*	MEISE	43,9	43,6	0,3
NMT46-2*	WEZEMBEEK-OPPEM	54,3	53,8	0,5
NMT47-3*	WEZEMBEEK-OPPEM	48,3	47,7	0,6
NMT48-3*	BERTEM	25,4	32,4	-7,0
NMT70-1*	ROTSELAAR	49,0	49,4	-0,4

* noise data Department of the Environment, off-line correlated by the NMS

Table 4: Match between calculations and measurements for noise indicator L_{night} (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

Location code	Location name	Measures 2022 (dB(A))	Calculations 2022 (dB(A))	Difference (dB(A))
NMT01-2	STEENOKKERZEEL	54,6	65,1	-10,5
NMT02-2	KORTENBERG	61,4	62,4	-1,0
NMT03-3	HUMELGEM-Airside	56,7	55,9	0,9
NMT04-1	NOSSEGEM	60,5	60,1	0,4
NMT06-1	EVERE	44,4	43,7	0,7
NMT07-2	STERREBEEK	50,5	47,8	2,7
NMT08-1	KAMPENHOUT	53,1	53,7	-0,6
NMT09-2	PERK	41,6	45,1	-3,6
NMT10-3	NEDER-OVER-HEEMBE	49,9	47,9	2,0
NMT11-2	SINT-PIETERS-WOLUW	48,9	48,6	0,3
NMT12-1	DUISBURG	43,6	41,9	1,6
NMT13-2	GRIMBERGEN	37,7	39,4	-1,7
NMT14-1	WEMMEL	41,2	41,1	0,2
NMT15-3	ZAVENTEM	47,0	50,9	-3,9
NMT16-2	VELTEM	51,3	51,8	-0,5
NMT19-4	VILVOORDE	47,4	46,8	0,6
NMT20-3	MACHELEN	47,3	48,9	-1,6
NMT21-1	STROMBEEK-BEVER	47,5	44,8	2,7
NMT23-1	STEENOKKERZEEL	63,7	64,8	-1,1
NMT24-1	KRAAINEM	49,3	49,0	0,2
NMT26-2	BRUSSELS	42,3	42,3	0,0
NMT40-2*	KONINGSLO	48,0	46,0	2,1
NMT41-1*	GRIMBERGEN	43,2	42,2	1,0
NMT42-2*	DIEGEM	58,2	55,3	2,9
NMT43-2*	ERPS-KWERPS	49,9	52,1	-2,2
NMT44-2*	TERVUREN	46,3	44,0	2,4
NMT45-1*	MEISE	37,9	38,7	-0,8
NMT46-2*	WEZEMBEEK-OPPEM	51,3	51,0	0,3
NMT47-3*	WEZEMBEEK-OPPEM	50,6	48,2	2,4
NMT48-3*	BERTEM	18,9	28,3	-9,3
NMT70-1*	ROTSELAAR	44,9	45,5	-0,6

* noise data Department of the Environment, off-line correlated by the NMS

Table 5: Match between calculations and measurements for noise indicator L_{den} (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

Location code	Location name	Measures 2022 (dB(A))	Calculations 2022 (dB(A))	Difference (dB(A))
NMT01-2	STEENOKKERZEEL	61,9	72,4	-10,5
NMT02-2	KORTENBERG	69,8	70,5	-0,7
NMT03-3	HUMELGEM-Airside	65,3	65,7	-0,3
NMT04-1	NOSSEGEM	67,3	67,3	0,0
NMT06-1	EVERE	53,6	52,8	0,8
NMT07-2	STERREBEEK	56,1	53,9	2,2
NMT08-1	KAMPENHOUT	60,0	60,5	-0,5
NMT09-2	PERK	48,1	52,2	-4,1
NMT10-3	NEDER-OVER-HEEMBE	57,7	56,1	1,6
NMT11-2	SINT-PIETERS-WOLUW	56,5	56,3	0,3
NMT12-1	DUISBURG	50,5	49,4	1,0
NMT13-2	GRIMBERGEN	47,1	48,2	-1,1
NMT14-1	WEMMEL	50,1	49,6	0,5
NMT15-3	ZAVENTEM	52,7	58,0	-5,4
NMT16-2	VELTEM	59,4	59,9	-0,5
NMT19-4	VILVOORDE	55,3	54,9	0,4
NMT20-3	MACHELEN	55,0	56,9	-1,8
NMT21-1	STROMBEEK-BEVER	55,2	52,9	2,3
NMT23-1	STEENOKKERZEEL	70,6	71,6	-1,0
NMT24-1	KRAAINEM	57,4	56,9	0,5
NMT26-2	BRUSSELS	50,4	50,2	0,2
NMT40-2*	KONINGSLO	55,8	54,1	1,7
NMT41-1*	GRIMBERGEN	50,9	50,4	0,5
NMT42-2*	DIEGEM	66,6	64,0	2,6
NMT43-2*	ERPS-KWERPS	58,7	60,5	-1,8
NMT44-2*	TERVUREN	52,2	50,7	1,5
NMT45-1*	MEISE	47,1	47,3	-0,2
NMT46-2*	WEZEMBEEK-OPPEM	59,0	58,7	0,4
NMT47-3*	WEZEMBEEK-OPPEM	56,3	54,4	1,9
NMT48-3*	BERTEM	28,0	36,5	-8,5
NMT70-1*	ROTSELAAR	53,1	53,6	-0,4

* noise data Department of the Environment, off-line correlated by the NMS

4.3 Noise contours

This section gives the results of the noise contour calculations for the parameters described above (L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day freq.70,night, freq.60,day and freq.60,night). These illustrations display the results for the years 2022, 2021 and 2019. In the contour report for 2019, the contours were still calculated with INM 7.0b. For the comparability of the results, the contours of 2019 were remodelled afresh with the Echo calculation model (as used for the contours of 2021 and 2022), whereby the counts are based on the population figures of 1 January 2022. To aid legibility of the figures, two contour values are visualised for each figure. Bijlage D shows the visualisation of all contour values for the years 2022 and 2021.

The surface area and the number of residents is calculated for each noise contour. On the basis of the L_{den} contours, the number of potentially seriously inconvenienced persons is calculated according to the method described in paragraph 2.2. The appendices offer more details: per municipality (appendix C). Appendix D shows the visualisation of the contours and the evolution of the contours for several years is shown in appendix E.

4.3.1 L_{day} contours

The L_{day} contours represent the A-weighted equivalent sound pressure level for the period 07:00 to 19:00 and are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A). The evolution of the contours for 2019, 2021 and 2022 is shown in Figure 10, where only the 55 dB(A) and 60 dB(A) contour are presented.

The evaluation period for the L_{day} contours falls entirely within the operational daytime period (06:00 to 23:00) as specified at Brussels Airport. This means that the 'Departure 25R – Landing 25L/25R' runway usage is to be preferred at all times, except at the weekend on Saturdays after 16:00 and on Sundays before 16:00, when departures are to be distributed over 25R and 19. When this preferential runway usage cannot be applied due to weather conditions (often with an easterly wind), then the combination of departures from 07R/07L and landings on 01 or 07L/07R is generally applied.

Most important findings in evolution L_{day} contour 2019, 2021, 2022

Compared to 2021, a general increase of the noise impact is visible, which is primarily the consequence of an increase in the number of movements (+51.5%). The increasing traffic totals are not uniformly distributed over the runways due to a shift in the runway use. The share of the number of landings on 25L has increased, while the share of the number of landings on 25R has actually decreased. That the number of movements is not the only parameter that effects the size of the contour can be seen in the comparison with the contour from 2019. Although the number of movements during the daytime period in 2022 is 23.9% lower than in 2019, the size of the contour to the east (in the extension of runway 25R/25L) and south of Brussels Airport has actually increased. This can primarily be explained through a shift in the runway use.

Comparison 2022 and 2021

There are a number of relevant findings. In the first place, there was a strong increase in the number of landings (+53.4%) as well as the number of departures (+49.8%) during the day, which explains the overall increasing size of the contours in 2022. There are also evolutions in runway usage, whereby the number of landings during the day has increased on all runways. The largest relative increase is seen on runway 07L, where the number of landings has increased from 988 in 2021 to 4,605 in 2022. This means that the relative share of departures on runway 07L rose from 2.6% in 2021 to 7.9% in 2022. In addition the number of landings on runway 19 more than doubled from 615 in 2016 to 1,250 in 2022. Further, the number of landings on runway 25L has risen relatively more in comparison to 2021 (+74%) than the number of landings on runway 25R (+24%). Due to these various increases, runway 25L has a relatively larger share in the total number of landings during the day than runway 25R (45.8% and 32.3% respectively).

For the use of the runways for departures, we primarily see an increasing use of runway 07R. The relative number of departures during the day from runway 07R has increased from 12.0% in 2021 to 17.3% in 2022. In absolute numbers, this means an increase of 5,425 departures to 10,144 in 2022. The use of 25R as departure runway during the day has increased by 46.3% which is line with the general increase of departures during the day. With the increasing use of runways 07R and 25R for departures there is a decreasing use of runway 07L (2,256 movements in 2021 and 1,706 movements in 2022). With this, the relative share of departures on runway 07L decreased from 5.8% in 2021 to 2.9% in 2022.

The increase in the number of movements with heavy aircraft in 2022 (+9%) is considerably lower than the increase in the number of movements with lighter types of aircraft (+63%) during the day period.

To the west of Brussels Airport, the 55 dB contour is larger as a result of an increase in departures from runway 25R. An increase in landing traffic on runway 07L also plays a role. This leads to an increase in noise impact of 3 dB(A) in the landing area of runway 07L.

To the north of Brussels Airport, in the landing area of runway 19, the noise impact has increased by slightly more than 3 dB(A). This is primarily the consequence of the number of landings during the day on runway 19 more than doubling. In absolute number, this is 1,250 landings on runway 19 in 2022.

To the east of Brussels Airport, the L_{day} noise impact has increased compared to 2021. The noise impact in this area is largely caused by landings on runway 25L and 25R. The number of landings has increased on both runways compared to 2022. However, due to the changes in the runway use, the noise impact in the extension of runway 25L has increased more (increase of 2 dB(A)) than the noise impact in the extension of runway 25R. Through an increase in the passenger traffic in 2022 compared to the COVID years, the distribution of arrivals on 25L/25R is moving back to the situation in 2019.

Due to an increase in the number of departures from runway 07R, the lobe in the extension of this runway in a westerly direction is also considerable wider compared to 2021.

Also to the south of the aircraft, an increase of less than 1 dB(A) is visible. This is the consequence of the increase in the number of landings on runway 01 (5,882 landings in 2021 and 6,769 landings in 2022).

Comparison 2022 and 2019

In comparison with 2019, there is a decrease in the number of landings (-22.5%) and number of departures (-25.3%) during the day. This decrease is not uniformly distributed across all runways. The number of landings has decreased on all runways with the exception of runway 01 where the number of landings has increased by 44.9% (4,670 landings in 2019 and 6,769 landings in 2022). Furthermore, the relative share of arrivals on runway 25L has decreased from 55.2% in 2019 to 45.8% in 2022. The use of runway 07L for departures has considerably increased by 51.5% from 1,126 departures in 2019 to 1,706 departures in 2022. The number of departures from runway 25R dropped considerably (from 65,342 in 2021 to 44,875 in 2022). This means that the relative share of this runway for departing traffic has decreased from 83.2% in 2021 to 76.5% in 2022.

The changes described above in the runway usage in 2022 compared to 2019 explains the lower noise impact to the east (in the extension of landing runway 25L) and to the west of Brussels Airport (traffic departing from 25R). Yet, due to the shifts in runway usage, there is also a higher noise impact in the south (arrivals 01). A shift in runway usage is a consequence of weather conditions and changes in the traffic picture.

Also the evolution of the fleet plays a role in the changes in the contours compared to 2019. So the number of movements during the day with heavy aircraft has increased by 1.8%, while the number of movements with lighter aircraft has actually decreased by 27.2%. The use of lighter aircraft shows the renovation of the fleet, whereby the share of the A20N/A21N and the B38M has increased compared to 2019.

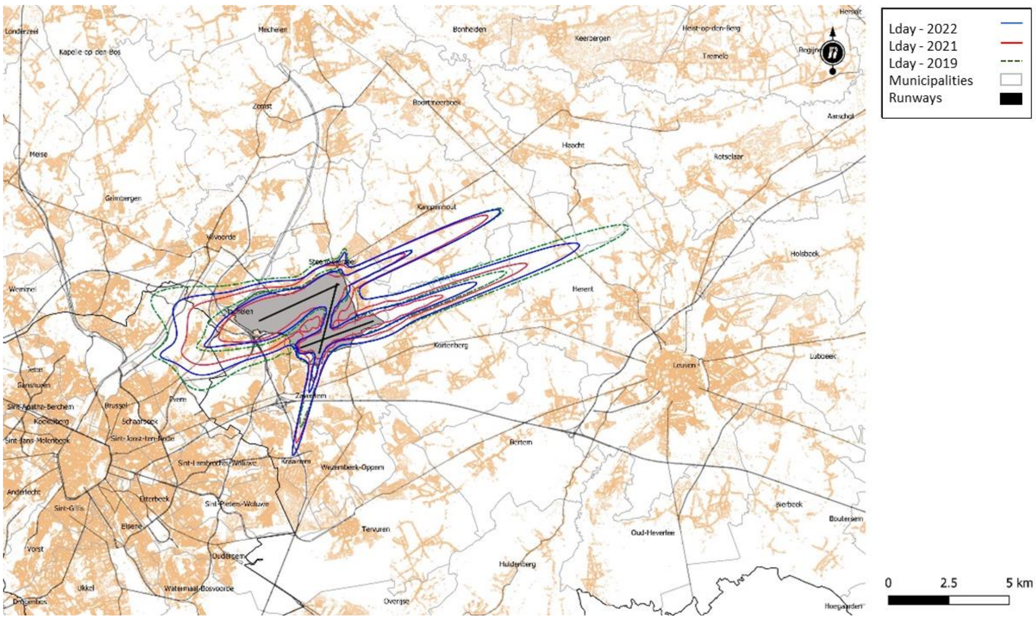


Figure 10: L_{day} noise contours of 55 and 60 dB(A) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area within the L_{day} contour of 55 dB(A) rose in 2022 by 35.0% compared to 2021 (from 3,024 to 4,083 ha). The number of residents inside the L_{den} contour of the 55 dB(A) noise contour rose by 39.2% (from 21,401 to 29,797). The number of residents within the contour increased by 510 (+1.7%) due to developments in the resident numbers. Compared to 2019, the total area is 16.4% smaller (area in 2019 was 4,886 hectare) and the number of residents 14.8% lower (number of residents in 2019 was 35,003 based on the population file of 1 January 2022).

4.3.2 $L_{evening}$ contours

The $L_{evening}$ contours represent the A-weighted equivalent sound pressure level for the period 19:00 to 23:00 and are reported from 50 dB(A) to 75 dB(A) in steps of 5 dB(A). The evolution of the contours for 2019, 2021 and 2022 is shown in Figure 11, where only the 50 dB(A) and 55 dB(A) contour are presented. Due to a lower level being reported in comparison with L_{day}, there is a visual magnifying effect. By correcting 5 dB(A), the 50 dB(A) contour becomes as important for the calculation of L_{den} as the 55 dB(A) L_{day} contour. The evaluation period for the $L_{evening}$ contours falls entirely within the operational daytime period (06:00 to 23:00), as specified at Brussels Airport.

Most important findings in evolution $L_{evening}$ contour 2019, 2021, 2022

Just as with the L_{day} contours, a general increase of the contours compared to 2021 can be seen due to an increase in the number of movements during the evening (+62.9%). Here too, a shift in runway usage is at the basis of the change in the noise impact near to the airport. In general, the noise contours compared to 2019 are smaller due to a lower number of movements during the evening (-30.1%). The greatest differences take place to the east of the airport, where the noise impact in the landing area of runway 25L is more than 3 dB(A) lower than in 2019. Yet there are also, despite the general decrease in the total number of movements, areas where the noise impact is higher than in 2019. This primarily concerns the area to the south of the airport, where the noise impact is dominated by the approach traffic on runway 01.

Comparison 2022 and 2021

There are a number of relevant findings, which are similar to those of the day period. In the first place, there was a slight increase in the number of landings during the evening (+55.7%) and in the number of departures (+70.1%). Also during the evening, the runway usage increased for every runway. With an increase of 77.4%, runway 25L is also in the evening the most frequently used runway for landings (4,485 in 2021 and 7,955 in 2022) and with this has a share of 44.0% of the total number of landings in the evening. The relative share of landings on runway 25R has actually decreased from 45.2% in 2021 to 33.3% in 2022. On the other hand, the runway usage of runway 01 and 07L for landings in the evening increased, whereby the number of landings on runway 07L nearly quadrupled (186 in 2021 compared to 737 in 2022). The number of landings on runway 01 in the evening increased by 76.3% to 2,739 landings in 2022. This increase in landings on runway 01 is thus higher in the evening than during the day.

With a share of 77.0%, runway 25R is also in the evening the most used runway for departing traffic. This share was higher in 2021 (82.9%). This shift is compensated by an increasing share of runway 07R where the number of departures increased with 2,025 to 3,017 departures in 2022. While the number of departures from 07L during the day decreased, an increase of 40.2% can be seen during the evening period: 647 departures in 2021 and 907 departures in 2022.

The number of movements with heavy aircraft decreased slightly by 1.9%. The general increase of the traffic departing in the evening can thus be entirely attributed to an almost doubling of the number of departures with lighter aircraft: 8,803 departures in 2021 and 16,865 departures in 2022. The number of landings with both heavy and light type aircraft increased by respectively 7.7% and 62.9%.

To the east of Brussels Airport, similar increases can be seen as those described for the L_{day} contours. The increase in noise impact is greater in the landing area of runway 25L than in the landing area of runway 25R due to the shift in the distribution of landings between these two runways. The contours in the extension of runway 07R/25L are wider due to the increase in traffic departing from 07R towards the east.

To the south, the noise impact has increased by slightly more than 2 dB(A) due to the increase in the number of landings on runway 01. The contour close to the airport is also wider due to an increase in the number of departures in a southerly direction from runway 19 (299 in 2021 and 550 in 2022).

To the south west of Brussels Airport, the 50 dB(A) contour is larger than in 2021. In addition to the general increase in the number of departures from 25R, the share in departures via routes with a turn to the left (from 25R) has increased more. In 2022, the relative share of these routes increased from 38% to 40% of all departures from 25R in the evening.

And just as in the L_{day} noise impact, the $L_{evening}$ to the north of Brussels Airport shows an increase of the noise impact of slightly more than 3 dB(A) as a consequence of the increase in the number of arrivals on runway 19.

Comparison 2022 and 2019

In comparison with 2019, the number of landings during the evening has decreased by 34.8% and the number of departures has decreased by 25.2%. Just as in the day period, the number of landings on each runway has decreased with the exception of runway 01, where the number of landings increased slightly by 6%. This explains the slightly increasing noise impact to the south of Brussels Airport in 2022 compared to 2019. Furthermore, the noise impact to the east of Brussels Airport decreased more in the extension of runway 25L (just as the L_{day} noise impact). To the west of the airport, the reduction in noise impact can be seen as a consequence in the reduction of the traffic departing from 25R (21,799 departures in 2019 and 14,960 departures in 2022).

In combination with a general reduction of the number of movements and shift in the runway usage, the change in the fleet has always had an effect on the evolution of the noise impact in the evening. The number of movements with heavy aircraft, despite the general reduction of the number of movements, increased by 13.7%. This means that heavy aircraft have a relatively higher share in the traffic during the evening. In 2019, 6.9% of the movements in the evening were performed with heavier aircraft. In 2022, the share of heavy aircraft increased to 11.2%. In 2019, the B744, A332 and B77L were the most used heavy aircraft during the evening. In 2022, the share of the A332 and the B77L increased further, but the use of the B744 decreased. The share of less noisy heavy aircraft such as the B748 (3 movements in 2019 and 105 movements in 2022) and the A359 (2 movements in 2019 and 86 movements in 2022) increased.

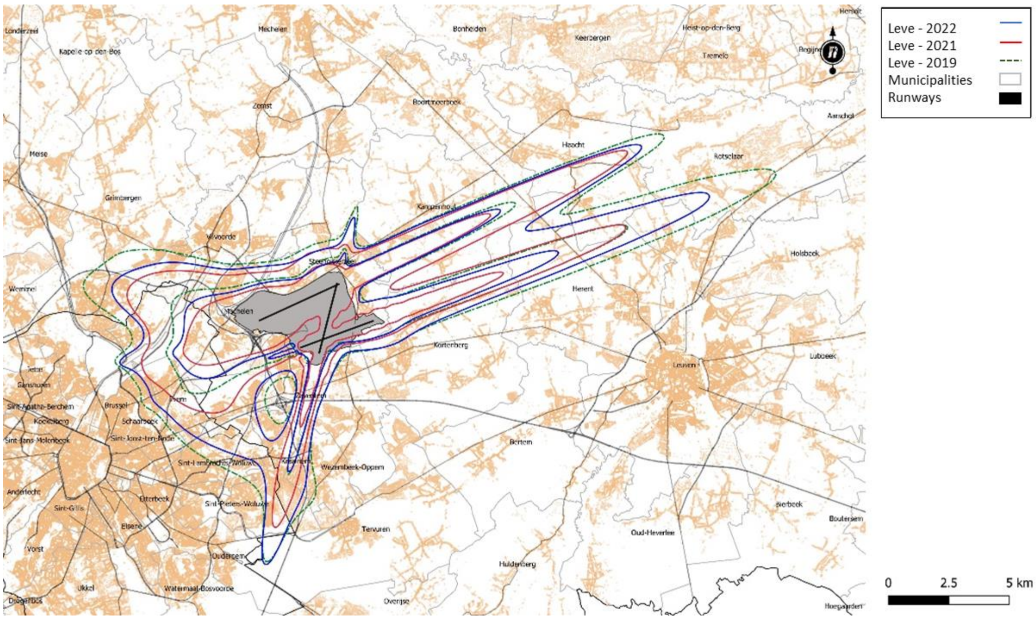


Figure 11: $L_{evening}$ noise contours of 50 and 55 dB(A) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area inside the $L_{evening}$ contour of 50 dB(A) in 2021 is 45.0% larger than in 2021 (from 7,757 ha to 11,251 ha). The number of residents inside the $L_{evening}$ contour of 50 dB(A) increased by 108.2% (from 76,812 to 159,949). The relative increase in population is larger than the increase in surface area, considering the expansion of the $L_{evening}$ contour is lying partly in the densely-populated areas. The number of residents within the contour increased by 1,983 (+1.3%) due to developments in the population numbers. Compared to 2019, the total area is 19.7% smaller (area in 2019 was 14,010 hectare) and the number of residents 28.9% lower (number of residents in 2019 was 224,882 based on the population file of 1 January 2022).

4.3.3 L_{night} contours

The L_{night} contours represent the A-weighted equivalent sound pressure level for the period 23:00 to 07:00 and are reported from 45 dB(A) to 70 dB(A) in steps of 5 dB(A). The evolution of the contours for 2021 and 2022 is shown in Figure 12, whereby only the 45 dB(A) and 50 dB(A) contour are presented. Due to an additional contour being reported, a magnifying visual effect between the day and the evening is created. The 45 dB(A) L_{night} contour is larger than the 55 dB(A) contour for daytime and is now, due to the correction of 10 dB(A) for the calculation of L_{den}, just as significant as the L_{day} contour of 55 dB(A) and the $L_{evening}$ contour of 50 dB(A).

The evaluation period for the L_{night} contours does not coincide with the operational night period (23:00 to 06:00) and also consists of the flights during the operational daytime period between 06:00 and 07:00. The noise contours are a combination of the runway and route usage during the operational night and during the operational day.

Most important findings in evolution L_{night} contour 2019, 2021, 2022

The L_{night} contours are, due to the general increase in the number of movements in the night (+32.3%), larger than in 2021. The greatest differences can be seen to the north and south of Brussels Airport, where the noise impact shows a 2 dB(A) increase. The same evolution as in the L_{day} and L_{night} noise impact can be seen to the east of Brussels Airport, whereby the increase in noise impact in the extension of 25R is smaller than in the extension of 25L. To the west of Brussels Airport, where the noise impact is primarily caused by traffic departing from 25R, the increase compared to 2021 can primarily be seen to the south west of the airport. This is due to an increase in the route usage of departures from 25R with a bend to the left between 06:00 and 07:00. In comparison with 2019, the number of movements in the night has decrease less (-9.7%0 than the number of movements in the day (-23.9%) and evening (-30.1%). To the north and south of the airport, the noise impact has increased compared to 2019. The noise impact to the south east and west of the airport has, in fact, decreased in the extension of runway 25L.

Comparison 2022 and 2021

There are a number of relevant findings for the night, which are similar to those of the day. The number of landings in the evening period increased by 34.8% and the number of departures increased by 29.4%. Although runway 25R is in general the preferential landing runway in the night (mainly for cargo), the share of this runway has still decreased from 57.3% in 2021 to 47.8% in 2022. This is the consequence of a relative higher increase in passenger traffic compared to cargo. In common with the evening and day period, the number of landings on runway 01 has increased (+80.2%). The number of arrivals on runway 07R has increased from 30 arrivals in 2021 to 188 arrivals in 2022. The number of arrivals on runway 19 (+69.3%) and runway 25L (+52.5%) has also increased.

For departing traffic, an increase is mainly seen in the use of 07R, whereby the relative share of this runway for departing night flights increased from 3.4% in 2021 to 7.2% in 2022. In absolute numbers, the number of departures from 07R increased from 294 in 2021 to 821 in 2022. Runway 25R remains, just as in 2021, by far the most used runway for departures of night flights. The relative share of this runway in the total number of departures at night did decline slightly from 69.0% in 2021 to 68.0% in 2022.

