Noise Contours around Brussels Airport for the Year 2017

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1 Introduction

The Government imposes an obligation on Brussels Airport Company to calculate noise contours are calculated every year in order to perform an assessment of the noise impact caused by departing and landing aircraft on the area surrounding the airport. The calculations are imposed on Brussels Airport pursuant to Flemish environmental legislation (VLAREM) which was amended in 2005[1] in accordance with the European guideline on the assessment and control of environmental noise, and the environmental permit[2] of Brussels Airport Company. These noise contours are calculated according to a strictly defined methodology (see 1.2) 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 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 KULeuven. This assignment has been carried out by the WAVES research group of the Ghent University (UGent) since 2015. The calculations are commissioned by the airport operator which is currently Brussels Airport Company.

1.1 Disclaimer

This assignment is performed by recognised sound experts working at the Ghent University with the explicit order 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 the Ghent University are responsibility for the conformity of this result but are not responsible for the quality and comprehensiveness of the raw data provided. The following limitations apply with regard to the use of this report:

- This report contains no information, judgment or opinion about the applicable (environmental) at federal or regional level and is not suitable to be used for this purpose.
- This report may not be interpreted as an opinion or action plan to minimise exposure, sleep disruption or nuisance among the public.

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[1] Belgian Official Gazette, Decision by the Flemish Government on the evaluation and control of environmental noise, amending the decision of the Flemish Government of 1 June 1995 on the general and sector-specific rules on environmental health, 31 August 2005.

[2] AMV/0068637/1014B AMV/0095393/1002B; Decision by the Flemish Minister of Public Works, Energy, Environment and Nature, containing the judgment relating to the appeals lodged against the Decision with reference D/PMVC/04A06/00637 of 8 July 2004 by the Provincial Executive of the Provincial Council of Flemish Brabant, on granting of the environmental licence for a period expiring on 8 July 2024 to NV Brussels International Airport Company (B.I.A.C), Vooruitgangsstraat 80 bus 2, 1030 Brussels, to continue operating and to alter (by adding to it) an airport located at Brussels National Airport in 1930 Zaventem, 1820 Steenokkerzeel, 1830 Machelen and 3070 Kortenberg, 30 December 2004

1.2 Compulsory calculations

In accordance with the VLAREM environmental legislation, the operator of an airport classified in category[3] 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;

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

- L_{night} and L_{den} noise contours such as required by the present VLAREM obligation;
- Frequency contours for 70 dB(A) and 60 dB(A); as in preceding years, Brussels Airport Company requested UGent to calculate the following frequency contours:
    - Frequency contours for 70 dB(A) during the day 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 day 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 calculation of the noise contours must be carried out in accordance with the 'Integrated Noise Model' (INM) of the United States Federal Aviation Administration (FAA), version 6.0c or later.

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.

1.3 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 in 2005, the following division of the day was used (day: 06:00 – 23:00; night: 23:00 – 06:00). Since VLAREM was adjusted in accordance with the

[3] Class 1 airports: airports that meet the requirements of the Chicago Convention of 1944 on the establishing of the International Civil Aviation Organisation and with a take-off and arrival runway of at least 800 metres

guideline, the noise contours reports are calculated officially 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 2015, the annual calculation is no longer carried out by the Acoustics and Thermal Physics Laboratory of KULeuven but by the WAVES research group of the Ghent University. During this transition of executing party, it has been verified that the calculation models and assumptions do not lead to discontinuities in the results.

1.4 INM: Integrated Noise Model

For the calculation of the noise contours since 2011, INM 7 (subversion INM 7.0b) has been used. For the years 2000 to 2010, model version 6.0c was always used for the officially reported noise contours. 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 for the years 2006 to 2010 were recalculated with version 7.0b[4]. In this way, it is possible to assess the evolution of the noise contours since 2000 without being affected by the calculation model used.

1.5 Population data