The number of movements with heavier aircraft increased by 9.8% and the number of movements with lighter aircraft increased by 42.2%. The number of departures with heavier aircraft on the other hand did decrease by 1.8%. The A306 has, just as in 2021, the largest share of departing night flights with heavier aircraft.

To the north of the airport, the noise impact has increased by 2 dB(A) which is primarily due to the increase in the number of landings in the night on runway 19 (583 landings in 2021 and 987 landings in 2022). To the east of the airport, the same conclusion can be drawn where the increase in noise impact is greater in the extension of runway 25L.

To the south of Brussels Airport, the noise impact has increased by 2 dB(A) due to an increase in the number of landings on 01 (1,024 landings in 2021 and 1,845 landings in 2022).

In the night, too, an increase in the share of departures with a bend to the left from 25R can be seen, which leads to a higher increase in the noise impact in the south west than in the north west. This is the consequence of the increase in departing passenger traffic compared to 2021 between 06:00 and 07:00.

Comparison 2022 and 2019

The number of landings in the night has dropped by 8.9% compared to 2019 and the number of departures decreased by 10.7%. In 2022, the number of landings on runway 01 during the night almost double compared to 2019. The number of landings rose from 939 in 2019 to 1,845 landings in 2022. This is partly why the noise impact to the south of the airport has increased by more than 2 dB(A). The number of landings on runway 25L has considerably decreased by 32.3% (5,826 landings in 2019 and 3,944 landings in 2022). In 2019, 54.9% of the landings on 25L were carried out with heavier type aircraft. The share of heavier aircraft decreased in 2022 to 44.6%. The decrease in the number of movements in combination with the evolution in the fleet led to a reduction of more than 1 dB(A) to the east of the airport in the landing zone of runway 25L.

The number of departures from runways 07L and 07R increased by 34.8% and 66.2% respectively. The relative share of runway 25R as departure runway for night flights did, however, decrease from 75.3% in 2019 to 68.0% in 2022, which explains the decrease in noise impact to the west of the airport.

To the north of the airport, where the noise impact comes from landings on runway 19, the noise impact has remained virtually the same. The number of night-time arrivals on this runway has only slightly increased by 2.1% compared to 2019.

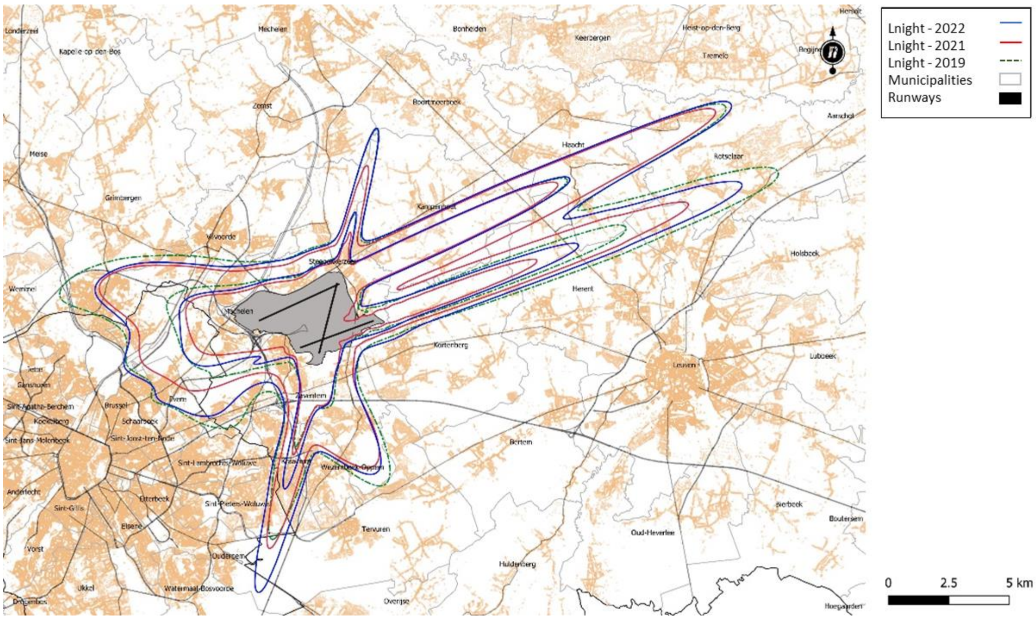


Figure 12: L_{night} noise contours of 45 and 50 dB(A) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area within the L_{night} contour of 45 dB(A) in 2021 is 24.9% larger than in 2021 (from 10,870 ha to 13,572 ha). The number of residents within the L_{night} contour of 45 dB(A) increased by 44.8% (from 104,908 to 151,901). The number of residents within the contour increased by 2,001 (+1.3%) due to developments in the population numbers. Compared to 2019, the total area is 7% smaller (area in 2019 was 14,586 hectare) and the number of residents 15.1% lower (number of residents in 2019 was 179,001 based on the population file of 1 January 2022).

4.3.4 L_{den} contours

The L_{den} unit is a combination of L_{day}, $L_{evening}$ and L_{night}. The evening flight movements are penalised with 5 dB(A) and the night flight movements with 10 dB(A). The evolution of the contours for 2021 and 2022 is shown in Figure 13, whereby only the 55 dB(A) and 60 dB(A) contour are presented.

The changed form is a weighted combination of all effects which are outlined in detail in the discussion of L_{day}, $L_{evening}$ and L_{night} contours. The findings for the different periods are confirmed.

In comparison with 2021, the noise impact to the east of the airport has increased more in the extension of runway 25L, which comes through a shift in runway usage where the relative share of landings on 25L has increased, while the share of 25R as landing runway has actually decreased. The widening in the lobe close to runway 25L/07R is due to an increase of the use of 07R for departing traffic, where the greatest increase took place in the evening (+204.1%). All other changes are the same for the day, evening and night, which is reflected in the L_{den} contour.

Also in comparison with 2019, previously stated findings were confirmed, where, despite the fact that fewer movements took place in 2022, the noise impact did not decrease everywhere. This is due to a shift in the runway usage and the evolution of the fleet.

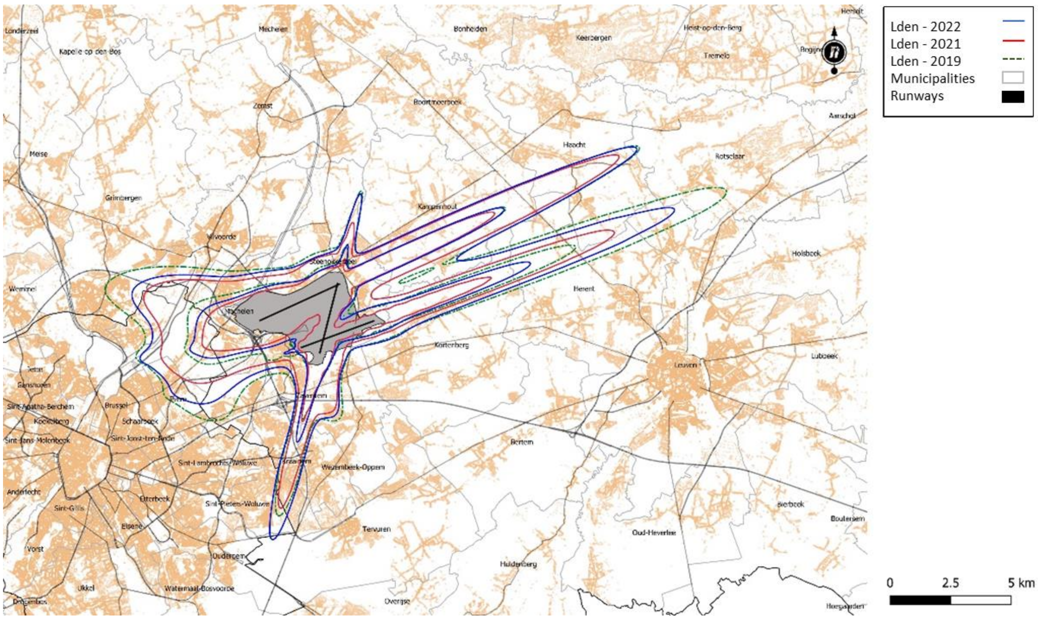


Figure 13: L_{den} noise contours of 55 and 60 dB(A) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area inside the L_{den} noise contour of 55 dB(A) increased in 2022 by 32.6% compared with 2021 (from 6,520 ha to 8,648 ha). The number of residents within the L_{den} contour of 55 dB(A) increased by 53.2% (from 51,119 to 78,326). The number of residents within the contour increased by 1,024 (+1.3%) due to developments in the resident numbers. Compared to 2019, the total area is 10.9% smaller (area in 2019 was 9,701hectare) and the number of residents 19.2% lower (number of residents in 2019 was 96,966 based on the population file of 1 January 2022).

4.3.5 Freq.70,day contours (day 07:00 - 23:00)

The Freq.70,day contours are calculated for an evaluation period consisting of both the L_{day} and $L_{evening}$ evaluation periods. The evolution of the Freq.70,day contours reflects the general decrease in traffic, changes in the runway usage and the changes in the fleet (see Figure 14). The figure indicates the contours for 2019, 2021 and 2022 where on average a noise level of 70 dB(A) or more occurs 5x and 20x per day during the day period (07:00 to 23:00).

In common with the development of the L_{day} and $L_{evening}$ noise impact, the differences in the contours for landings on runway 25L are larger between the various years than the differences in the contours for landings on runway 25R. This is the consequence of the fact that in 2021 and 2022 runway 25L has a relatively lower share in the total number of landings when compared with 2019.

The change of the frequency contours to the south and north of Brussels Airport is similar to the change in L_{day} and $L_{evening}$ as a consequence of the change in runway usage. In 2019 and 2022, the landing contours to the north of the airport were considerably greater than in 2021 due to the fact that runway 19 was more frequently deployed as landing runway than in 2021. To the south, the frequency contours, where on average 20x a day a noise level of 70 dB(A) or more occurs, are the largest in 2022. This is the consequence of the increasing use of runway 01 as landing runway.

To the west of the airport, where the noise impact is dominated by traffic departing from 25R, the contours of 2019 and 2022 can be seen to overlap more in the west and south west. In the north west, the frequency contours are considerably larger in 2019 than in 2021 and 2022. This is the consequence of the route distribution for departing traffic from 25R.

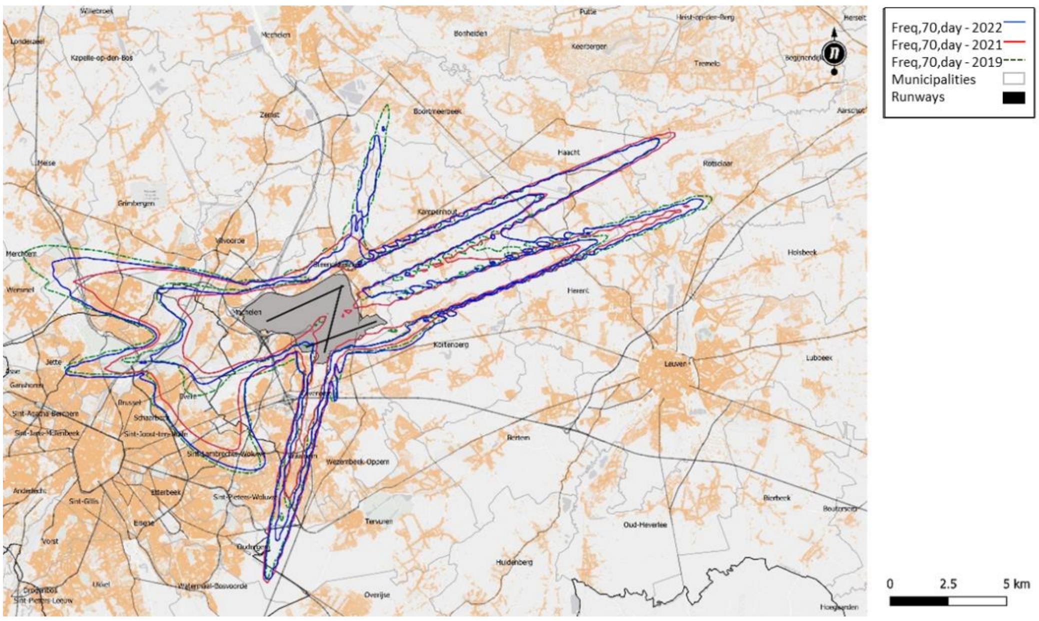


Figure 14: Freq.70,day contours (5x and 20x above 70 dB(A)) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area inside the contour of '5x above 70 dB(A)' increased in 2022 by 15.7% compared with 2021 (from 9,998 ha to 11,566). The number of residents inside the Freq.70,day contour of five events increased by 39.2% (from 151,451 to 210,819). Compared to 2019, the total area is 4.4% smaller (area in 2019 was 12,097 ha) and the number of residents 1.7% lower (number of residents in 2019 was 214,528 based on the population file of 1 January 2022).

4.3.6 Freq.70,night contours (night 23:00-07:00)

The Freq.70,night contours are calculated for the same evaluation period as the L_{night}. The evolution of the Freq.70,night contours reflects the general changes in traffic numbers, the changes in the runway usage and the changes in the fleet that were discussed for L_{night}. The figure indicates the contours where on average a noise level of 70 dB(A) occurs 1x and 5x per day during the night period (23:00 to 07:00).

In common with the development of the L_{night} noise impact, the differences in the contours for landings on runway 25L are larger between the various years than the differences in the contours for landings on runway 25R. This is the consequence of the changes in the distribution of the number of landings between runway 25L and 25R.

To the north of the airport, the frequency contours of 2019 and 2022 overlap. The number of landings on runway 19 in 2022 is comparable to the number in 2019.

To the south of Brussels Airport, the calculated landing contour is larger due to the increase in the number of arrivals on runway 01 (from 1,024 in 2021 to 1,845 in 2022). In 2019, only 939 landings took place on runway 01 in the night, which means that the frequency contours in 2019 are smaller than in 2021 and 2022. The greatest differences between the frequency contours can be seen to the south west of the airport, where departing traffic from 25R has a higher share in 2019 and 2022 compared to 2021.

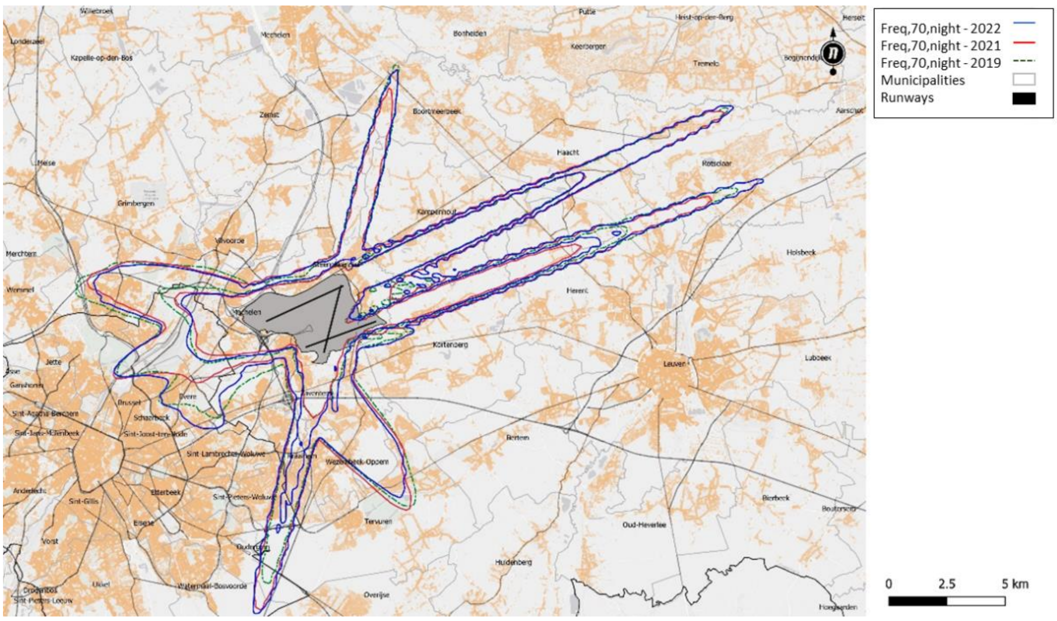


Figure 15: Freq.70,night contours (1x and 5x above 70 dB(A)) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area inside the contour of '1x above 70 dB(A)' increased in 2022 by 8.4% compared with 2021 (from 11,087 ha to 12,016). The number of residents within this contour has risen by 42.1% (from 108,852 to 154,700). Compared to 2019, the total area is 0.8% smaller (area in 2019 was 11,920 ha) and the number of residents 9.3% lower (number of residents in 2019 was 141,583 based on the population file of 1 January 2022).

4.3.7 Freq.60,day contours (day 07:00-23:00)

The Freq.60,day contours are calculated for an evaluation period consisting of both the L_{day} and $L_{evening}$ evaluation periods. The evolution of the Freq.60,day contours reflects the general changes in traffic numbers, the changes in the runway usage and the fleet changes that have already been discussed. The figure indicates the contours where on average a noise level of 60 dB(A) occurs 50x, 100x per day during the day period (07:00 to 23:00).

The changes in the frequency contours for 60 dB reflects to the east of Brussels Airport the higher number of landings on runways 25L and 25R compared to 2021 and 2022. To the north of the airport, there are no contours of 50x or higher, since in all years there were on average fewer than 50 events per day between 07:00 and 23:00. To the west of the airport, it can once again be seen that in 2019 more movements from 25R left towards the north west/west.

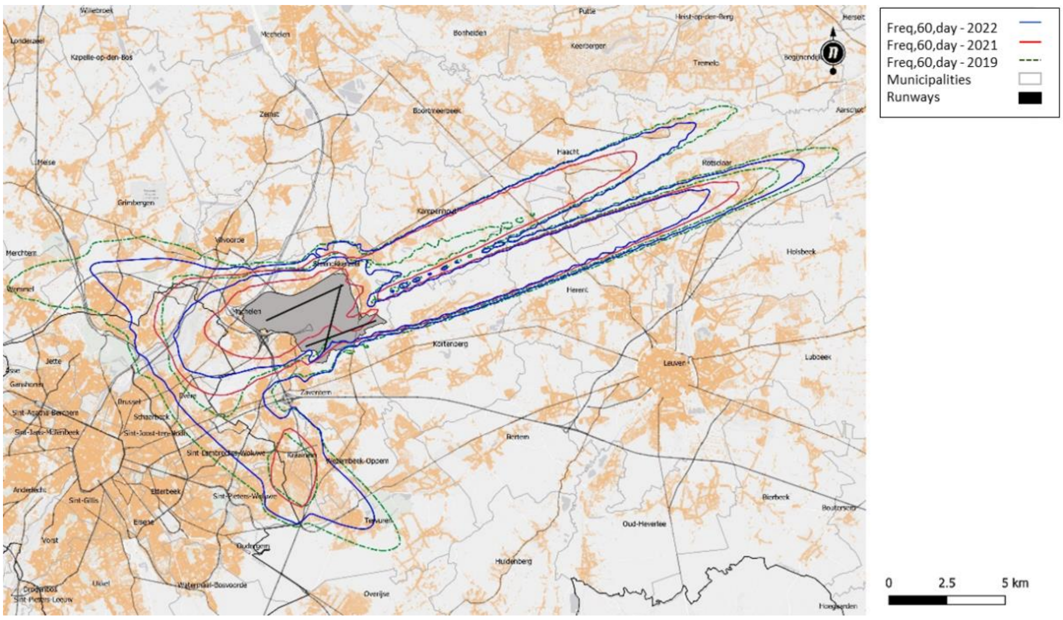


Figure 16: Freq.60,day contours (50x and 100x above 60 dB(A)) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area within the Freq.60,day-contour of 50x above 60 dB(A) rose in 2022 by 59.2% compared with 2021 (from 8,959 ha to 14.262 ha.). The number of residents within the Freq.60,day contour of 50x above the 60 dB(A) rose sharply by 161.4% (from 77,644 to 202,942). Compared to 2019, the total area is 17% smaller (area in 2019 was 17,175 ha) and the number of residents 23.2% lower (number of residents in 2019 was 264,291 based on the population file of 1 January 2022).

4.3.8 Freq.60,night - contours (night 23:00-07:00)

The Freq.60,night contours are calculated for the same evaluation period as the L_{night}. The evolution of the Freq.60,night contours reflects the general changes in traffic numbers, changes in the runway usage and the changes in the fleet. The figure shows the contours where on average a noise level of 60 dB(A) occurs 10x and 15x per day during the night period (23:00 to 07:00).

To the east of the airport, it can be seen that the frequency contour in the extension of 25L is missing for 2021. This shows that in this region on average fewer than 10 events occurred per day between 23:00 and 07:00. The same applies for the lobe to the south of the airport.

To the north of the airport, there are no contours of 10x or higher, since in all years there were on average fewer than 10 events per day between 07:00 and 23:00.

The frequency contours to the west of Brussels Airport reflect the higher number of departures in a north-westerly direction from 25R in 2019 compared to those in 2021 and 2022.

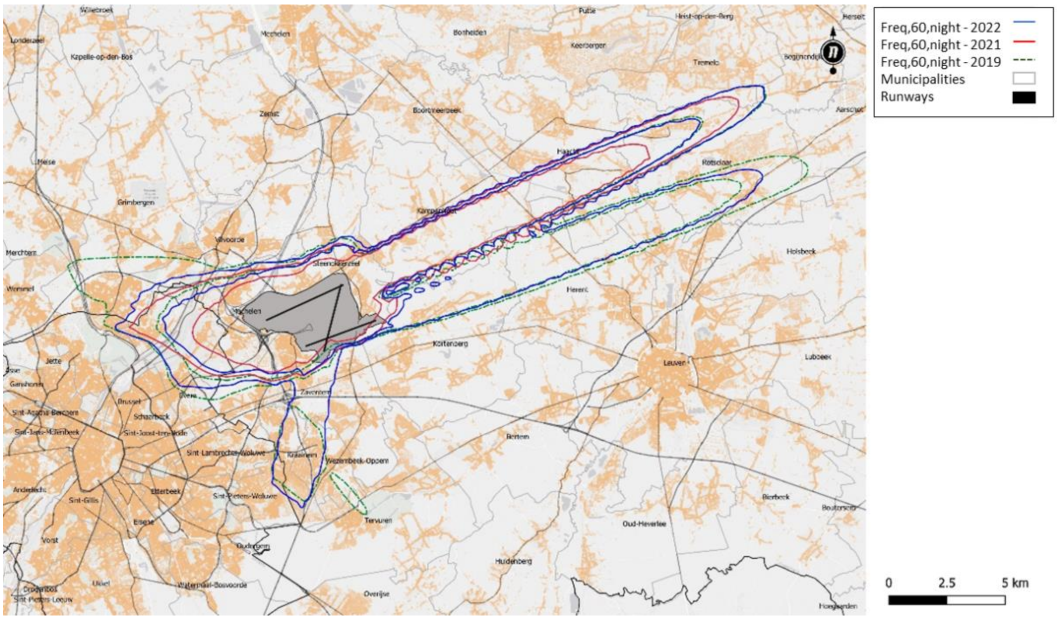


Figure 17: Freq.60,night contours (10x and 15x above 60 dB(A)) around Brussels Airport in 2019 (green), 2021 (red) and 2022 (blue).

The total surface area within the Freq.60,night contour with 10x above 60 dB(A) rose in 2022 by 70.8% compared with 2021 (from 7,491 ha to 12,796 ha). The number of residents inside the Freq.60,night contour of 10x above 60 dB(A) increased by 86.7% (from 66,026 to 123,293). Compared to 2019, the total area is 9.9% smaller (area in 2019 was 14,204 ha) and the number of residents 21.2% lower (number of residents in 2019 was 156,569 based on the population file of 1 January 2022).

4.4 Potentially seriously inconvenienced

The number of people who are potentially seriously inconvenienced is determined on the basis of the calculated L_{den} and the exposure-effect relationship for serious inconvenience, as stipulated in VLAREM II (see paragraph 2.2). The number of people who are potentially seriously inconvenienced is also reported per municipality. This report uses the most recent population numbers (1 January 2023).

Table 6 shows the results for the number of potentially seriously inconvenienced persons. The results are also shown graphically in Figure 18. Table 6 shows that the year 2019 is modelled both with INM7.0b (official reporting noise contours 2019) and later redone with Echo (comparability with contours 2021 and 2022).

The total number of potentially highly inconvenienced persons in 2022 within the contour of 55 dB(A) is 11,744, an increase of 52.2% in comparison to 2021 but a decrease of 18.6% compared to 2019. The number of potentially seriously inconvenienced within the contour of 55 dB(A) increased by 155 (+1.3%) due to developments in the population numbers.

Compared to 2019, many municipalities fall outside the L_{den} 55 dB contour, in particular: Grimbergen and Sint Lambrechts-Woluwe. In the other municipalities, the number of potentially highly inconvenienced people increased compared to 2021: The greatest increase is in the municipality of Evere (+1,137). There are municipalities where the number of potentially highly inconvenienced people is higher than in 2019: Haacht (+85), Herent (+8), Kampenhout (+196), Leuven (+13), Kortenberg (+76), Kraainem (+94), Sint-Pieters-Woluwe (+199), Steenokkerzeel (+42), Wezembeek-Oppem (+151). There are, however, municipalities where the number of potentially highly inconvenienced people is lower than in 2019: Brussels (-344), Evere (-517), Grimbergen (-485), Machelen (-475), Sint-Lambrechts-Woluwe (-241), Vilvoorde (-1,053) and Zaventem (-425).

The most exposed municipalities in absolute numbers are Machelen, Zaventem, Steenokkerzeel, Brussels, Evere and Kampenhout, with in total 9.609 potentially seriously inconvenienced or 81.8% of the total number.

Table 6: Evolution of the number of people who are potentially seriously inconvenienced inside the L_{den} 55 dB(A) noise contour

Year	2000	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019	2020	2021	2022
INM version	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	Echo	Echo	Echo	Echo
Method	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	adres	adres	adres	adres	adres	adres	adres
Population data	1jan'00	1jan'03	1jan'06	1jan'07	1jan'07	1jan'08	1jan'08	1jan'10	1jan'10	1jan'10	1jan'11	1jan'11	1jan'16	1jan'17	1jan'19	1jan'22	1jan'20	1jan'22	1jan'23
Brussel	2.441	1.254	1.691	1.447	1.131	1.115	1.061	1.080	928	1.780	1.739	1.789	1.803	1.889	1.898	1.933	959	1151	1554
Evere	3.648	2.987	3.566	3.325	2.903	2.738	2.599	2.306	1.142	2.975	1.443	1.850	1.505	1.875	1.754	1.902	0	100	1237
Grimbergen	3.111	479	1.305	638	202	132	193	120	0	175	428	517	449	440	485	8	0	0	0
Haacht	96	103	119	58	36	31	37	37	24	50	115	70	78	66	51	164	2	74	136
Herent	186	88	140	162	119	115	123	134	107	152	111	161	133	136	136	183	3	88	144
Huldenberg	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kampenhout	529	747	727	582	453	483	461	399	430	469	648	566	457	563	439	632	329	481	635
Kortenberg	664	548	621	604	512	526	497	422	603	443	366	438	431	521	495	654	101	301	571
Kraainem	1.453	934	1.373	1.277	673	669	667	500	589	111	368	379	388	524	393	400	22	256	487
Leuven	70		9	22	2	1	3	5	0	11	0	0	13	18	22	114	0	0	35
Machelen	3.433	2.411	2.724	2.635	2.439	2.392	2.470	2.573	2.278	2.505	2.598	2.649	3.015	2.995	3.032	2.872	2.194	2.242	2557
Meise	506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Overijse	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rotselaar	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	0	0	0
Schaarbeek	2.026	995	1.937	1.440	603	1.153	1.652	1.703	76	1.647	354	956	6	165	0	0	0	0	0
Sint-L.-Woluwe	1.515	382	1.218	994	489	290	196	150	0	0	0	1	142	44	241	16	0	0	0
Sint-P.-Woluwe	642	411	798	607	396	477	270	82	390	0	79	102	90	338	85	78	0	7	284
Steenokkerzeel	1.769	1.530	1.584	1.471	1.327	1.351	1.360	1.409	1.455	1.439	1.675	1.525	1.506	1.595	1.545	1.583	1.388	1.298	1587
Tervuren	1.550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vilvoorde	2.622	1.158	1.483	1.177	894	812	868	851	302	1.012	1.120	1.136	1.146	1.103	1.129	879	139	7	76
Wemmel	142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wezembeek-O.	1.818	739	878	670	359	425	408	399	457	172	282	252	268	360	250	302	35	226	401
Zaventem	5.478	3.490	3.558	3.628	2.411	2.152	2.544	2.716	2.618	1.884	2.638	1.835	2.144	2.315	2.464	2.670	1.582	1.485	2039
Zemst	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Total	**33.889**	**18.257**	**23.732**	**20.737**	**14.950**	**14.861**	**15.409**	**14.886**	**11.399**	**14.825**	**13.965**	**14.226**	**13.575**	**14.948**	**14.420**	**14.469**	**6.756**	**7.716**	**11.744**

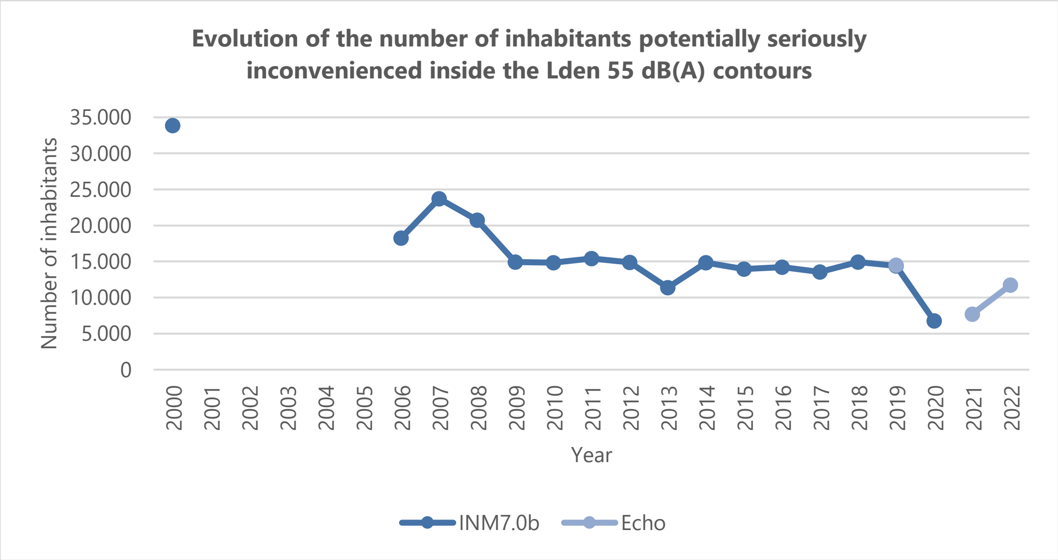


Figure 18: Evolution of the number of people who are potentially seriously inconvenienced inside the L_{den} 55 dB(A) noise contour.

Bijlage A. Runway usage

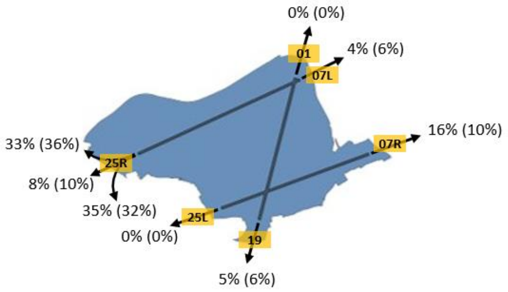
This appendix gives a complete description of the runway usage. The number of departures and arrivals are given for each runway, both absolute or percentage-wise, for 2022 and place against those for 2021, for:

- The total
- The day period, from 07:00 to 19:00
- The evening period, from 19:00 to 23:00
- The night period, from 23:00 to 07:00

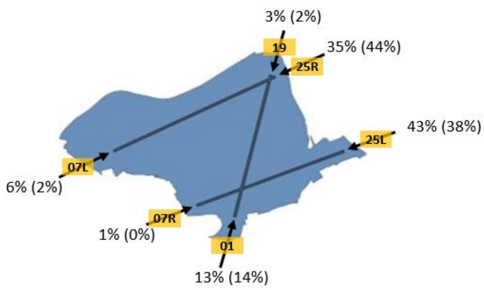
The figures give the share of departures and arrivals for each runway, with runway usage in 2021 between brackets. The tables also give the absolute number of movements.

Total runway usage: all flights day, evening and night.

Departures



Arrivals

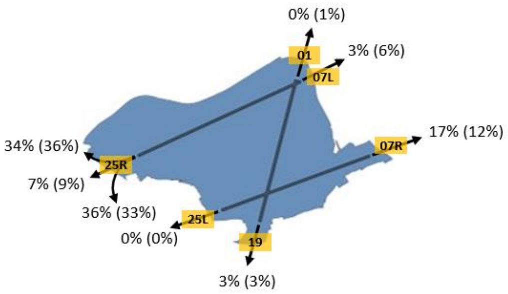


All flights (Day, Evening and Night)				
Take-offs				
	Number		Share	
Runway	2021	2022	2021	2022
01	269	172	0,5%	0,2%
07L	3.444	3.326	5,8%	3,7%
07R	6.005	13.982	10,1%	15,6%
19	3.433	4.390	5,8%	4,9%
25L	30	50	0,1%	0,1%
25R	46.198	67.547	77,8%	75,5%

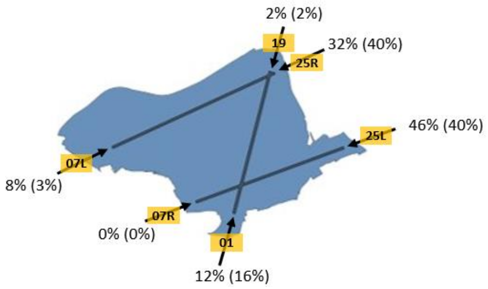
All flights (Day, Evening and Night)				
Landings				
	Number		Share	
Runway	2021	2022	2021	2022
01	8.460	11.353	14,3%	12,7%
07L	1.187	5.362	2,0%	6,0%
07R	88	491	0,1%	0,5%
19	1.316	2.657	2,2%	3,0%
25L	22.322	38.475	37,6%	43,0%
25R	25.981	31.125	43,8%	34,8%

Runway usage for the day period, from 07:00 to 19:00

Departures



Arrivals

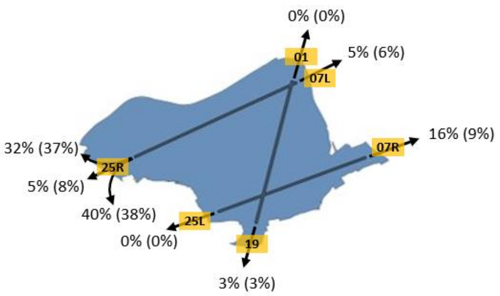


flights Day				
Take-offs				
	Number		Share	
Runway	2021	2022	2021	2022
01	248	165	0,6%	0,3%
07L	2.256	1.706	5,8%	2,9%
07R	4.719	10.144	12,0%	17,3%
19	1.282	1.798	3,3%	3,1%
25L	9	6	0,0%	0,0%
25R	30.680	44.875	78,3%	76,5%

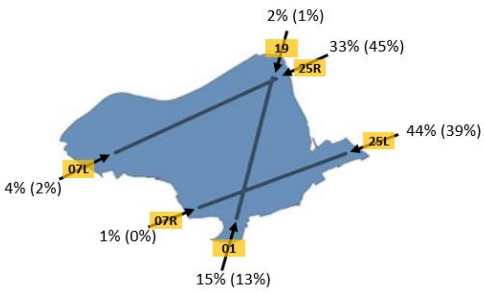
flights Day				
Landings				
	Number		Share	
Runway	2021	2022	2021	2022
01	5.882	6.769	15,6%	11,7%
07L	988	4.605	2,6%	7,9%
07R	31	82	0,1%	0,1%
19	615	1.250	1,6%	2,2%
25L	15.251	26.576	40,3%	45,8%
25R	15.038	18.699	39,8%	32,3%

Runway usage for the evening period, from 19:00 to 23:00

Departures



Arrivals

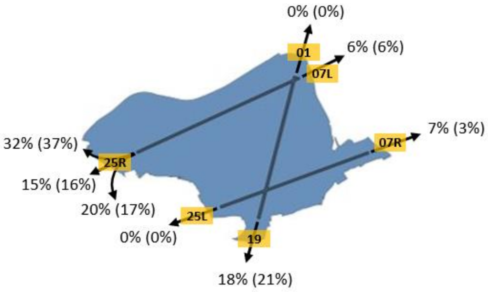


flights Evening				
Take-offs				
	Number		Share	
Runway	2021	2022	2021	2022
01	13	4	0,1%	0,0%
07L	647	907	5,7%	4,7%
07R	992	3.017	8,7%	15,5%
19	299	550	2,6%	2,8%
25L	1	0	0,0%	0,0%
25R	9.473	14.960	82,9%	77,0%

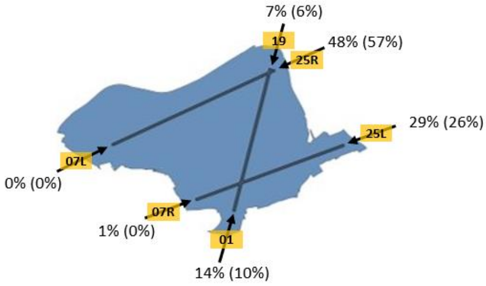
flights Evening				
Landings				
	Number		Share	
Runway	2021	2022	2021	2022
01	1.554	2.739	13,4%	15,1%
07L	186	737	1,6%	4,1%
07R	27	221	0,2%	1,2%
19	118	420	1,0%	2,3%
25L	4.485	7.955	38,6%	44,0%
25R	5.253	6.025	45,2%	33,3%

Runway usage for the night period from 23:00 to 07:00

Departures



Arrivals



flights Night				
Take-offs				
	Number		Share	
Runway	2021	2022	2021	2022
01	8	3	0,1%	0,0%
07L	541	713	6,2%	6,3%
07R	294	821	3,4%	7,2%
19	1.852	2.042	21,1%	18,0%
25L	20	44	0,2%	0,4%
25R	6.045	7.712	69,0%	68,0%

flights Night				
Landings				
	Number		Share	
Runway	2021	2022	2021	2022
01	1.024	1.845	10,3%	13,8%
07L	13	20	0,1%	0,1%
07R	30	188	0,3%	1,4%
19	583	987	5,9%	7,4%
25L	2.586	3.944	26,1%	29,5%
25R	5.690	6.401	57,3%	47,8%

Bijlage B. Location of the measuring stations

This appendix gives the locations of the measuring station.

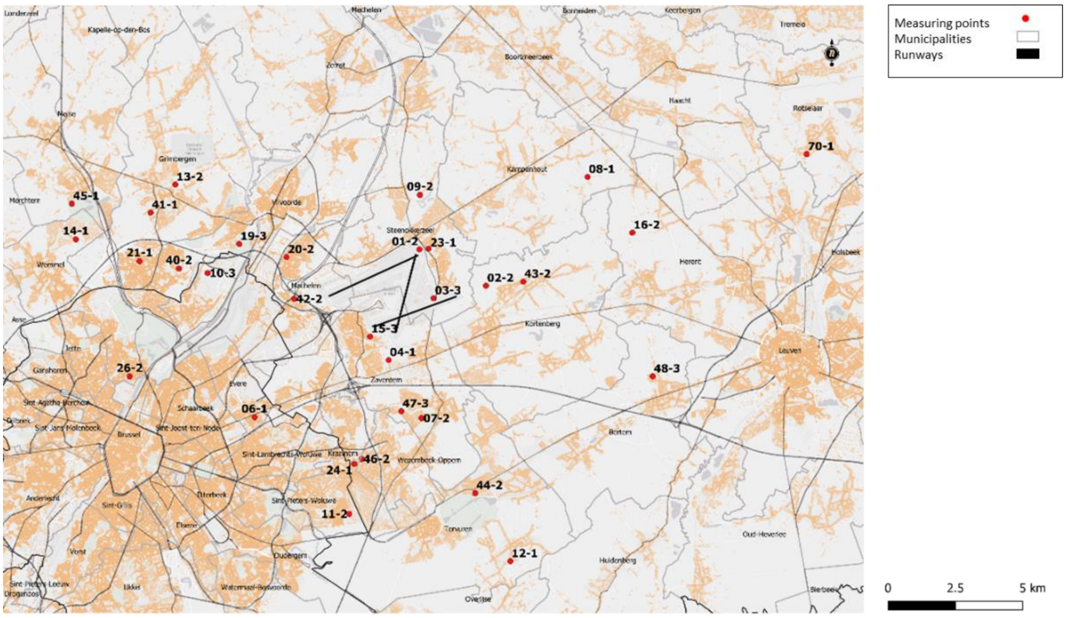


Figure 19: Location of the measuring stations

Table 7: Overview of the measuring stations

Location code	Location name	Location code	Location name
NMT01-2	STEENOKKERZEEL	NMT19-4	VILVOORDE
NMT02-2	KORTENBERG	NMT20-3	MACHELEN
NMT03-3	HUMELGEM-Airside	NMT21-1	STROMBEEK-BEVER
NMT04-1	NOSSEGEM	NMT23-1	STEENOKKERZEEL
NMT06-1	EVERE	NMT24-1	KRAAINEM
NMT07-2	STERREBEEK	NMT26-2	BRUSSELS
NMT08-1	KAMPENHOUT	NMT40-2*	KONINGSLO
NMT09-2	PERK	NMT41-1*	GRIMBERGEN
NMT10-3	NEDER-OVER-HEEMBE	NMT42-2*	DIEGEM
NMT11-2	SINT-PIETERS-WOLUW	NMT43-2*	ERPS-KWERPS
NMT12-1	DUISBURG	NMT44-2*	TERVUREN
NMT13-2	GRIMBERGEN	NMT45-1*	MEISE
NMT14-1	WEMMEL	NMT46-2*	WEZEMBEEK-OPPEM
NMT15-3	ZAVENTEM	NMT47-3*	WEZEMBEEK-OPPEM
NMT16-2	VELTEM	NMT48-3*	BERTEM
		NMT70-1*	ROTSELAAR

* noise data Department of the Environment, off-line correlated by the NMS

Bijlage C. Results of contour calculations 2022

This appendix gives the number of residents per contour zone and per municipality.

C.1 Surface area per contour zone and per municipality

Table 8: Surface area per L_{day} contour zone and municipality 2022

area (ha)	Lday - Noise contours dB(A) (day 07h00-19h00)					
location name	55-60	60-65	65-70	70-75	>75	Total
Brussels	450	13	0	0	0	462
Evere	3	0	0	0	0	3
Haacht	1	0	0	0	0	1
Herent	198	0	0	0	0	198
Kampenhout	334	38	0	0	0	371
Kortenberg	441	152	24	0	0	618
Kraainem	24	0	0	0	0	24
Machelen	392	258	97	25	4	775
Steenokkerzeel	456	307	171	99	64	1.097
Vilvoorde	4	0	0	0	0	4
Wezembeek-Oppem	10	0	0	0	0	10
Zaventem	335	113	38	19	14	519
Total	**2.647**	**881**	**330**	**143**	**82**	**4.083**

Table 9: Surface area per $L_{evening}$ contour zone and municipality 2022

area (ha)	Levening- Noise contours en dB(A) (evening 19:00-23:00)						
location name	50-55	55-60	60-65	65-70	70-75	>75	Total
Brussels	667	378	2	0	0	0	1.046
Evere	462	0	0	0	0	0	462
Grimbergen	4	0	0	0	0	0	4
Haacht	654	0	0	0	0	0	654
Herent	686	112	0	0	0	0	798
Kampenhout	1.048	328	40	0	0	0	1.417
Kortenberg	530	395	110	15	0	0	1.051
Kraainem	302	34	0	0	0	0	337
Leuven	225	0	0	0	0	0	225
Machelen	301	407	246	85	22	7	1.068
Rotselaar	103	0	0	0	0	0	103
Schaarbeek	30	0	0	0	0	0	30
Sint-Lambrechts-Woluwe	240	0	0	0	0	0	240
Sint-Pieters-Woluwe	216	0	0	0	0	0	216
Steenokkerzeel	425	468	295	167	95	61	1.510
Tervuren	70	0	0	0	0	0	70
Vilvoorde	429	0	0	0	0	0	429
Wezembeek-Oppem	146	31	0	0	0	0	177
Zaventem	887	359	108	37	16	8	1.415
Total	**7.425**	**2.512**	**802**	**304**	**133**	**75**	**11.251**

Table 10: Surface area per L_{night} contour zone and municipality 2022

area (ha)	Lnight - Noise contours en dB(A) (night 23:00-7:00)						
location name	45-50	50-55	55-60	60-65	65-70	>70	Total
Brussels	815	305	0	0	0	0	1.120
Evere	335	0	0	0	0	0	335
Grimbergen	73	0	0	0	0	0	73
Haacht	932	81	0	0	0	0	1.013
Herent	752	208	0	0	0	0	960
Kampenhout	963	568	177	13	0	0	1.720
Kortenberg	507	357	118	19	0	0	1.001
Kraainem	213	61	0	0	0	0	274
Leuven	260	0	0	0	0	0	260
Machelen	327	481	203	62	17	5	1.095
Oudergem	28	0	0	0	0	0	28
Rotselaar	764	0	0	0	0	0	764
Schaarbeek	19	0	0	0	0	0	19
Sint-Pieters-Woluwe	182	0	0	0	0	0	182
Steenokkerzeel	512	496	302	202	119	67	1.699
Tervuren	142	0	0	0	0	0	142
Vilvoorde	518	4	0	0	0	0	522
Wezembeek-Oppem	220	67	0	0	0	0	287
Zaventem	1.224	533	209	55	22	5	2.048
Zemst	32	0	0		0	0	32
Total	**8.817**	**3.160**	**1.010**	**351**	**158**	**77**	**13.572**

Table 11: Surface area per L_{den} contour zone and municipality 2022

area (ha)	Lden - Noise contourss en dB(A) (day 07h-19h, evening 19-23h, night 23h-07h)					
location name	55-60	60-65	65-70	70-75	>75	Total
Brussels	790	134	0	0	0	924
Evere	184	0	0	0	0	184
Haacht	537	0	0	0	0	537
Herent	530	26	0	0	0	556
Kampenhout	946	318	46	0	0	1.310
Kortenberg	457	306	66	7	0	836
Kraainem	169	11	0	0	0	180
Leuven	112	0	0	0	0	112
Machelen	397	381	153	47	17	995
Rotselaar	4	0	0	0	0	4
Sint-Pieters-Woluwe	91	0	0	0	0	91
Steenokkerzeel	537	394	262	156	127	1.476
Tervuren	3	0	0	0	0	3
Vilvoorde	156	0	0	0	0	156
Wezembeek-Oppem	119	7	0	0	0	126
Zaventem	648	357	97	36	19	1.157
Total	**5.681**	**1.935**	**622**	**247**	**163**	**8.648**

Table 12: Surface area per Freq.70,day contour zone and municipality 2022

Area (ha)	Freq.70,day - Noise contours (day 07:00-23:00)					
location name	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Boortmeerbeek	1	0	0	0	0	1
Brussels	190	413	577	134	5	1.319
Evere	139	341	33	0	0	513
Grimbergen	456	59	0	0	0	516
Haacht	286	155	56	1	0	498
Herent	227	79	81	149	17	553
Jette	13	0	0	0	0	13
Kampenhout	456	339	284	344	0	1.423
Kortenberg	219	137	209	177	308	1.050
Kraainem	28	44	142	0	0	214
Leuven	134	0	0	0	0	134
Machelen	57	91	218	202	385	952
Meise	11	0	0	0	0	11
Oudergem	17	0	0	0	0	17
Rotselaar	127	0	0	0	0	127
Schaarbeek	166	1	0	0	0	166
Sint-Lambrechts-Woluwe	420	12	0	0	0	432
Sint-Pieters-Woluwe	39	50	66	0	0	155
Steenokkerzeel	204	136	384	298	465	1.487
Tervuren	55	47	12	0	0	114
Vilvoorde	164	310	25	0	0	499
Wemmel	46	0	0	0	0	46
Wezembeek-Oppem	18	32	93	0	0	143
Zaventem	339	224	399	126	62	1.150
Zemst	33	0	0	0	0	33
Total	**3.845**	**2.470**	**2.579**	**1.430**	**1.242**	**11.566**

Table 13: Surface area per Freq.70,night contour zone and municipality 2022

area (ha)	Freq.70,night - Noise contours (night 23:00-07:00)				
location name	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	167	0	0	0	167
Brussels	806	257	69	0	1.132
Evere	450	0	0	0	450
Grimbergen	197	0	0	0	197
Haacht	330	198	13	0	540
Herent	213	188	112	0	512
Kampenhout	565	195	594	5	1.358
Kortenberg	275	154	397	0	827
Kraainem	122	113	0	0	235
Leuven	149	0	0	0	149
Machelen	205	190	313	223	931
Oudergem	94	0	0	0	94
Rotselaar	529	0	0	0	529
Schaarbeek	33	0	0	0	33
Sint-Lambrechts-Woluwe	20	0	0	0	20
Sint-Pieters-Woluwe	138	34	0	0	173
Steenokkerzeel	606	181	420	409	1.616
Tervuren	319	2	0	0	321
Vilvoorde	454	12	0	0	466
Watermaal - Bosvoorde	54	0	0	0	54
Wezembeek-Oppem	161	86	0	0	247
Zaventem	1.042	486	299	50	1.877
Zemst	85	0	0	0	85
Total	**7.015**	**2.098**	**2.217**	**686**	**12.016**

Table 14: Surface area per Freq.60,day contour zone and municipality 2022

area (ha)	Freq.60,day - Noise contours (day 07:00-23:00)				
location name	50-100	100-150	150-200	>200	Total
Aarschot	6	0	0	0	6
Brussels	596	403	126	0	1.125
Evere	411	6	0	0	417
Grimbergen	250	0	0	0	250
Haacht	793	258	0	0	1.050
Herent	369	637	0	0	1.007
Kampenhout	1.422	87	0	0	1.508
Kortenberg	212	814	7	0	1.033
Kraainem	513	0	0	0	513
Leuven	78	252	0	0	330
Machelen	161	260	674	0	1.095
Rotselaar	1.110	179	0	0	1.288
Schaarbeek	8	0	0	0	8
Sint-Lambrechts-Woluwe	354	0	0	0	354
Sint-Pieters-Woluwe	272	0	0	0	272
Steenokkerzeel	314	367	522	327	1.531
Tervuren	243	0	0	0	243
Vilvoorde	527	1	0	0	529
Wezembeek-Oppem	476	0	0	0	476
Zaventem	761	185	211	70	1.227
Total	**8.875**	**3.449**	**1.540**	**398**	**14.262**

Table 15: Surface area per Freq.60,night contour zone and municipality 2022

area (ha)	Freq.60,night - Noise contours (night 23:00-07:00)				
location name	10-15	15-20	20-30	>30	Total
Begijnendijk	21	0	0	0	21
Brussels	536	445	93	0	1.075
Evere	125	0	0	0	125
Haacht	518	627	76	0	1.221
Herent	879	49	81	0	1.008
Kampenhout	367	719	575	0	1.660
Kortenberg	869	88	12	0	969
Kraainem	318	0	0	0	318
Leuven	312	0	0	0	312
Machelen	132	213	761	0	1.106
Rotselaar	1.151	413	0	0	1.563
Sint-Pieters-Woluwe	63	0	0	0	63
Steenokkerzeel	153	193	629	610	1.584
Tremelo	122	0	0	0	122
Vilvoorde	211	12	0	0	222
Wezembeek-Oppem	273	0	0	0	273
Zaventem	533	125	371	122	1.152
Total	**6.584**	**2.884**	**2.597**	**732**	**12.796**

C.2 Number of residents per contour zone and per municipality

Table 16: Number of residents per L_{day} contour zone and municipality 2022

Number of inhabitants	Lday - Contours in dB(A) (day 07:00-19:00)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussels	6.577	292	0	0	0	6.869
Herent	514	0	0	0	0	514
Kampenhout	735	163	0	0	0	898
Kortenberg	1.989	227	0	0	0	2.216
Kraainem	109	0	0	0	0	109
Machelen	5.557	3.944	36	0	0	9.538
Steenokkerzeel	4.744	797	112	0	0	5.653
Vilvoorde	12	0	0	0	0	12
Wezembeek-Oppem	49	0	0	0	0	49
Zaventem	3.793	146	0	0	0	3.939
Total	**24.080**	**5.570**	**148**	**0**	**0**	**29.797**

Table 17: Number of residents per $L_{evening}$ contour zone and municipality 2022

Number of inhabitants	Levening - Contours in dB(A) (soirée 19:00-23:00)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussels	6.441	6.573	95	0	0	0	13.108
Evere	39.171	0	0	0	0	0	39.171
Grimbergen	2	0	0	0	0	0	2
Haacht	1.600	0	0	0	0	0	1.600
Herent	1.297	76	0	0	0	0	1.373
Kampenhout	3.863	792	163	0	0	0	4.817
Kortenberg	3.284	1.588	107	0	0	0	4.979
Kraainem	8.681	227	0	0	0	0	8.908
Leuven	718	0	0	0	0	0	718
Machelen	6.170	5.462	3.680	29	0	0	15.341
Rotselaar	138	0	0	0	0	0	138
Schaarbeek	5.362	0	0	0	0	0	5.362
St-Lambrechts-Woluwe	13.900	0	0	0	0	0	13.900
St-Pieters-Woluwe	9.590	0	0	0	0	0	9.590
Steenokkerzeel	3.383	4.706	706	116	0	0	8.911
Vilvoorde	6.656	0	0	0	0	0	6.656
Wezembeek-Oppem	3.891	537	0	0	0	0	4.428
Zaventem	15.923	4.915	109	0	0	0	20.947
Total	**130.068**	**24.876**	**4.859**	**145**	**0**	**0**	**159.949**

Table 18: Number of residents per L_{night} contour zone and municipality 2022

Number of inhabitants	Lnight - Contours in dB(A) (nacht 23:00-07:00)						
Municipality	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
Brussels	13.970	6.012	0	0	0	0	19.982
Evere	24.037	0	0	0	0	0	24.037
Grimbergen	2.290	0	0	0	0	0	2.290
Haacht	3.600	15	0	0	0	0	3.615
Herent	1.358	486	0	0	0	0	1.844
Kampenhout	4.172	1.596	373	124	0	0	6.265
Kortenberg	2.728	1.505	132	0	0	0	4.365
Kraainem	5.644	813	0	0	0	0	6.457
Leuven	1.022	0	0	0	0	0	1.022
Machelen	5.817	8.835	1.173	6	0	0	15.831
Rotselaar	3.955	0	0	0	0	0	3.955
Schaarbeek	2.058	0	0	0	0	0	2.058
St-Pieters-Woluwe	6.787	0	0	0	0	0	6.787
Steenokkerzeel	3.067	5.182	1.422	254	25	0	9.950
Vilvoorde	10.062	9	0	0	0	0	10.071
Wezembeek-Oppem	4.790	1.442	0	0	0	0	6.232
Zaventem	18.377	8.599	99	1	0	0	27.077
Zemst	64	0	0	0	0	0	64
Total	**113.796**	**34.494**	**3.200**	**386**	**25**	**0**	**151.901**

Table 19: Number of residents per L_{den} contour zone and municipality 2022

Number of inhabitants	den - Contours in dB(A) (day. 07h-19h, evening. 19-23h, night 23h-07					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussels	6.358	3.606	0	0	0	9.964
Evere	10.857	0	0	0	0	10.857
Haacht	1.196	0	0	0	0	1.196
Herent	1.035	15	0	0	0	1.051
Kampenhout	3.438	723	167	0	0	4.329
Kortenberg	2.763	972	17	0	0	3.751
Kraainem	3.739	48	0	0	0	3.787
Leuven	326	0	0	0	0	326
Machelen	6.877	6.716	519	3	0	14.115
St-Pieters-Woluwe	2.559	0	0	0	0	2.559
Steenokkerzeel	4.771	3.390	541	114	0	8.816
Vilvoorde	698	0	0	0	0	698
Wezembeek-Oppem	3.008	7	0	0	0	3.015
Zaventem	10.869	2.994	1	0	0	13.864
Total	**58.492**	**18.472**	**1.245**	**117**	**0**	**78.326**

Table 20: Number of residents per Freq.70,day contour zone and municipality 2022

Number of inhabitants	Freq.70,day - Contours (day 07:00-23:00)					
Municipality	5-10	10-20	20-50	50-100	>100	Total
Brussels	15.662	5.494	4.045	3.300	116	28.618
Evere	16.967	25.784	698	0	0	43.449
Grimbergen	10.972	2.628	0	0	0	13.600
Haacht	1.025	122	9	0	0	1.157
Herent	211	176	388	277	0	1.052
Jette	1.326	0	0	0	0	1.326
Kampenhout	1.867	970	1.070	702	0	4.608
Kortenberg	1.651	1.370	1.390	1.219	519	6.149
Kraainem	897	971	2.932	0	0	4.800
Leuven	303	0	0	0	0	303
Machelen	1.577	1.847	2.984	3.057	3.892	13.357
Meise	109	0	0	0	0	109
Rotselaar	43	0	0	0	0	43
Schaarbeek	20.900	0	0	0	0	20.900
St-Lambrechts-Woluwe	28.500	219	0	0	0	28.719
St-Pieters-Woluwe	2.209	2.580	996	0	0	5.785
Steenokkerzeel	1.048	1.018	3.548	2.311	453	8.378
Vilvoorde	3.742	6.967	47	0	0	10.756
Wemmel	559	0	0	0	0	559
Wezembeek-Oppem	634	1.087	2.037	0	0	3.759
Zaventem	6.718	1.949	2.538	1.458	657	13.320
Zemst	73	0	0	0	0	73
Total	**116.994**	**53.182**	**22.683**	**12.324**	**5.637**	**210.819**

Table 21: Number of residents per Freq.70,night contour zone and municipality 2022

Number of inhabitants	Freq.70,night - Contours (night 23:00-07:00)				
Municipality	1-5	5-10	10-20	>20	Total
Boortmeerbeek	1.361	0	0	0	1.361
Brussels	7.634	5.031	1.037	0	13.702
Evere	37.605	0	0	0	37.605
Grimbergen	7.413	0	0	0	7.413
Haacht	1.302	111	2	0	1.414
Herent	362	579	104	0	1.045
Kampenhout	1.933	726	1.631	0	4.290
Kortenberg	1.962	1.110	1.003	0	4.075
Kraainem	3.502	2.035	0	0	5.537
Leuven	333	0	0	0	333
Machelen	4.210	3.000	5.817	205	13.232
Rotselaar	2.603	0	0	0	2.603
Schaarbeek	4.425	0	0	0	4.425
St-Lambrechts-Woluwe	398	0	0	0	398
St-Pieters-Woluwe	6.577	11	0	0	6.588
Steenokkerzeel	4.292	1.732	2.494	1.002	9.520
Tervuren	2.165	0	0	0	2.165
Vilvoorde	9.294	40	0	0	9.334
Wezembeek-Oppem	3.650	1.753	0	0	5.403
Zaventem	15.890	5.843	2.329	82	24.144
Zemst	114	0	0	0	114
Total	**117.025**	**21.970**	**14.417**	**1.288**	**154.700**

Table 22: Number of residents per Freq.60,day contour zone and municipality 2022

Number of inhabitants	Freq.60,day - Contours (day 07:00-23:00)				
Municipality	50-100	100-150	150-200	>200	Total
Aarschot	4	0	0	0	4
Brussels	16.416	2.620	4.505	0	23.540
Evere	31.780	299	0	0	32.079
Grimbergen	4.117	0	0	0	4.117
Haacht	3.389	366	0	0	3.754
Kampenhout	5.053	23	0	0	5.075
Kortenberg	770	3.739	0	0	4.510
Kraainem	12.988	0	0	0	12.988
Leuven	541	887	0	0	1.429
Machelen	3.235	5.309	7.422	0	15.965
Rotselaar	7.598	901	0	0	8.499
Schaarbeek	473	0	0	0	473
St-Lambrechts-Woluwe	20.296	0	0	0	20.296
St-Pieters-Woluwe	12.691	0	0	0	12.691
Steenokkerzeel	1.894	3.468	3.632	7	9.000
Tervuren	6.116	0	0	0	6.116
Vilvoorde	10.035	0	0	0	10.035
Wezembeek-Oppem	10.417	0	0	0	10.417
Zaventem	14.201	2.911	4.843	0	21.955
Total	**162.013**	**20.522**	**20.402**	**7**	**202.942**

Table 23: Number of residents per Freq.60,night contour zone and municipality 2022

Number of inhabitants	Freq.60,night - Contours (night 23:00-07:00)				
Municipality	10-15	15-20	20-30	>30	Total
Begijnendijk	49	0	0	0	49
Brussels	17.382	4.429	2.439	0	24.250
Evere	10.297	0	0	0	10.297
Haacht	1.860	2.427	193	0	4.480
Herent	1.781	174	48	0	2.003
Kampenhout	1.401	3.162	1.733	0	6.296
Kortenberg	4.010	15	8	0	4.033
Kraainem	7.810	0	0	0	7.810
Leuven	1.298	0	0	0	1.298
Machelen	2.461	3.685	9.920	0	16.066
Rotselaar	6.706	1.834	0	0	8.539
St-Pieters-Woluwe	4.029	0	0	0	4.029
Steenokkerzeel	858	995	3.859	3.866	9.579
Tremelo	363	0	0	0	363
Vilvoorde	2.027	36	0	0	2.063
Wezembeek-Oppem	6.927	0	0	0	6.927
Zaventem	3.804	2.785	8.622	0	15.210
Total	**73.064**	**19.541**	**26.822**	**3.866**	**123.293**

C.3 Number of persons who are potentially highly inconvenienced per contour zone and per municipality.

Table 24: Number of residents potentially highly inconvenienced contour zone and municipality 2022

Number of inhabitants potentially highly impacted	Lden - Contours in dB(A) (day. 07h-19h, evening. 19h-23h, night. 23h-07h)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussels	876	678	0	0	0	1.554
Evere	1.237	0	0	0	0	1.237
Haacht	136	0	0	0	0	136
Herent	142	3	0	0	0	144
Kampenhout	435	149	51	0	0	635
Kortenberg	370	196	5	0	0	571
Kraainem	479	9	0	0	0	487
Leuven	35	0	0	0	0	35
Machelen	947	1.461	148	1	0	2.557
St-Pieters-Woluwe	284	0	0	0	0	284
Steenokkerzeel	684	696	160	46	0	1.587
Vilvoorde	76	0	0	0	0	76
Wezembeek-Oppem	400	1	0	0	0	401
Zaventem	1.455	584	0	0	0	2.039
Total	**7.555**	**3.778**	**365**	**47**	**0**	**11.744**

Bijlage D. Noise contour maps: evolution for 2021-2022

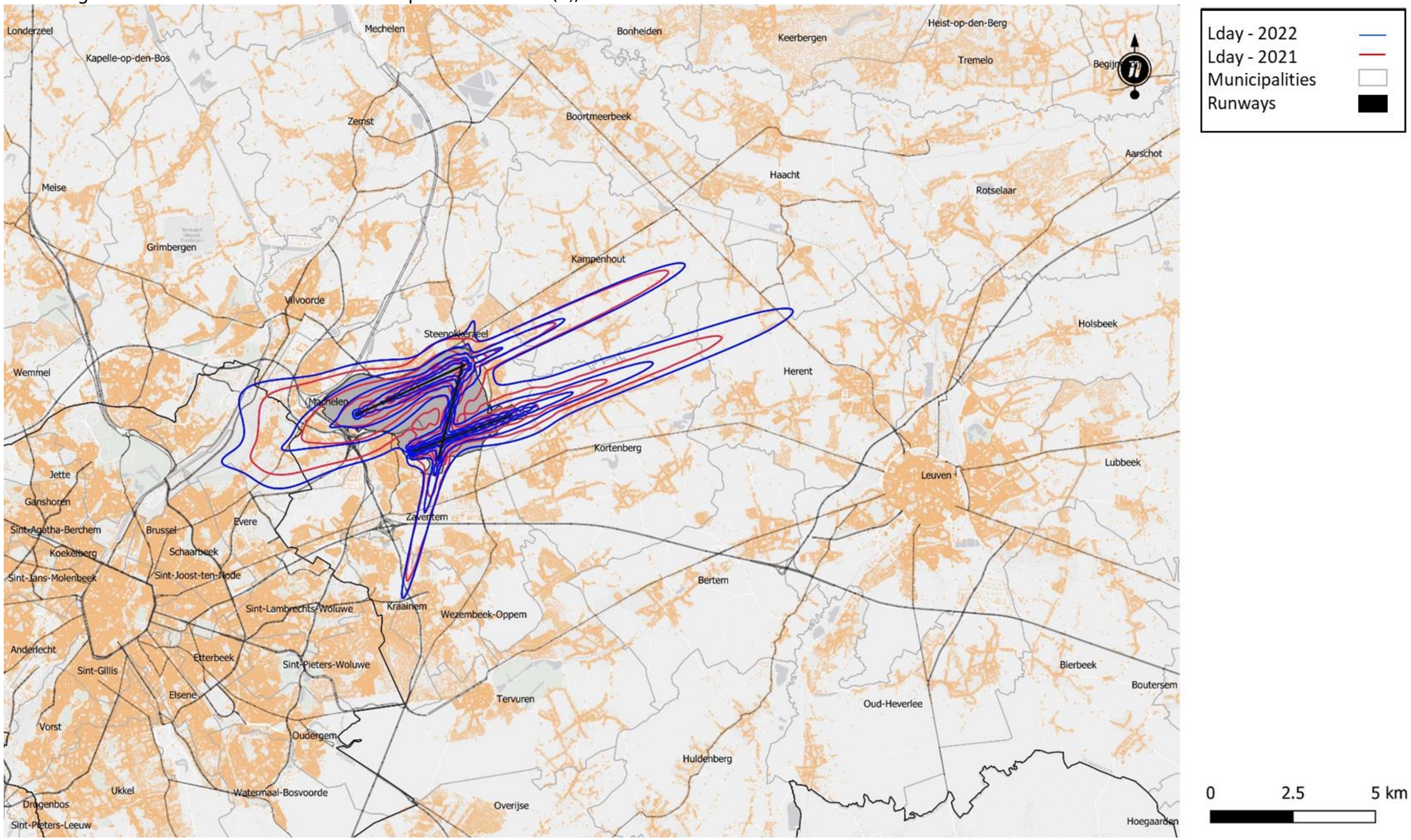
In this appendix the noise maps are available in A4 format.

- L_{day} noise contours for 2021 and 2022, background population map 2022
- $L_{evening}$ noise contours for 2021 and 2022, background population map 2022
- L_{night} noise contours for 2021 and 2022, background population map 2022
- L_{den} noise contours for 2021 and 2022, background population map 2022
- Freq.70,day noise contours for 2021 and 2022, background population map 2022
- Freq.70,night noise contours for 2021 and 2022, background population map 2022
- Freq.60,day noise contours for 2021 and 2022, background population map 2022
- Freq.60,night noise contours for 2021 and 2022, background population map 2022

- L_{day} noise contours for 2021 and 2022, background NGI topographical map
- $L_{evening}$ noise contours for 2021 and 2022, background NGI topographical map
- L_{night} noise contours for 2021 and 2022, background NGI topographical map
- L_{den} noise contours for 2021 and 2022, background NGI topographical map
- Freq.70,day noise contours for 2021 and 2022, background NGI topographical map
- Freq.70,night noise contours for 2021 and 2022, background NGI topographical map
- Freq.60,day noise contours for 2021 and 2022, background NGI topographical map
- Freq.60,night noise contours for 2021 and 2022, background NGI topographical map

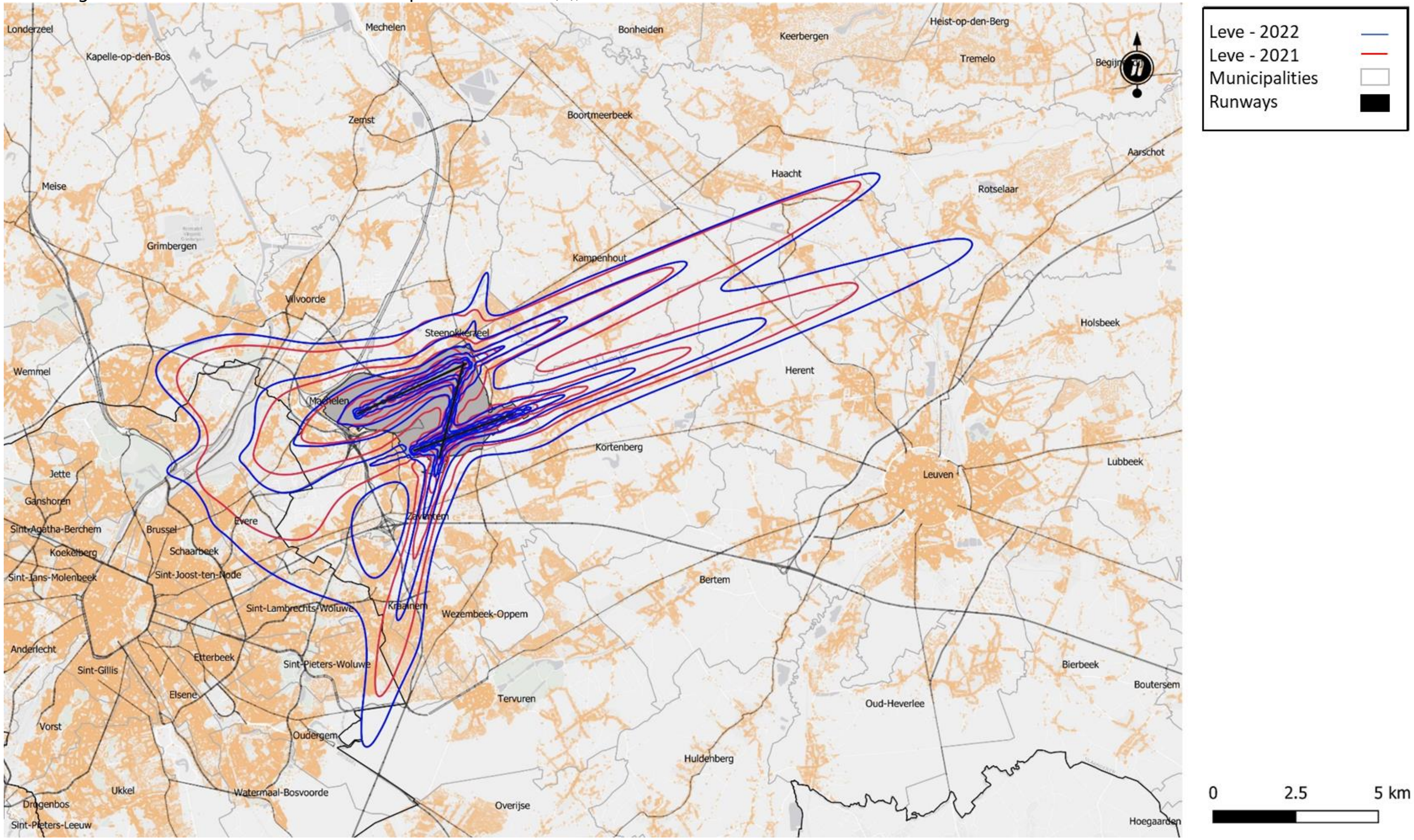
Evolution of L_{day} (07:00 to 19:00) noise contours - background population map 2022

The contours are shown here for 2021 and 2022 where, between 07:00 and 19:00, the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



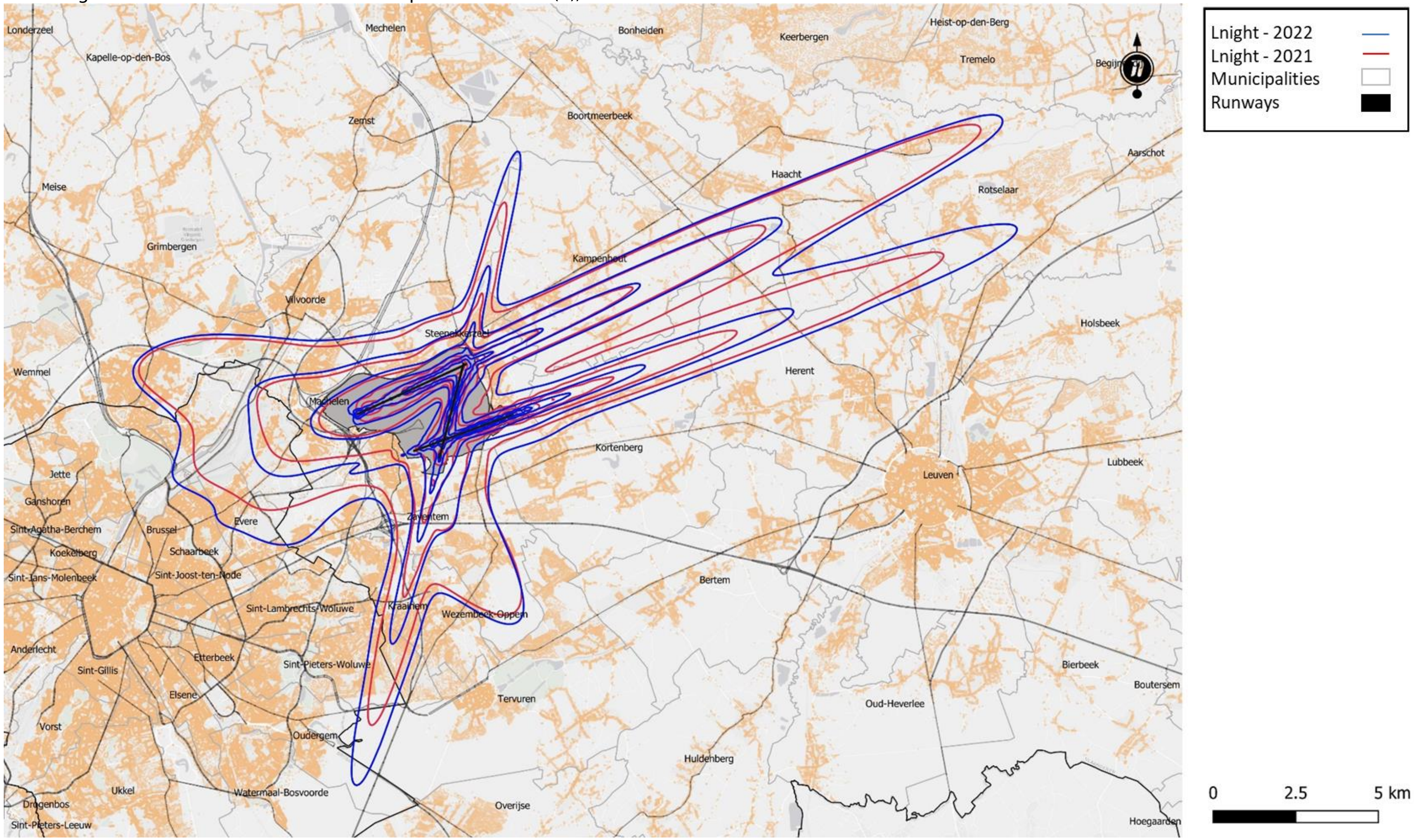
Evolution of L evening (19:00 to 23:00) noise contours - background population map 2022

The contours are shown here for 2021 and 2022 where, between 19:00 and 23:00, the noise impact by air traffic is, on average, 50, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 50 dB(A), etc.



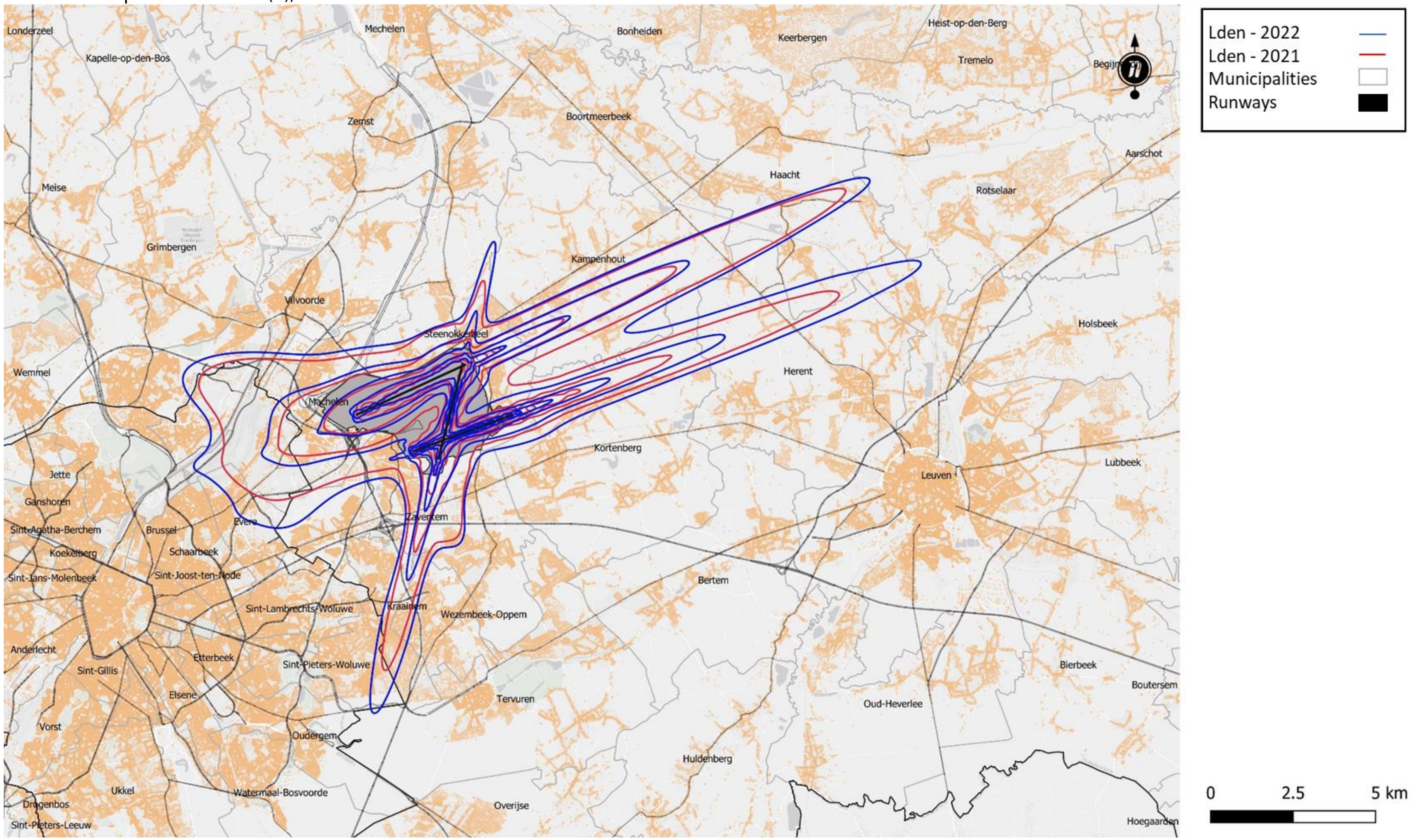
Evolution of L_{night} (23:00 to 07:00) noise contours - background population map 2022

The contours are shown here for 2021 and 2022 where, between 23:00 and 07:00, the noise impact by air traffic is, on average, 45, 50, 55, 60, 65 and 70 dB(a). The values are ascending inwards: the outermost contour corresponds with 45 dB(A), etc.



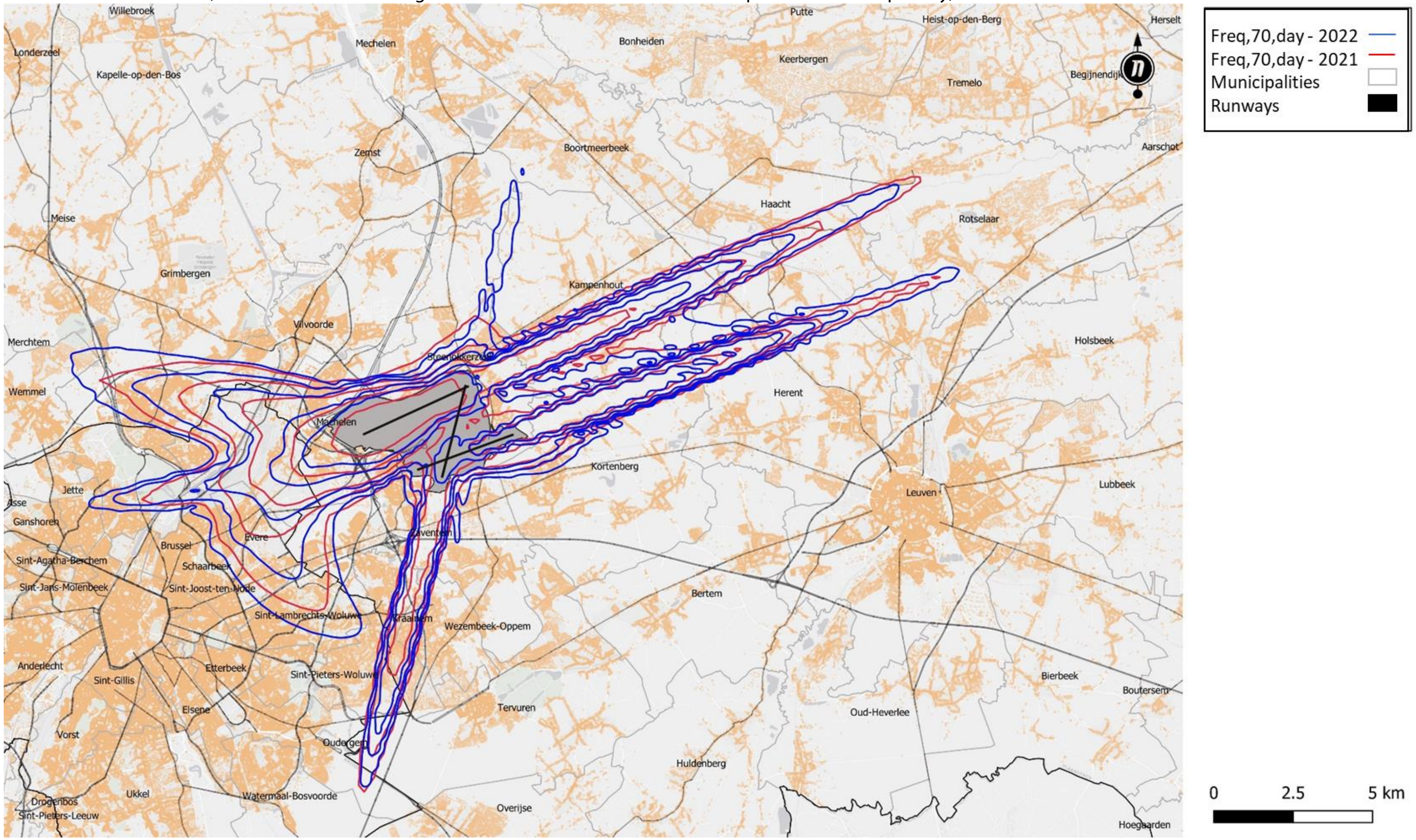
Evolution of L_{den} noise contours - background population map 2022

The contours are shown here for 2021 and 2022 where the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



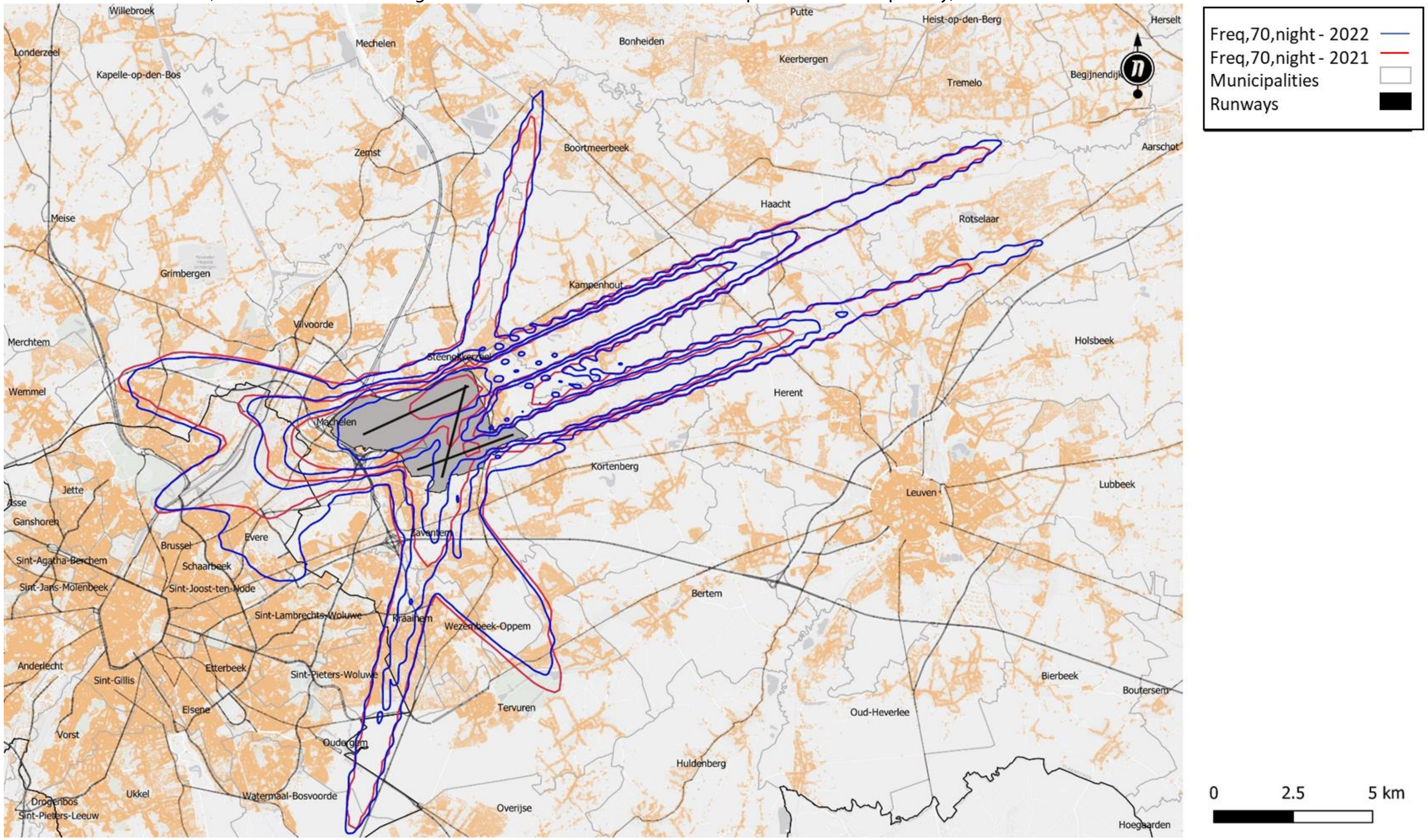
Evolution of Freq.70,day - background population map 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 70 dB or higher is observed 5x, 10x, 20x, 50x and 100x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 5x per day, etc.



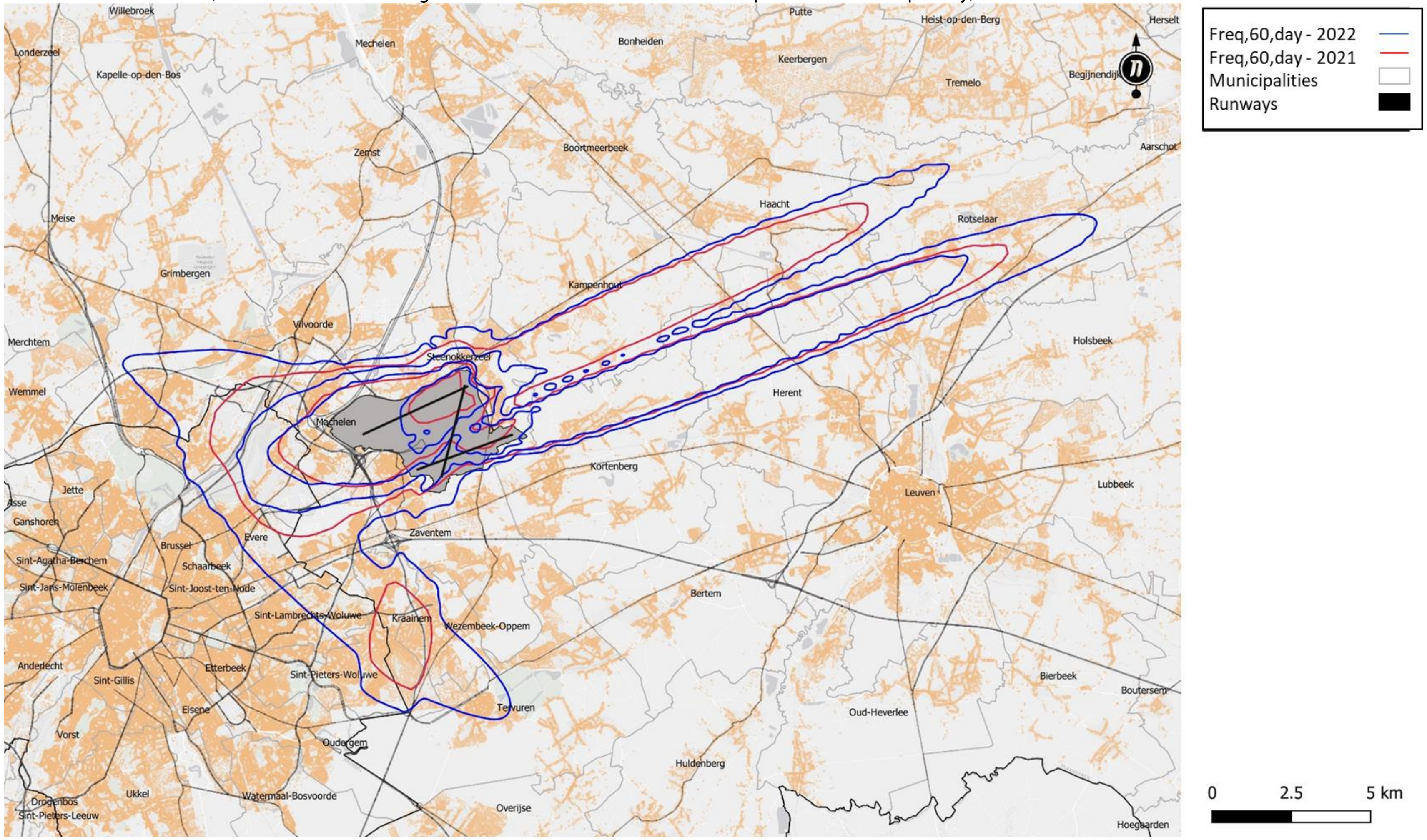
Evolution of Freq.70, night - background population map 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 70 dB or higher is observed 1x, 5x, 10x, 20x and 50x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 1x per day, etc.



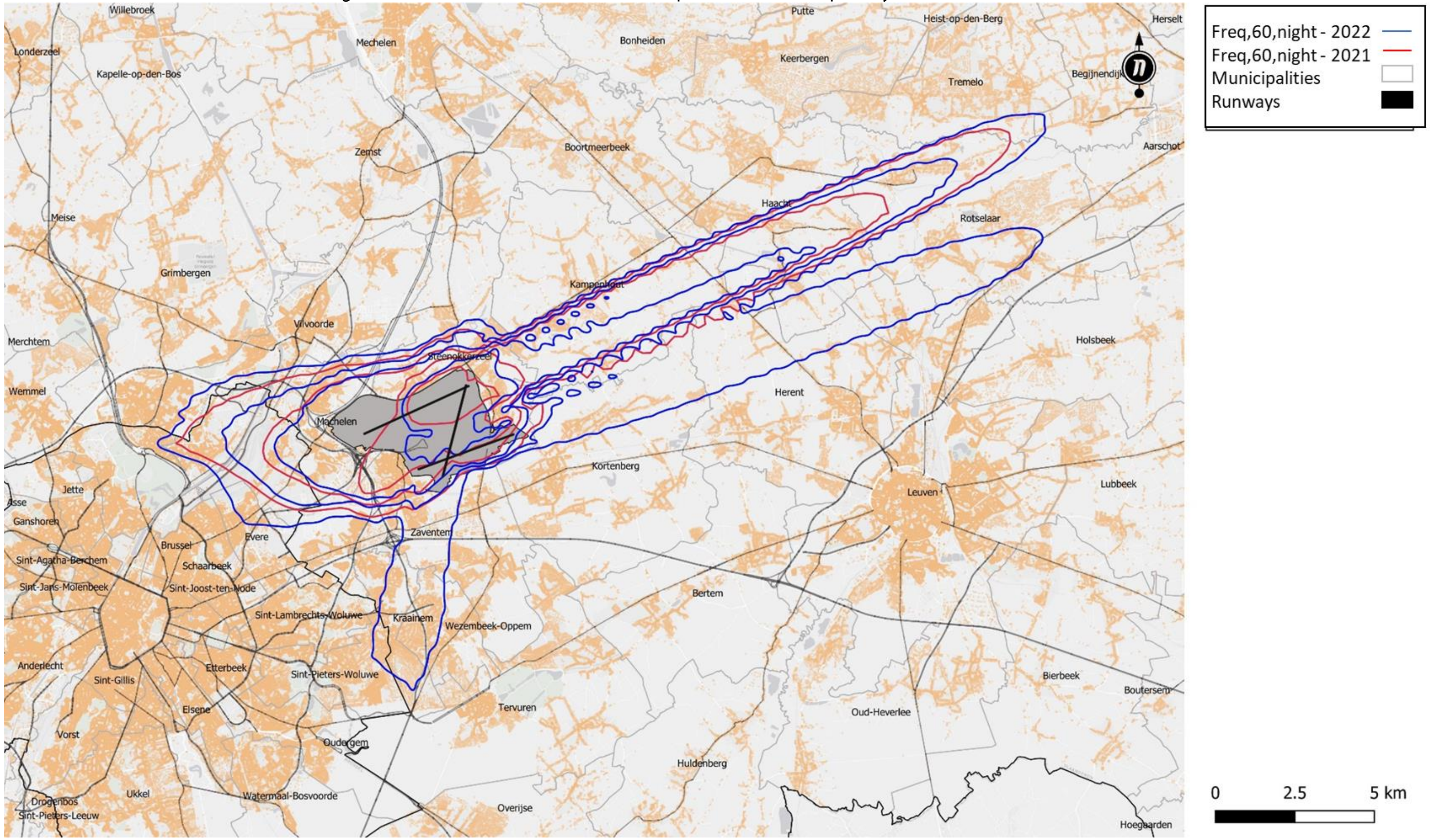
Evolution of Freq.60,day - background population map 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 60 dB or higher is observed 50x, 100x, 150x and 200x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 50x per day, etc.



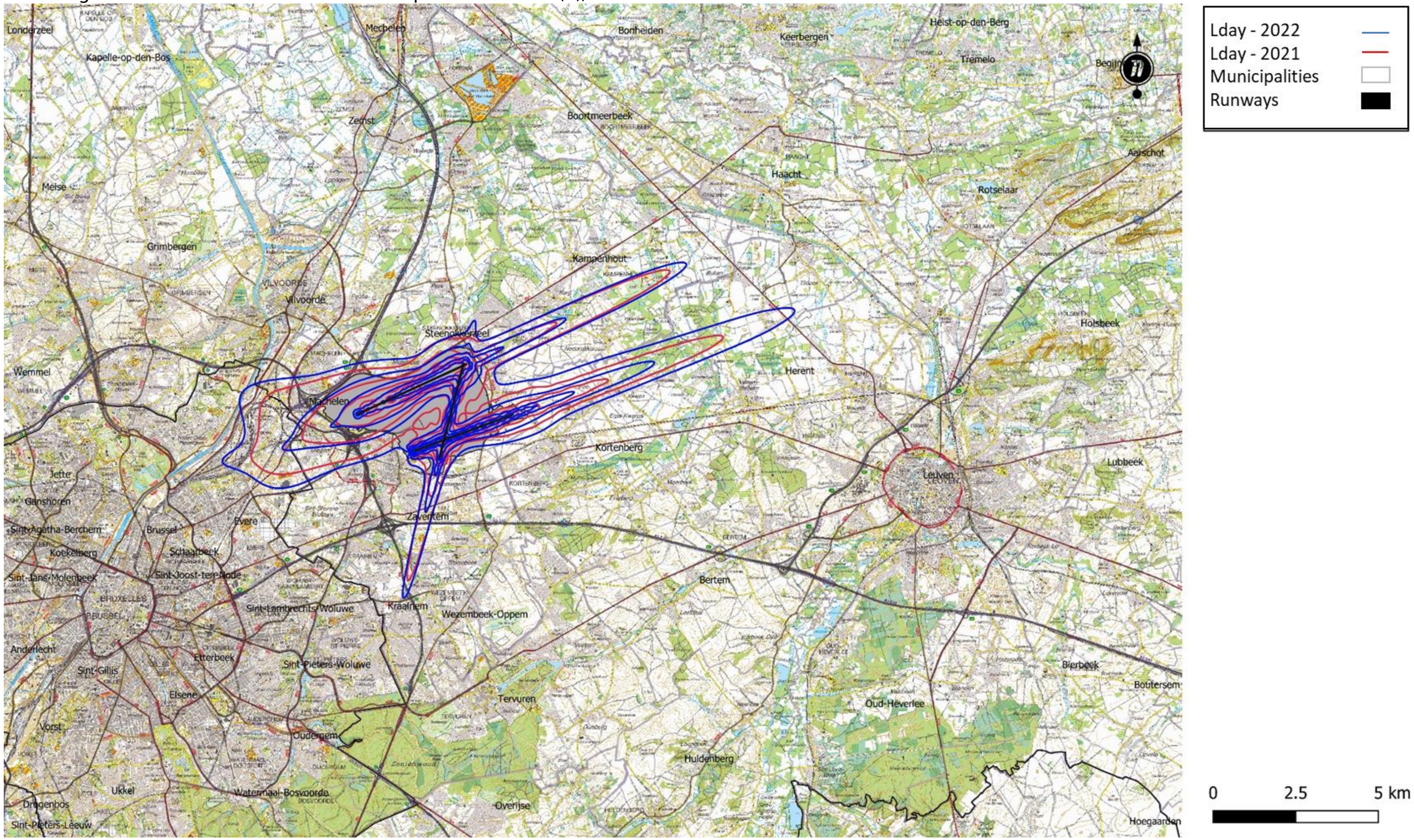
Evolution of Freq.60, night - background population map 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 60 dB or higher is observed 10x, 15x, 20x and 30x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 10x per day, etc.



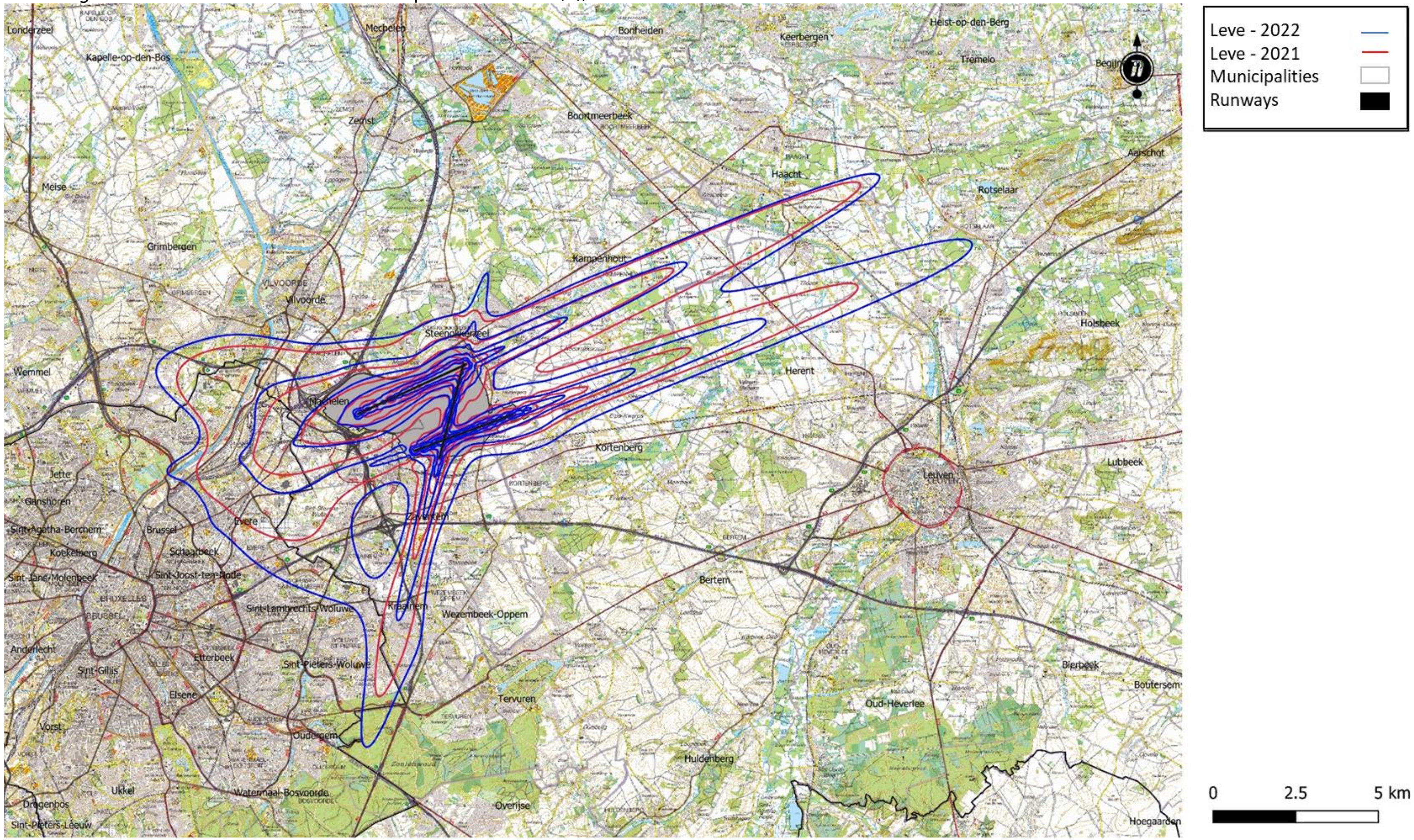
Evolution of L_{day} (07:00 to 19:00) noise contours - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where, between 07:00 and 19:00, the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



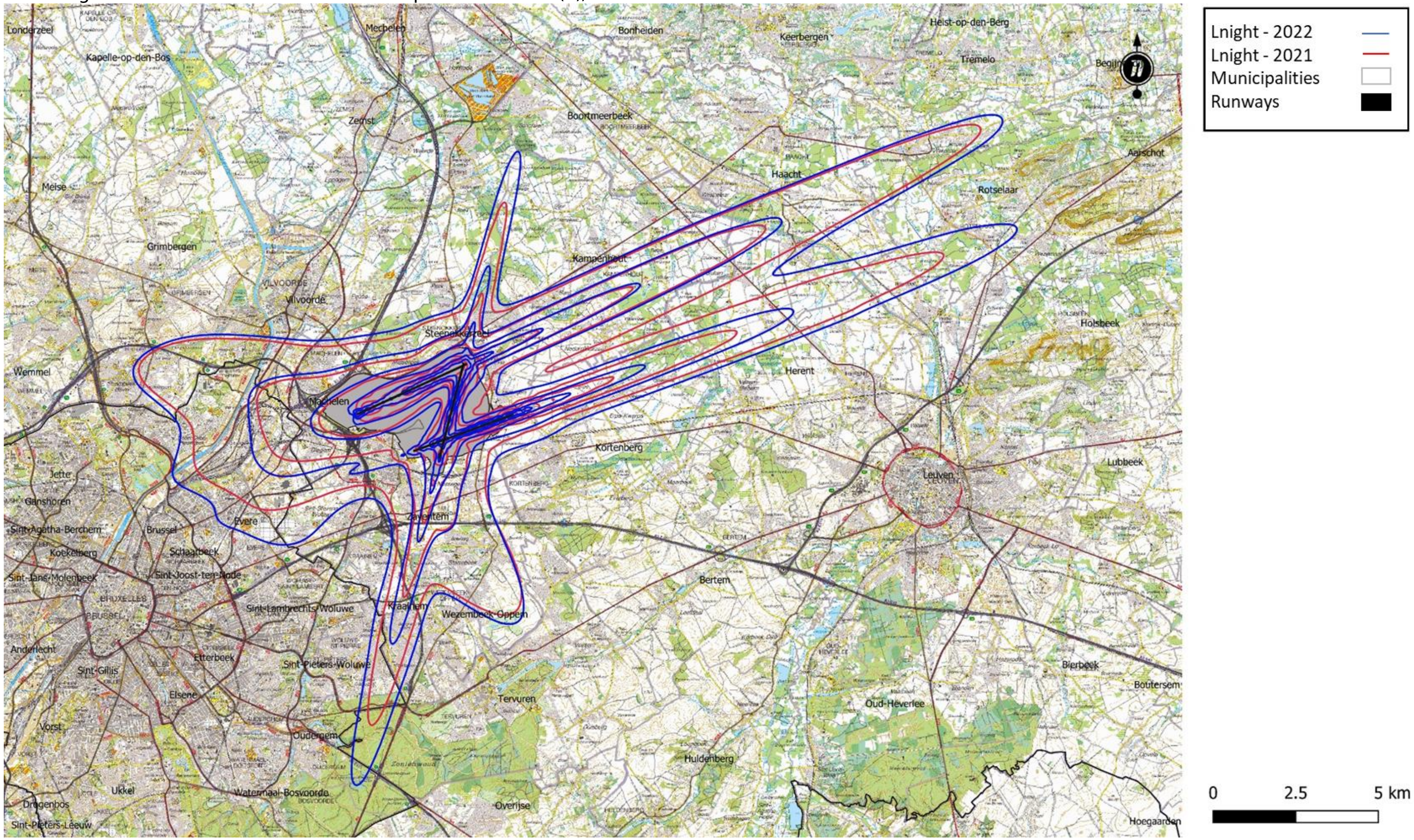
Evolution of L $_{evening}$ (19:00 to 23:00) noise contours - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where, between 19:00 and 23:00, the noise impact by air traffic is, on average, 50, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 50 dB(A), etc.



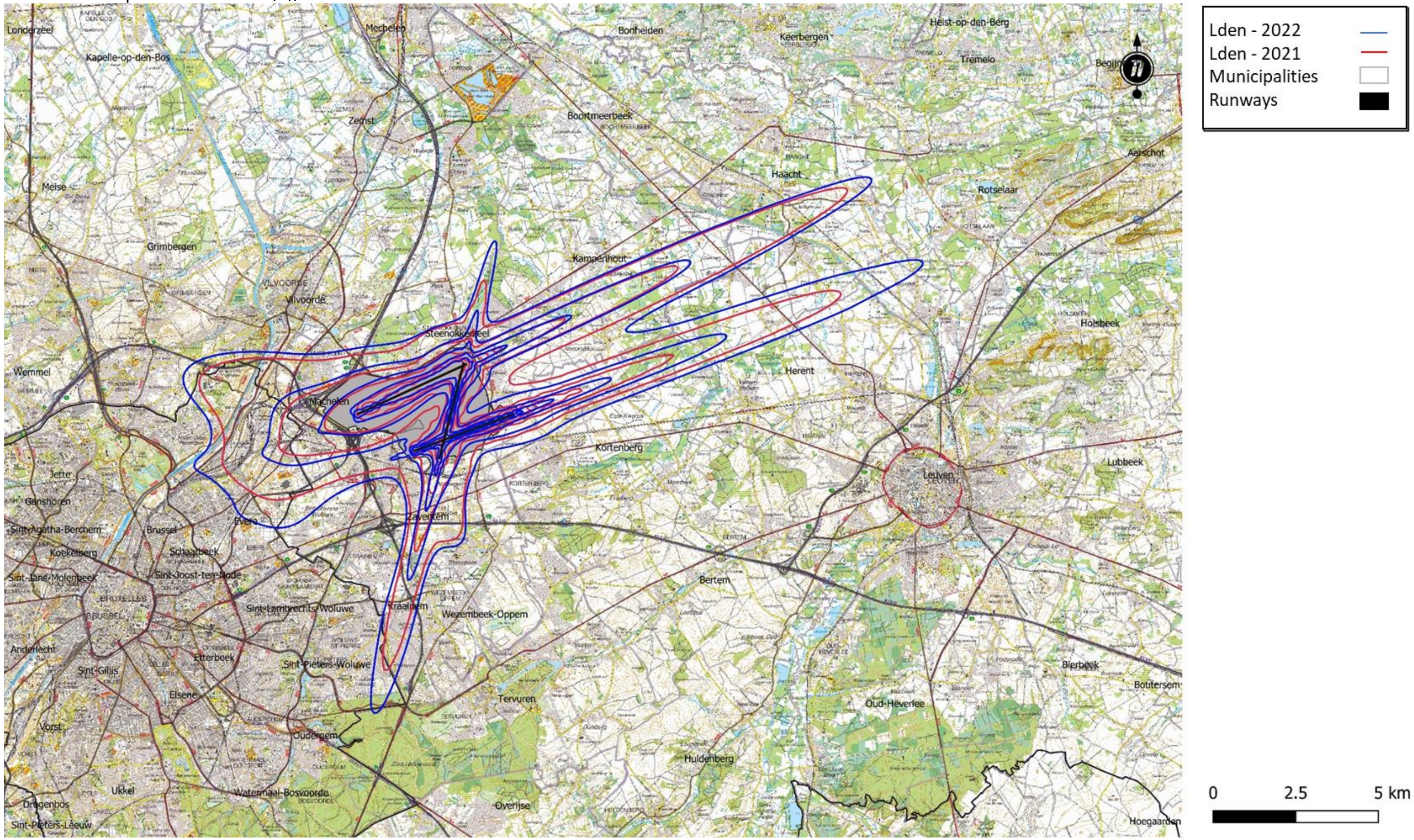
Evolution of L $_{night}$ (23:00 to 07:00) noise contours - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where, between 23:00 and 07:00, the noise impact by air traffic is, on average, 45, 50, 55, 60, 65 and 70 dB(a). The values are ascending inwards: the outermost contour corresponds with 45 dB(A), etc.



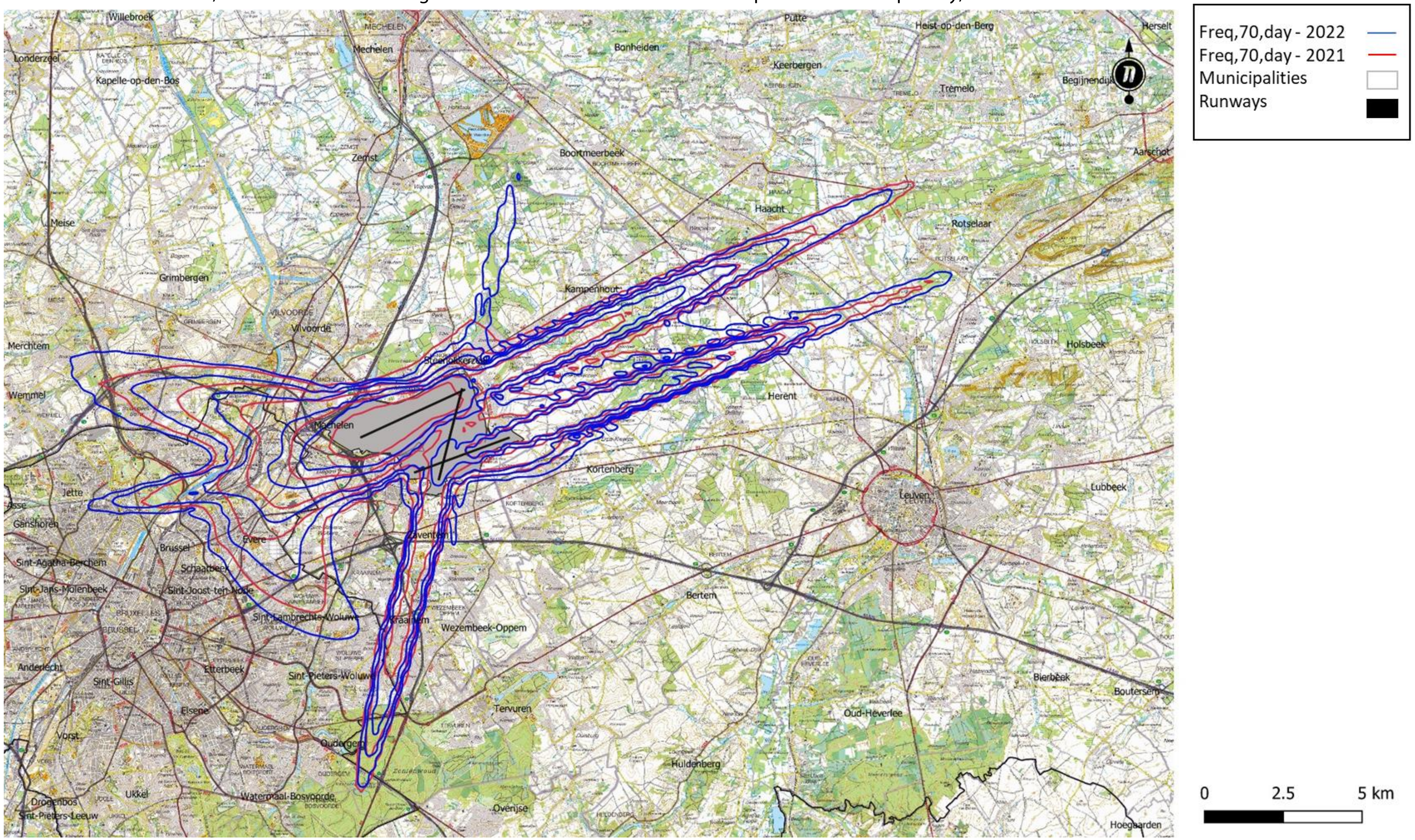
Evolution of L_{den} noise contours - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



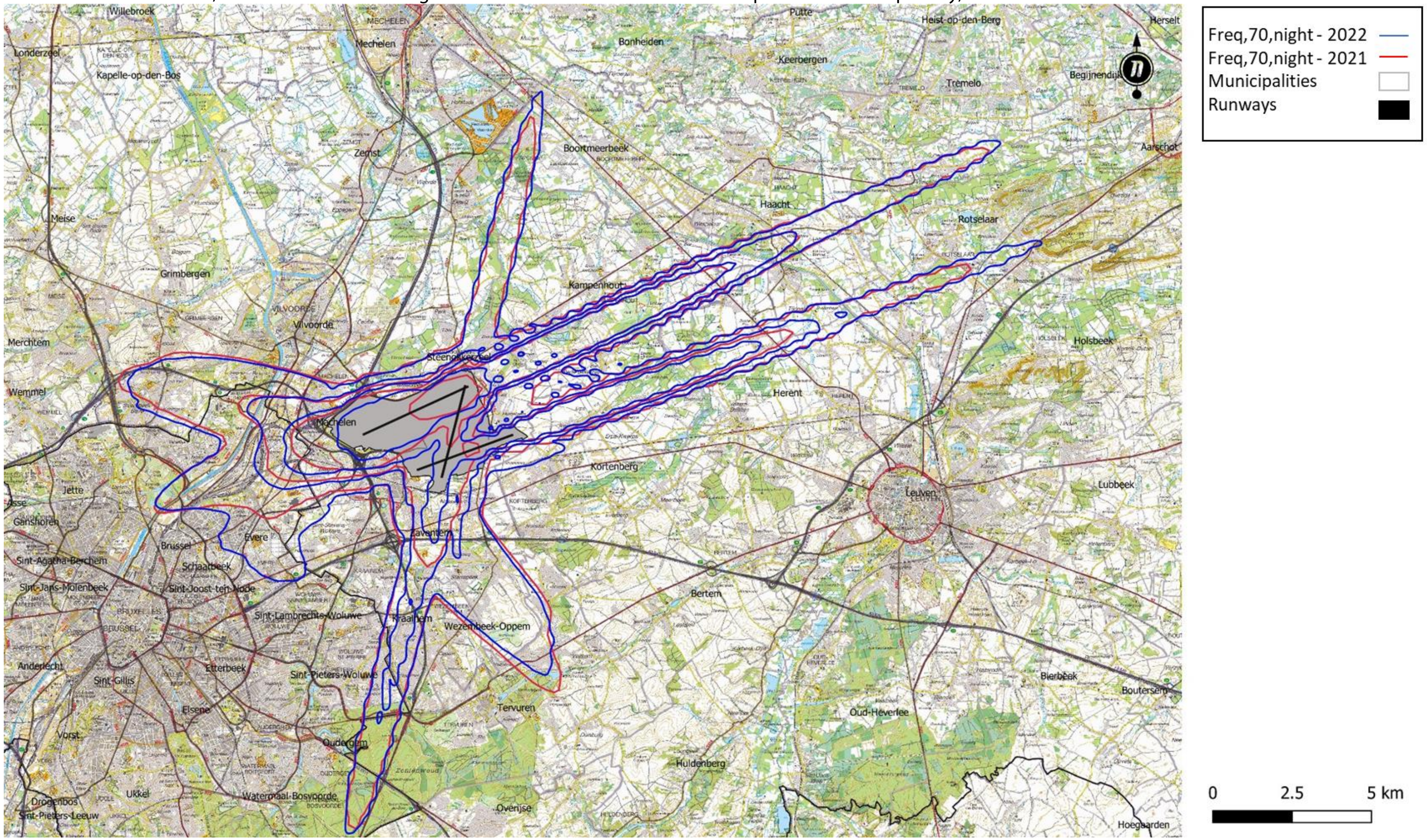
Evolution of Freq.70,day - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 70 dB or higher is observed 5x, 10x, 20x, 50x and 100x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 5x per day, etc.



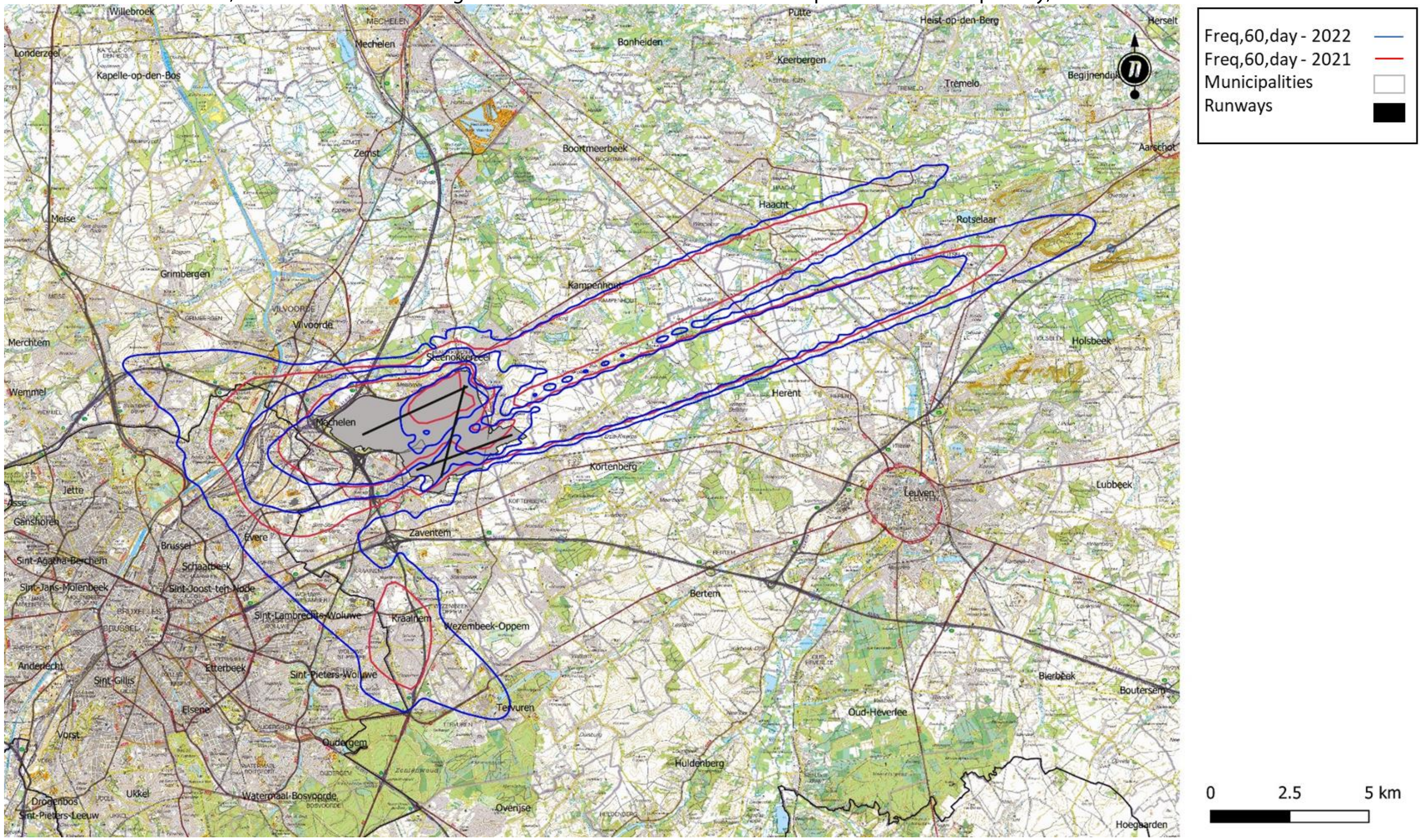
Evolution of Freq.70, night - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 70 dB or higher is observed 1x, 5x, 10x, 20x and 50x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 1x per day, etc.



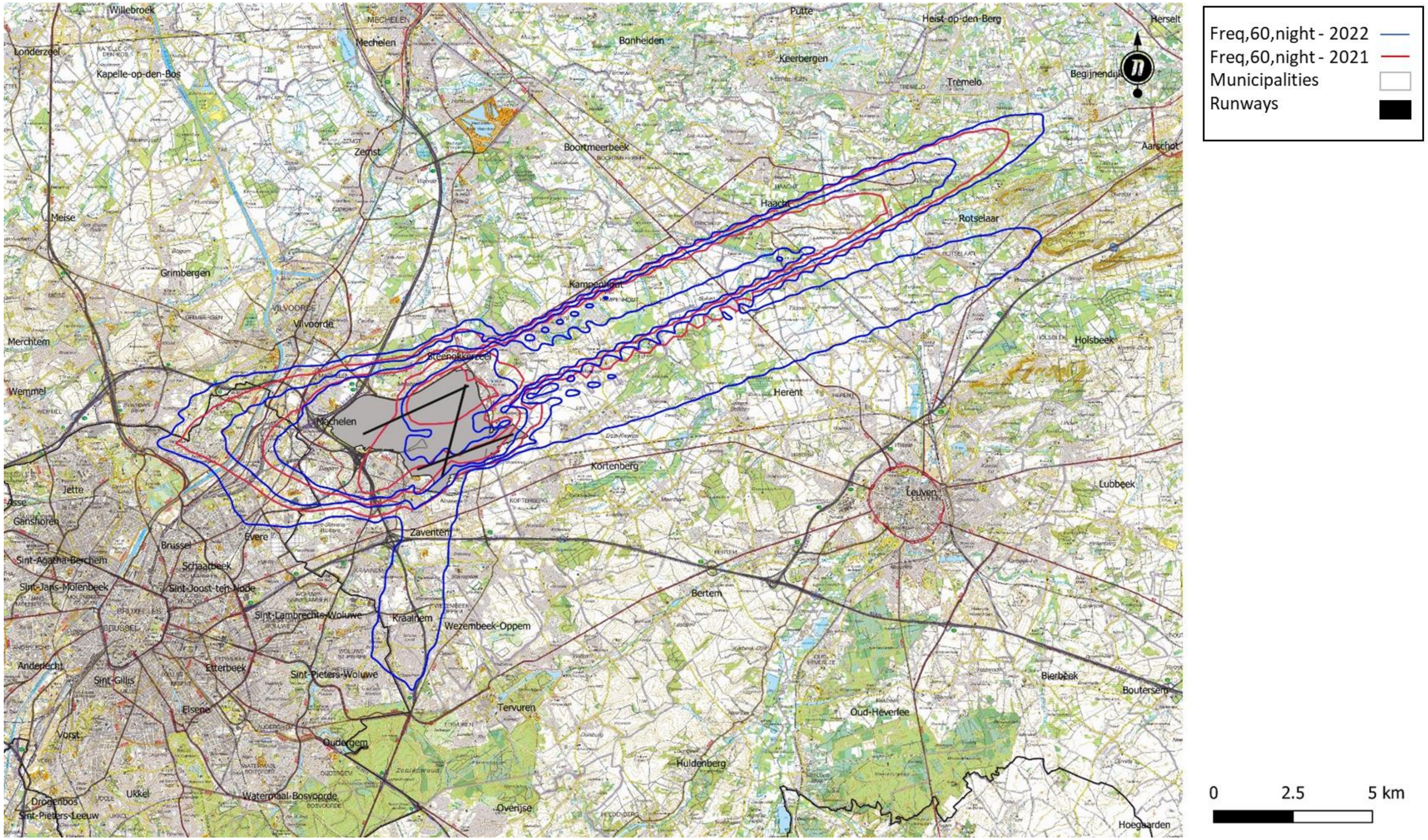
Evolution of Freq.60,day - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 60 dB or higher is observed 50x, 100x, 150x and 200x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 50x per day, etc.



Evolution of Freq.60, night - background NGI topographical 2022

The contours are shown here for 2021 and 2022 where on average a noise level of 60 dB or higher is observed 10x, 15x, 20x and 30x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 10x per day, etc.


Freq,60,night - 2022
Freq,60,night - 2021
Municipalities
Runways
0
2.5
5 km
Mechelen
Zemst
Vilvoorde
Steenokkerzeel
Zaventem
Kortenberg
Herent
Leuven
Haacht
Rotselaar
Kampenhout
Boortmeerbeek
Keerbergen
Tremelo
Bonheiden
Holsbeek
Lubbeek
Bertem
Kraainem
Wezembeek-Oppem
Tervuren
Oud-Heverlee
Huldenberg
Overijse
Bierbeek
Boutersem
Aarschot
Begijnendijk
Heist-op-den-Berg
Putte
Willebroek
Londerzeel
Kapelle-op-den-Bos
Meise
Grimbergen
Merchtem
Wemmel
Jette
Ganshoren
Brussel
Schaarbeek
Evere
Sint-Agatha-Berchem
Sint-Jans-Molenbeek
Sint-Joost-ten-Node
Sint-Lambrechts-Woluwe
Sint-Pieters-Woluwe
Anderlecht
Sint-Gillis
Etterbeek
Elsene
Vorst
Oudergem
Ukkel
Watermaal-Bosvoorde
Drogenbos
Sint-Pieters-Leeuw
Hoegaarden

Bijlage E. Evolution of the surface area and the number of residents

E.1 Evolution of the surface area per contour zone: L_{day}, $L_{evening}$, L_{night}, Freq.70,day, Freq.70,night, Freq.60,day, Freq.60,night

Table 25: Evolution of the surface area inside the L_{day} contours (2000, 2006-2022).

Area (ha)	Lday - Noise contours in dB(A) (day 07:00-19:00)					
Year	55-60	60-65	65-70	70-75	>75	Total
2000*	5.919	2.113	827	383	242	**9.485**
2001						
2002						
2003						
2004						
2005						
2006*	3.787	1.379	545	213	150	**6.073**
2007*	3.978	1.431	575	227	153	**6.364**
2008*	4.072	1.492	596	232	161	**6.553**
2009*	3.461	1.300	523	206	133	**5.622**
2010*	3.334	1.261	514	196	126	**5.431**
2011*	3.330	1.241	509	199	127	**5.406**
2012*	2.978	1.121	466	189	117	**4.871**
2013*	2.779	1.106	455	176	121	**4.637**
2014*	2.924	1.120	474	187	116	**4.821**
2015*	3.143	1.180	489	230	93	**5.135**
2016*	2.886	1.087	545	123	82	**4.723**
2017*	2.990	1.109	471	216	90	**4.876**
2018*	3.037	1.150	486	227	87	**4.987**
2019*	2.963	1.105	554	138	91	**4.851**
2020*	1.521	602	247	176	0	**2.547**
2021**	1.936	649	258	115	65	**3.024**
2022**	2.647	881	330	143	82	**4.083**

* Calculated with INM 7.0b, ** Calculated with Echo

Figure 19: Evolution of the surface area inside the L_{day} contours (2000, 2006-2022).

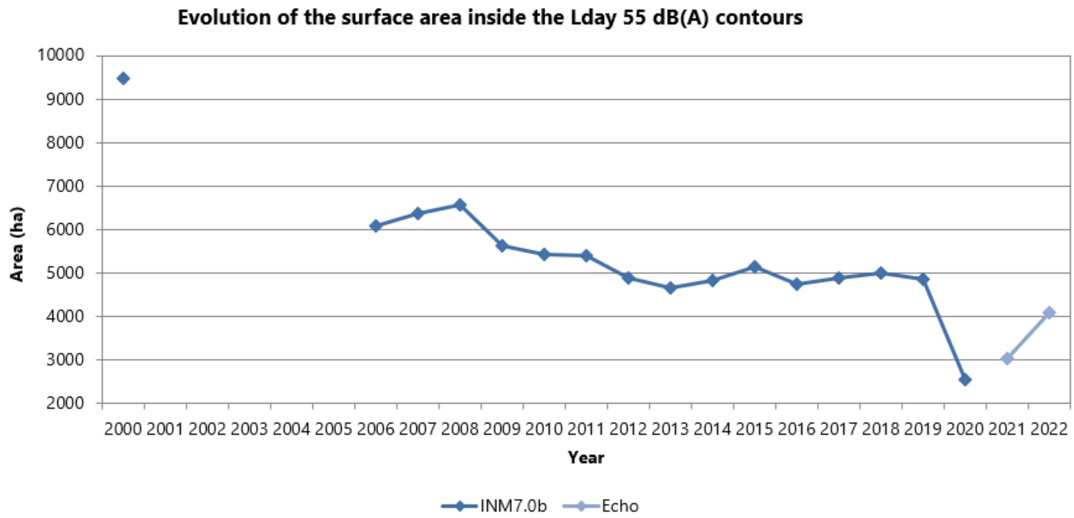


Table 26: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2022).

Area (ha)	Levening - Noise contours in dB(A) (soirée 19:00-23:00)						
Year	50-55	55-60	60-65	65-70	70-75	>75	Total
2000*	11.266	5.265	1.889	741	346	216	**19.723**
2001							
2002							
2003							
2004							
2005							
2006*	8.483	3.000	1.106	449	178	113	**13.329**
2007*	9.106	3.369	1.223	506	200	124	**14.528**
2008*	10.052	3.730	1.354	548	218	135	**16.037**
2009*	8.313	3.126	1.146	463	178	109	**13.336**
2010*	7.821	3.073	1.124	452	171	106	**12.747**
2011*	7.711	3.004	1.106	446	175	105	**12.547**
2012*	7.608	2.881	1.046	427	171	103	**12.237**
2013*	6.998	2.668	994	401	161	104	**11.222**
2014*	7.421	3.087	1.106	445	175	50	**12.283**
2015*	8.244	3.051	1.108	450	205	89	**13.147**
2016*	8.402	3.188	1.137	536	135	91	**13.488**
2017*	8.556	3.172	1.108	457	205	92	**13.590**
2018*	9.134	3.445	1.207	489	225	99	**14.599**
2019*	8.836	3.283	1.138	542	142	97	**14.038**
2020*	4.440	1.751	621	441	0	0	**7.252**
2021**	5.117	1.637	632	213	91	67	**7.757**
2022**	7.425	2.512	802	304	133	75	**11.251**

*Calculated with INM 7.0b, ** Calculated with Echo

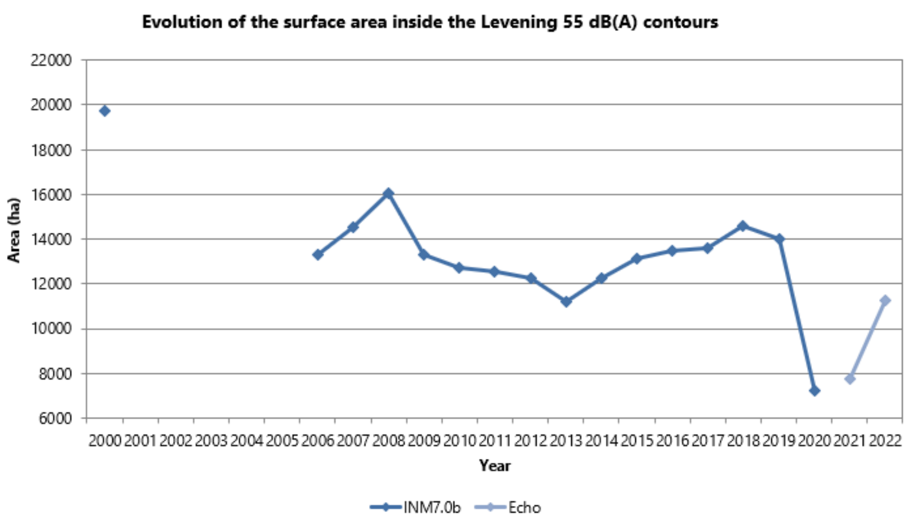


Figure 20: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2022).

Table 27: Evolution of the surface area inside the L_{night} contours (2000, 2006-2022)

Area (ha)	Lnight - Noise contours in dB(A) (night 23:00-07:00)						
Year	45-50	50-55	55-60	60-65	65-70	>70	Total
2000*	13.927	6.145	2.366	1.090	492	290	**24.310**
2001							
2002							
2003							
2004							
2005							
2006*	10.135	3.571	1.450	554	211	153	**16.075**
2007*	10.872	3.936	1.597	625	236	165	**17.430**
2008*	9.375	3.232	1.260	495	189	123	**14.673**
2009*	7.638	2.613	1.014	397	155	96	**11.913**
2010*	7.562	2.633	999	390	154	96	**11.835**
2011*	8.184	2.803	1.066	413	164	106	**12.736**
2012*	8.525	2.827	1.074	419	168	105	**13.118**
2013*	7.817	2.857	1.525	172	130	0	**12.501**
2014*	7.800	2.921	1.120	448	179	115	**12.583**
2015*	8.451	3.019	1.172	460	194	117	**13.413**
2016*	7.969	2.930	1.111	441	188	109	**12.748**
2017*	7.995	2.929	1.112	427	186	104	**12.754**
2018*	8.495	3.084	1.148	442	178	128	**13.476**
2019*	8.172	3.016	1.124	437	190	105	**13.044**
2020*	5.418	2.016	756	308	193	0	**8.691**
2021**	7.129	2.428	840	282	123	68	**10.870**
2022**	8.817	3.160	1.010	585	158	77	**13.572**

*Calculated with INM 7.0b, ** Calculated with Echo

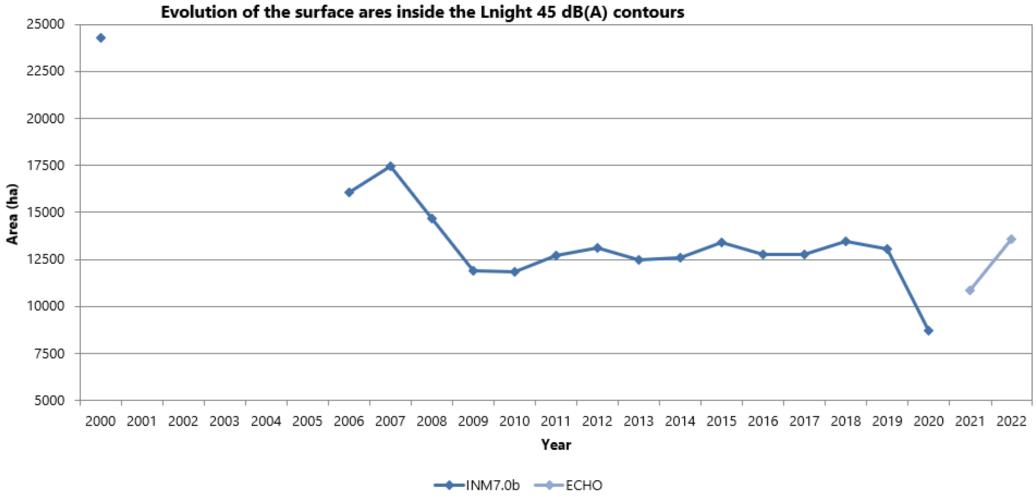


Figure 21: Evolution of the surface area inside the L_{night} contours (2000, 2006-2022)

Table 28: Evolution of the surface area inside the L_{den} contours (2000, 2006-2022)

Area (ha)	Lden - Noise contours in dB(A) (d. 07h-19h, av. 19h-23h, n. 23h-07h)					
Year	55-60	60-65	65-70	70-75	>75	Total
2000*	10.664	4.063	1.626	745	497	**17.594**
2001						
2002						
2003						
2004						
2005						
2006*	6.963	2.448	957	373	251	**10.992**
2007*	7.632	2.640	1.036	416	271	**11.996**
2008*	7.118	2.483	953	379	246	**11.178**
2009*	5.771	2.077	797	316	203	**9.163**
2010*	5.576	2.052	782	308	199	**8.917**
2011*	5.767	2.076	800	316	208	**9.167**
2012*	5.623	1.998	771	308	205	**8.905**
2013*	5.152	1.981	767	299	216	**8.415**
2014*	5.429	2.066	800	325	136	**8.756**
2015*	5.695	2.159	825	332	224	**9.236**
2016*	5.554	2.085	797	326	213	**8.974**
2017*	5.579	2.088	795	325	213	**9.000**
2018*	5.957	2.186	832	336	228	**9.540**
2019*	5.646	2.115	802	331	220	**9.115**
2020*	3.445	1.270	494	208	133	**5.549**
2021**	4.290	1.378	543	176	132	**6.520**
2022**	5.681	1.935	622	247	163	**8.648**

*Calculated with INM 7.0b, ** Calculated with Echo

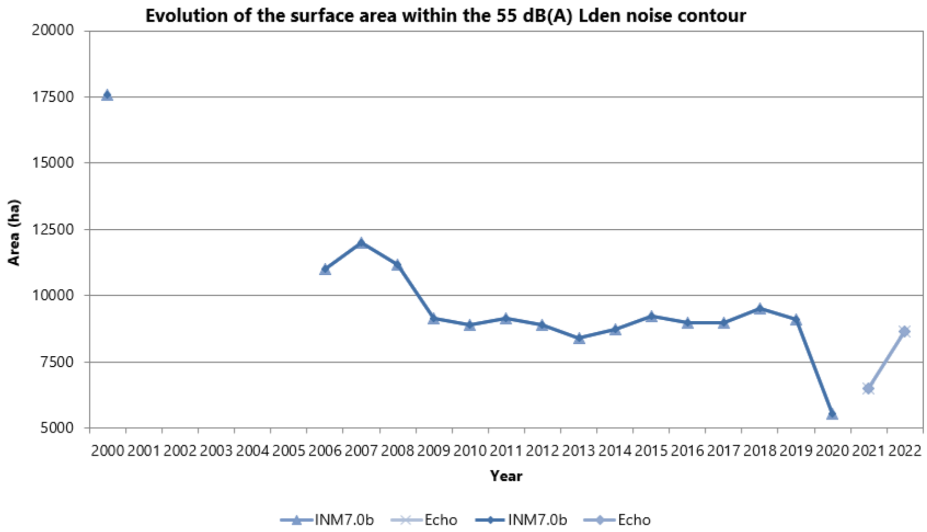


Figure 22: Evolution of the surface area inside the L_{den} contours (2000, 2006-2022)

Table 29: Evolution of the surface area inside the Freq.70,day contours (2006-2022)

Area (ha)	Freq.70,day - Noise contours (day 07:00-23:00)					
Year	5-10	10-20	20-50	50-100	>100	Total
2006						
2007						
2008						
2009						
2010*	5.171	3.164	4.119	2.097	1.877	**16.428**
2011*	4.933	2.989	4.216	1.934	1.854	**15.926**
2012*	5.155	3.662	3.797	1.578	1.684	**15.877**
2013*	4.660	3.915	3.154	1.879	1.503	**15.557**
2014*	4.809	3.745	3.465	1.631	1.722	**15.372**
2015*	6.650	4.431	3.442	1.903	1.887	**18.314**
2016*	3.331	3.407	3.372	1.715	1.666	**13.491**
2017*	3.556	3.415	3.375	1.625	1.750	**13.722**
2018*	3.851	3.553	3.286	1.811	1.773	**14.276**
2019*	3.489	3.432	3.249	1.607	1.844	**13.621**
2020*	4.334	2.988	2.600	958	156	**11.036**
2021**	3.408	2.402	2.386	1.333	469	**9.998**
2022**	3.845	2.470	2.579	1.430	1.242	**11.566**

*Calculated with INM 7.0b, ** Calculated with Echo

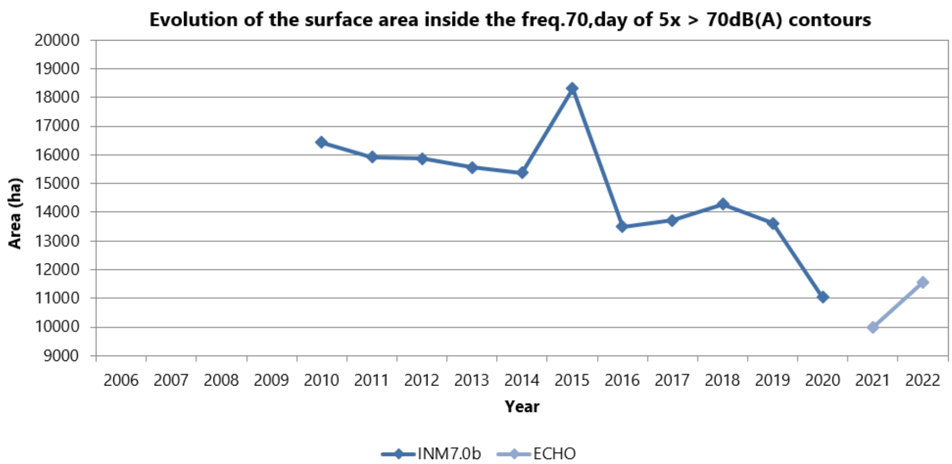


Figure 23: Evolution of the surface area inside the Freq.70,day contours (2006-2022).

Table 30: Evolution of the surface area inside the Freq.70,night contours (2006-2022).

Area (ha)	Freq.70,night - Noise contours (night 23:00-07:00)					
Year	1-5	5-10	10-20	20-50	>50	Total
2006						
2007						
2008						
2009						
2010*	9.535	2.679	1.948	748	0	**14.910**
2011*	9.557	2.662	2.095	801	0	**15.115**
2012*	9.226	2.846	2.005	861	0	**14.938**
2013*	9.083	2.821	2.223	723	0	**14.944**
2014*	8.169	2.586	2.030	1.001	27	**13.813**
2015*	7.949	2.928	1.876	1.133	0	**13.885**
2016*	8.104	2.439	2.149	998	0	**13.690**
2017*	7.813	2.512	2.142	959	0	**13.427**
2018*	8.207	2.508	2.362	957	0	**14.034**
2019*	7.834	2.345	2.299	1.012	0	**13.489**
2020*	7.397	1.990	1.385	204	0	**10.976**
2021**	6.797	2.475	1.627	188	0	**11.087**
2022**	7.015	2.098	2.217	686	0	**12.016**

*Calculated with INM 7.0b, ** Calculated with Echo

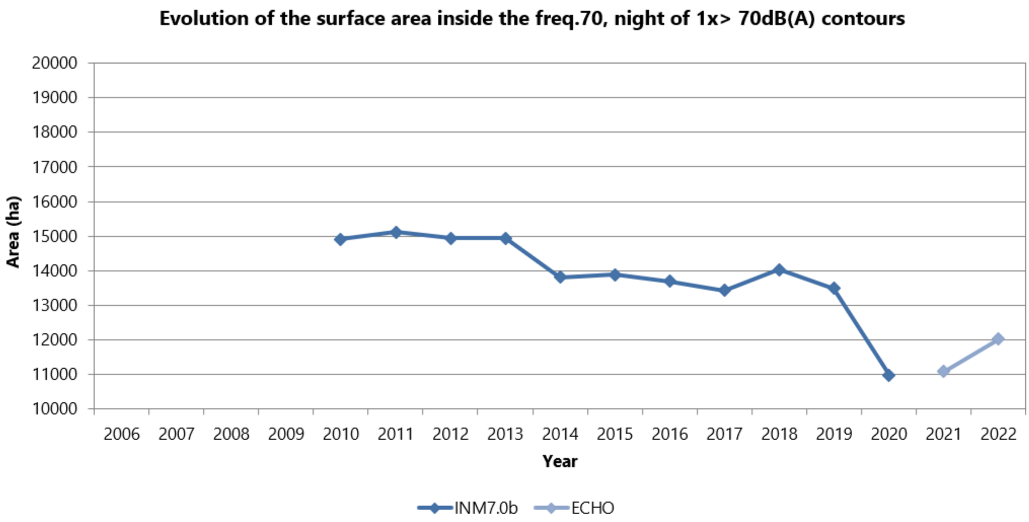


Figure 24: Evolution of the surface area inside the Freq.70,night contours (2006-2022).

Table 31: Evolution of the surface area within the Freq. 60,day contours (2006-2022)

Area (ha)	Freq.60,day - Noise contours (day 07:00-23:00)				
Year	50-100	100-150	150-200	>200	Total
2006					
2007					
2008					
2009					
2010*	9.288	3.313	1.681	2.409	**16.692**
2011*	9.112	3.405	1.476	2.579	**16.572**
2012*	9.007	2.691	1.754	1.885	**15.337**
2013*	8.005	1.958	2.053	972	**13.632**
2014*	9.329	2.112	1.865	2.050	**15.357**
2015*	9.211	3.511	1.633	1.848	**16.203**
2016*	9.256	2.670	1.918	1.916	**15.760**
2017*	8.315	3.795	1.795	2.223	**16.129**
2018*	9.359	3.235	1.876	2.159	**16.629**
2019*	8.816	3.495	1.916	2.239	**16.467**
2020*	3.072	635	117	0	**3.824**
2021**	7.255	1.514	190	0	**8.959**
2022**	8.875	3.449	1.540	398	**14.262**

*Calculated with INM 7.0b, ** Calculated with Echo

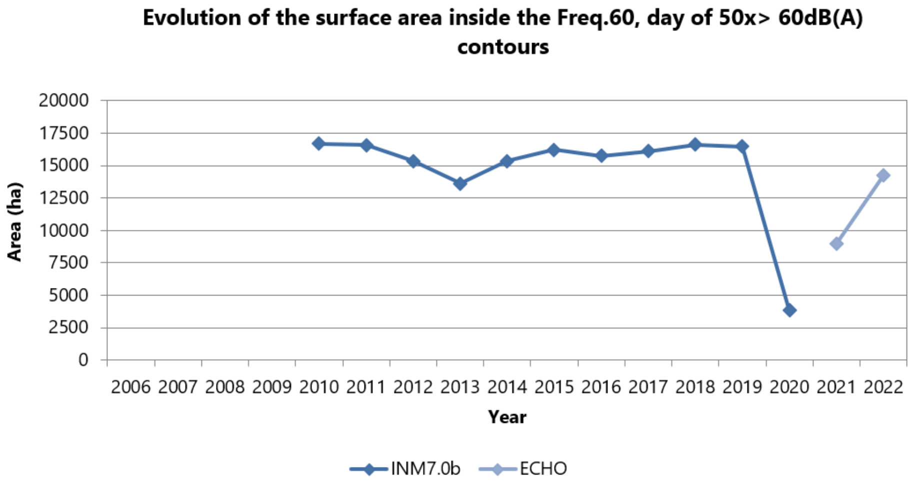


Figure 25: Evolution of the surface area inside the Freq.60,day contours (2006-2022)

Table 32: Evolution of the surface area inside the Freq.60,night contours (2006-2022).

Area (ha)	Freq.60,night - Noise contours (night 23:00-07:00)				
Year	10-15	15-20	20-30	>30	Total
2006					
2007					
2008					
2009					
2010*	5.577	1.797	1.930	725	**10.030**
2011*	6.436	1.972	1.930	905	**11.242**
2012*	7.522	1.778	1.932	1.004	**12.236**
2013*	5.083	2.367	1.888	1.031	**10.369**
2014*	4.807	2.542	1.845	1.670	**10.864**
2015*	5.819	1.786	3.064	1.295	**11.964**
2016*	5.142	3.635	2.053	1.222	**12.052**
2017*	5.612	3.310	2.349	1.183	**12.454**
2018*	5.580	3.434	2.746	1.301	**13.061**
2019*	5.802	3.774	2.480	1.296	**13.352**
2020*	4.111	882	567	267	**5.827**
2021**	2.845	3.459	869	318	**7.491**
2022**	6.584	2.884	2.597	732	**12.796**

*Calculated with INM 7.0b, ** Calculated with Echo

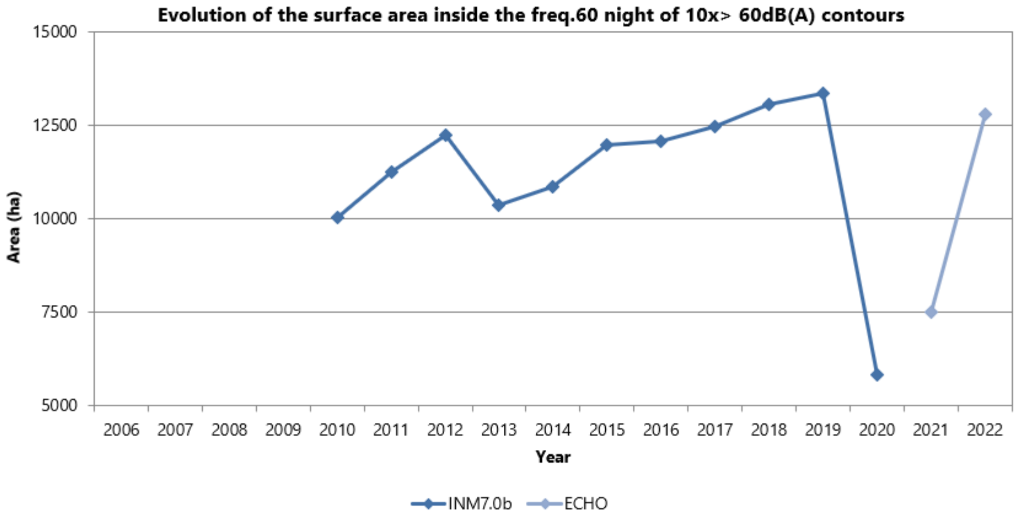


Figure 26: Evolution of the surface area inside the Freq.60,night contours (2006-2022).

Evolution of the number of residents per contour zone: L_{day}, $L_{evening}$, L_{night}, Freq.70,day, Freq.70,night, Freq.60,day, Freq.60,night

Table 33: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2022).

number of inhabitants		Lday - Noise contours in dB(A) (day 07:00-19:00)					
Year	**Population data**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
2000*	01jan00	106.519	13.715	5.660	1.134	20	**127.048**
2001							
2002							
2003							
2004							
2005							
2006*	01jan03	39.478	9.241	2.714	74	3	**51.511**
2007*	01jan06	47.260	9.966	3.168	102	3	**60.499**
2008*	01jan07	44.013	10.239	3.217	101	4	**57.575**
2009*	01jan07	32.144	8.724	2.815	58	3	**43.745**
2010*	01jan08	30.673	8.216	2.393	35	7	**41.323**
2011*	01jan08	28.828	8.486	2.460	46	7	**39.828**
2012*	01jan10	23.963	8.277	2.110	22	2	**34.375**
2013*	01jan10	22.737	7.482	1.318	7	2	**31.546**
2014*	01jan11	22.998	8.649	2.249	22	2	**33.920**
2015*	01jan11	23.662	8.945	2.350	99	0	**35.056**
2016*	01jan11	20.554	8.380	2.094	28	0	**31.057**
2017[1]*	01jan16	21.950	9.003	3.108	0	0	**34.062**
2018[1]*	01jan17	23.289	8.993	2.798	3	0	**35.083**
2019[1]*	01jan19	21.875	9.342	3.270	3	0	**34.489**
2020[1]*	01jan20	14.195	4.191	122	0	0	**18.507**
2021[1]**	01jan22	17.686	3.670	45	0	0	**21.401**
2022[1]**	01jan23	24.080	5.570	148	0	0	**29.797**

Evaluation based on address point

* Calculated with INM 7.0b, ** Calculated with Echo

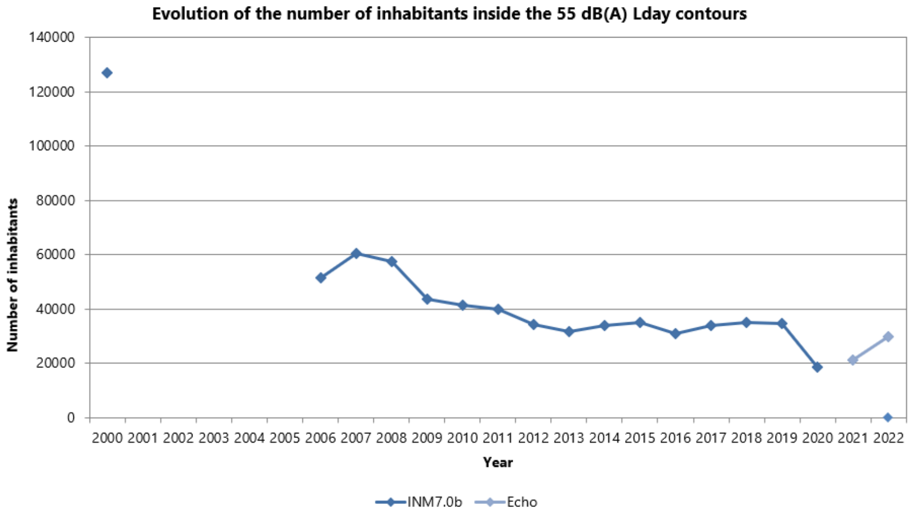


Figure 27: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2022).

Table 34: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2022).

number of inhabitants		Levening - Noise contours in dB(A) (evening 19:00-23:00)						
Year	Population data	50-55	55-60	60-65	65-70	70-75	>75	Total
2000*	01jan00	209.265	86.637	13.246	4.990	602	9	**314.750**
2001								
2002								
2003								
2004								
2005								
2006*	01jan03	185.699	24.488	7.138	2.030	28	3	**219.386**
2007*	01jan06	214.616	35.445	8.217	2.583	38	2	**260.901**
2008*	01jan07	249.024	43.589	9.514	2.969	52	3	**305.152**
2009*	01jan07	198.351	29.774	7.448	2.186	32	2	**237.793**
2010*	01jan08	198.934	37.729	7.127	2.057	25	5	**245.878**
2011*	01jan08	198.540	41.951	7.110	2.077	32	5	**249.716**
2012*	01jan10	213.799	46.427	7.309	2.072	27	1	**269.635**
2013*	01jan10	148.866	25.888	6.432	1.054	7	1	**182.247**
2014*	01jan11	187.698	23.913	9.632	2.052	29	0	**223.324**
2015*	01jan11	168.549	22.593	8.790	2.424	88	0	**202.444**
2016*	01jan11	204.319	29.643	9.140	2.796	52	0	**245.949**
2017[1]*	01jan16	206.220	26.880	9.055	3.173	5	0	**245.334**
2018[1]*	01jan17	226.101	34.113	10.033	3.538	57	0	**273.841**
2019[1]*	01jan19	213.243	28.965	9.814	3.531	5	0	**255.558**
2020[1]*	01jan20	54.642	16.266	5.093	261	0	0	**76.262**
2021**	01jan22	56.816	16.283	3.676	37	0	0	**76.812**
2022[1]**	01jan23	130.068	24.876	4.859	145	0	0	**159.949**

[1] Evalution based on address point
*Calculated with INM 7.0b, ** Calculated with Echo

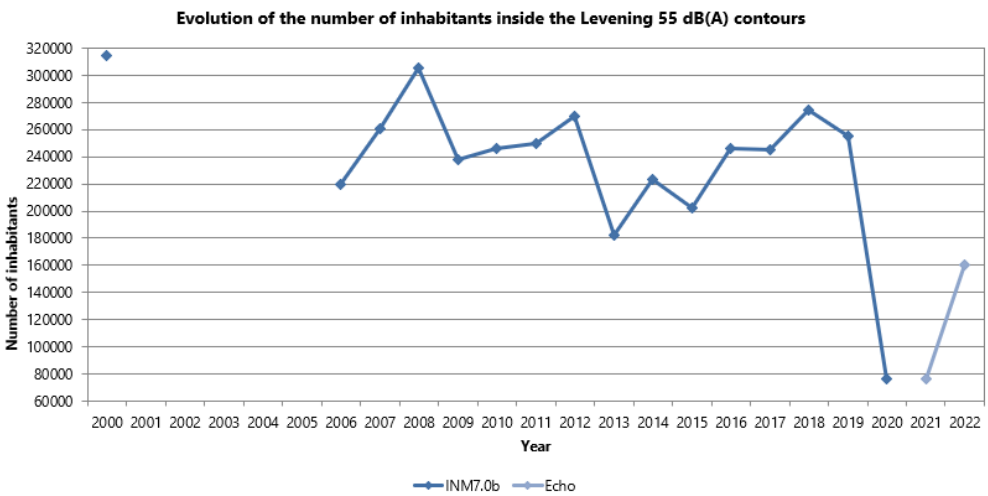


Figure 28: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2022).

Table 35: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2022).

number of inhabitants		Lnight - Noise contours in dB(A) (night 23:00-07:00)						
Year	Population data	45-50	50-55	55-60	60-65	65-70	>70	Total
2000*	01jan00	139.440	57.165	18.384	8.394	1.325	72	**224.779**
2001								
2002								
2003								
2004								
2005								
2006*	01jan03	167.033	28.985	8.836	1.167	174	8	**206.202**
2007*	01jan06	199.302	32.473	11.607	2.185	181	26	**245.772**
2008*	01jan07	151.736	26.450	7.985	1.017	133	3	**187.323**
2009*	01jan07	122.871	19.528	6.303	622	92	2	**149.418**
2010*	01jan08	129.820	19.986	6.077	571	89	5	**156.548**
2011*	01jan08	129.969	22.490	6.414	622	94	5	**159.594**
2012*	01jan10	124.012	24.015	6.963	585	78	2	**155.655**
2013*	01jan10	91.140	28.407	7.152	51	3	0	**126.754**
2014*	01jan11	163.270	24.221	7.889	869	110	3	**196.362**
2015*	01jan11	125.407	26.956	8.239	762	159	2	**161.524**
2016*	01jan11	128.939	23.476	7.954	715	131	0	**161.216**
2017[1]*	01jan16	106.964	27.127	7.484	469	66	0	**142.110**
2018[1]*	01jan17	122.588	29.355	7.601	501	64	0	**160.109**
2019[1]*	01jan19	127.079	27.978	8.065	529	66	0	**163.718**
2020[1]*	01jan20	60.530	18.372	2.217	390	57	0	**81.566**
2021[1]**	01jan22	77.128	25.889	1.479	412	0	0	**104.908**
2022[1]**	01jan23	113.796	34.494	3.200	386	25	0	**151.901**

1 Evaluation based on address point
*Calculated with INM 7.0b, ** Calculated with Echo

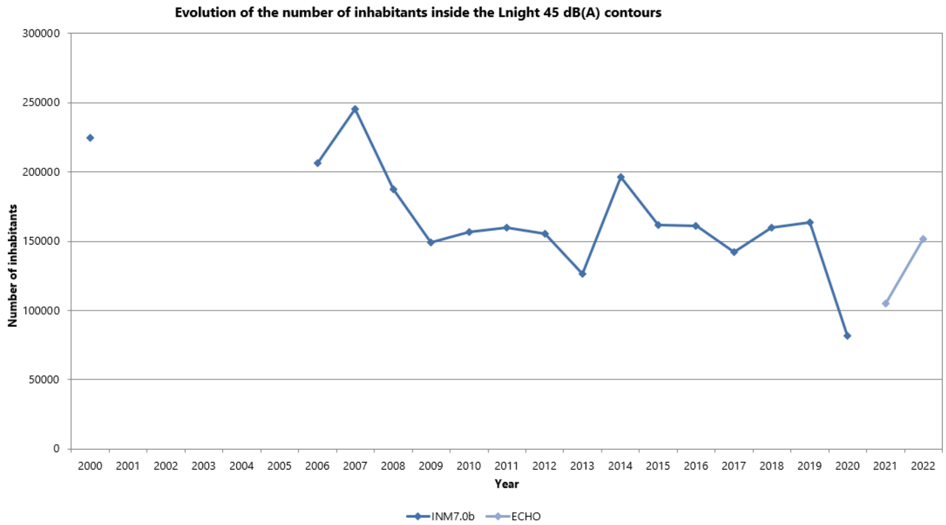


Figure 29: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2022).

Table 36: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2022).

number of inhabitant	Lden - Noise contours in dB(A) (d. 07h-19h, av. 19h-23h, n. 23h-07h)						
Year	pulation da	55-60	60-65	65-70	70-75	>75	Total
2000*	01jan00	166.767	36.797	14.091	3.952	264	**221.871**
2001							
2002							
2003							
2004							
2005							
2006*	01jan03	107.514	18.697	5.365	560	63	**132.198**
2007*	01jan06	147.349	19.498	6.565	946	82	**174.442**
2008*	01jan07	125.927	19.319	5.938	717	24	**151.925**
2009*	01jan07	87.766	15.105	4.921	404	9	**108.205**
2010*	01jan08	87.083	15.619	4.506	337	11	**107.556**
2011*	01jan08	90.988	15.941	4.664	362	13	**111.969**
2012*	01jan10	86.519	16.220	4.617	319	6	**107.680**
2013*	01jan10	56.516	16.517	3.994	197	5	**77.229**
2014*	01jan10	84.747	16.525	5.076	368	9	**106.725**
2015*	01jan11	72.628	17.721	5.244	428	55	**96.075**
2016*	01jan11	77.229	16.694	5.284	450	23	**99.680**
2017[1]*	01jan16	70.139	17.645	5.264	257	0	**93.305**
2018[1]*	01jan17	77.812	19.476	5.413	413	0	**103.114**
2019[1]*	01jan19	72.561	19.231	5.448	383	0	**97.624**
2020[1]*	01jan20	34.236	9.801	1.361	110	0	**45.508**
2021[1]**	01jan22	40.787	9.371	931	30	0	**51.119**
2022[1]**	01jan23	58.491	18.472	1.245	117	0	**78.326**

1 Evaluation based on address point
*Calculated with INM 7.0b, ** Calculated with Echo

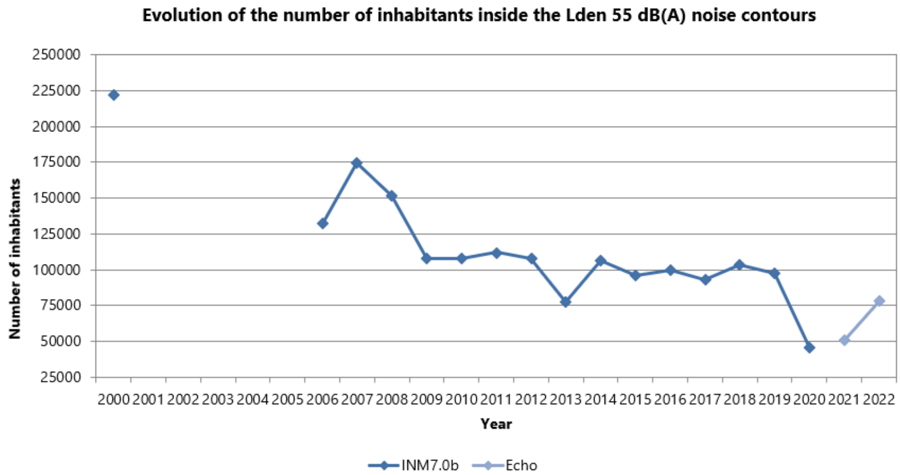


Figure 30: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2022).

Table 37: Evolution of the number of residents inside the Freq.70,day contours (2006-2022).

number of inhabitants		Freq.70,day - Noise contours (day 07:00-23:00)					
Year	Population data	5-10	10-20	20-50	50-100	>100	Total
2006							
2007							
2008							
2009							
2010*	01jan08	133.468	77.606	82.703	15.348	9.874	**318.999**
2011*	01jan08	133.014	80.395	78.893	11.783	10.018	**314.103**
2012*	01jan10	128.971	95.435	58.279	10.112	9.339	**302.136**
2013*	01jan10	94.888	84.745	33.045	14.225	6.554	**239.376**
2014*	01jan11	226.319	139.618	47.774	10.655	10.379	**434.746**
2015*	01jan11	163.105	104.564	43.843	11.547	11.204	**334.264**
2016*	01jan11	95.084	86.813	40.288	10.509	10.541	**243.235**
2017[1]*	01jan16	111.019	92.035	40.125	10.365	12.694	**266.238**
2018[1]*	01jan17	122.115	94.126	42.456	22.569	1.024	**282.289**
2019[1]*	01jan19	108.714	110.676	42.207	21.742	1.088	**284.427**
2020[1]*	01jan20	102.799	31.056	17.647	8.250	0	**159.753**
2021[1]**	01jan22	90.050	30.752	20.878	9.446	325	**151.451**
2022[1]**	01jan23	116.993	53.182	22.683	12.324	5.637	**210.819**

1 Evaluation based on address point

*Calculated with INM 7.0b, ** Calculated with Echo

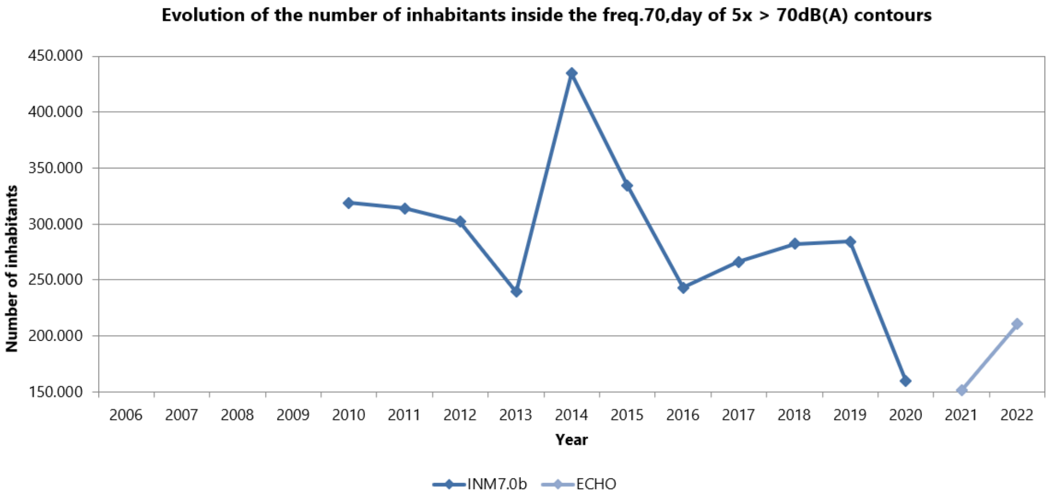


Figure 31: Evolution of the number of residents inside the Freq.70,day contours (2006-2022).

Table 38: Evolution of the number of residents inside the Freq.70,night contours (2006-2022).

number of inhabitants		Freq.70,night - Noise contours (night 23:00-07:00)					
Year	Population data	1-5	5-10	10-20	20-50	>50	Total
2006							
2007							
2008							
2009							
2010*	01jan08	239.529	23.583	12.968	2.597	0	**278.677**
2011*	01jan08	232.090	22.587	13.071	3.261	0	**271.010**
2012*	01jan10	195.400	21.774	12.858	4.078	0	**234.110**
2013*	01jan10	158.701	22.985	15.876	1.774	0	**199.913**
2014*	01jan11	240.106	19.794	13.018	6.333	0	**279.251**
2015*	01jan11	167.925	22.934	13.681	6.400	0	**210.939**
2016*	01jan11	183.776	18.616	14.079	6.151	0	**222.622**
2017[1]*	01jan16	155.257	19.411	14.408	5.854	0	**194.930**
2018[1]*	01jan17	172.835	21.478	14.948	6.020	0	**215.281**
2019[1]*	01jan19	184.024	20.072	15.028	6.574	0	**225.698**
2020[1]*	01jan20	89.653	17.902	6.243	496	0	**114.295**
2021[1]**	01jan22	80.278	18.228	10.346	0	0	**108.852**
2022[1]**	01jan23	117.025	21.970	14.417	1.288	0	**154.700**

1 Evaluation based on address point
*Calculated with INM 7.0b, ** Calculated with Echo

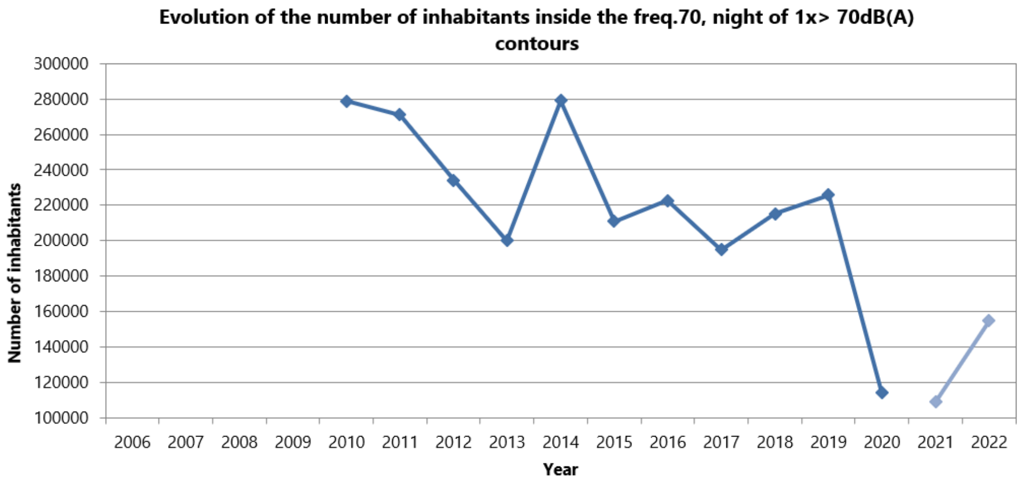


Figure 32: Evolution of the number of residents inside the Freq.70,night contours (2006-2022).

Table 39: Evolution of the number of residents inside the Freq.60,day contours (2006-2022).

number of inhabitants		Freq.60,day - Noise contours (day 07:00-23:00)				
Year	Population data	50-100	100-150	150-200	>200	Total
2006						
2007						
2008						
2009						
2010*	01jan08	154.110	49.587	14.723	15.834	**234.253**
2011*	01jan08	152.727	50.646	8.604	18.816	**230.793**
2012*	01jan10	158.634	35.632	10.547	15.498	**220.312**
2013*	01jan10	123.956	12.877	18.257	3.603	**174.921**
2014*	01jan11	273.603	22.036	10.282	17.121	**323.042**
2015*	01jan11	191.263	23.810	12.105	16.596	**243.774**
2016*	01jan11	179.841	31.127	10.476	17.495	**238.939**
2017[1]*	01jan16	174.069	62.701	9.661	22.736	**269.167**
2018[1]*	01jan17	221.416	18.985	11.353	21.484	**273.238**
2019[1]*	01jan19	200.841	55.497	10.932	23.645	**290.915**
2020[1]*	01jan20	32.599	4.191	0	0	**36.790**
2021[1]**	01jan22	61.144	16.500	0	0	**77.644**
2022[1]**	01jan23	162.012	20.522	20.401	7	**202.942**

1 Evaluation based on address point
*Calculated with INM 7.0b, ** Calculated with Echo

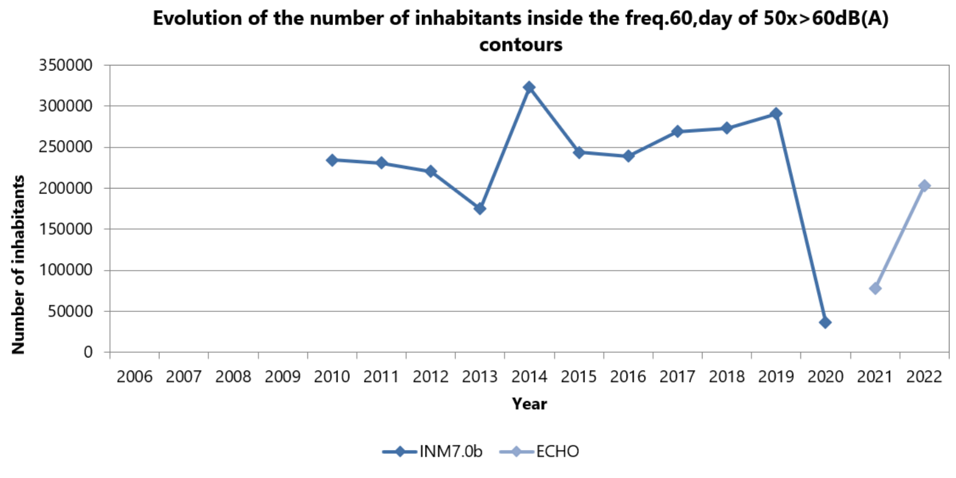


Figure 33: Evolution of the number of residents inside the Freq.60,day contours (2006-2022).

Table 40: Evolution of the number of residents inside the Freq.60,night contours (2006-2022).

number of inhabitants		Freq.60,night - Noise contours in dB(A)				
Year	Population data	10-15	15-20	20-30	>30	Total
2006						
2007						
2008						
2009						
2010*	01jan08	62.090	9.411	21.231	3.262	**95.994**
2011*	01jan08	65.246	9.522	20.695	5.450	**100.913**
2012*	01jan10	80.911	8.723	20.642	7.009	**117.284**
2013*	01jan10	52.151	14.679	20.269	6.340	**93.438**
2014*	01jan11	79.725	27.741	18.637	12.317	**138.420**
2015*	01jan11	84.429	12.453	24.502	10.351	**131.736**
2016*	01jan11	81.235	20.356	21.869	8.779	**132.238**
2017[1]*	01jan16	93.532	15.687	23.488	9.538	**142.245**
2018[1]*	01jan17	98.609	16.849	24.728	10.016	**150.202**
2019[1]*	01jan19	110.835	17.770	24.096	10.817	**163.518**
2020[1]*	01jan20	30.334	10.565	4.365	539	**45.803**
2021[1]**	01jan22	26.888	28.001	10.397	740	**66.026**
2022[1]**	01jan23	73.064	19.541	26.822	3.866	**123.293**

1 Evaluation based on address point
*Calculated with INM 7.0b, ** Calculated with Echo

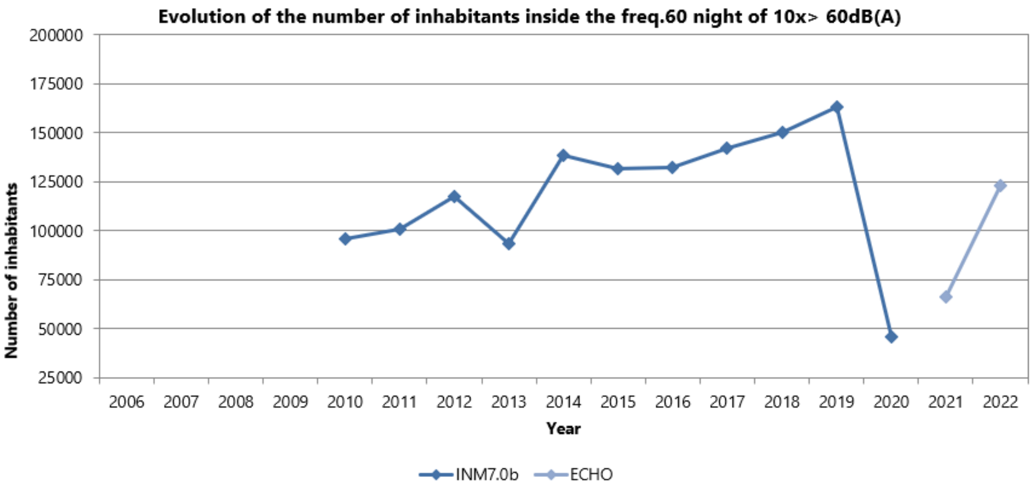


Figure 34: Evolution of the number of residents inside the Freq.60,night contours (2006-2022).

Bijlage F. Impact change to calculation method

The table below gives the effect on the calculated noise impact for the most significant changes in the calculation method.

Table 41: Description of the impact per change in the calculation method of the contours.

Change	Impact on the noise levels
Changes calculation model: INM → Echo	The most significant change as a consequence of applying Doc. 29 calculation method, is the advice for the use of a more recent method to determine atmospheric absorption. This leads to a rise in the noise levels. The impact close to the airport is small, farther away the differences can be 1 to 2 dB.
Updating source data	The correction of the noise levels for approaches by Airbus aircraft lead to higher noise levels for approaches. The noise impact for Brussels Airport thus increases to the order of 1 dB (larger contours). The addition of data of a number of aircraft has a marginal effect.
Correction factor compared to the proxy aircraft type	The application of the factor 'corrects' for the differences in noise levels of the proxy aircraft type in the calculation and the actual aircraft type. The application of the correction factor leads to around 1 dB lower noise level for departures and 0.5 dB for arrivals and thus to smaller contours.
Modelling based on actual flight paths	A calculation based on the actual flight paths is locally more accurate and can have an effect on the location of the contours. The impact overall is, however, marginal.
Modelling departures based on NADP1 procedure	In line with the prescribed departure procedure at Brussels Airport, departures are modelled based on the NADP 1 instead of the NADP2 procedure. The calculated noise levels for take-offs are thus 1 to 3 dB lower in the area under the flight path at c. 5 to 10 km measured from the beginning of the runway and around 1 dB higher in the area to the side of the flight path.
Distinction in approach profiles	By taking account of the 'level flying' (whereby a section of the approach is flown at a fixed altitude) in the modelling, the calculated noise levels for approaches is somewhat higher. The impact is only visible at a greater distance (10+ km) before the runway.

Bijlage G. Documentation provided files

Radar data for the year 2022 (source: BAC-TANOS)

2022-JAN-APR_flights.xlsx	09/01/2023	27.690 KB
2022-JAN-JUN_ops.csv	09/01/2023	938.451 KB
2022-JUL-DEC_flights.xlsx	09/01/2023	26.835 KB
2022-JUL-DEC_ops.csv	09/01/2023	1,117,801 KB

Flight data for the year 2022 (source: BAC-CDB)

ENV002_AT_202201_202212.csv	09/01/2023	62.621 KB

Data entry point per flight for 2022 (source Skeyes)

EBBR_2022_DEP.xlsx	25/01/2023	9.091 KB

Weather data for the year 2022 (source: BAC-TANOS)

2022_meteo.xls	09/01/2023	1.018 KB

Noise events for the year 2022 (source: BAC-TANOS / dOMG)

2022-01_04_events TANOS.xlsx	10/01/2023	91.847 KB
2021-01_12_events OMGEVING.xlsx	10/01/2023	131.141 KB
2022-05_08_events TANOS.xlsx	10/01/2023	80.022 KB
2022-09_12_events TANOS.xlsx	10/01/2023	87.500 KB

hour reports noise measuring network for the year 2021 (BAC-TANOS / dOMG)

status_OMG_2022.xls	10/01/2023	1.057 KB
uur-rapporten_2021-0107 TANOS.xlsx	10/01/2023	22.832 KB

Address files Flanders and Brussels

Centraal Referentieadressenbestand (CRAB)	01/01/2023	Government of Flanders
OSLO business estates	01/01/2023	Government of Flanders
UrBis-Adm	01/01/2023	CIBG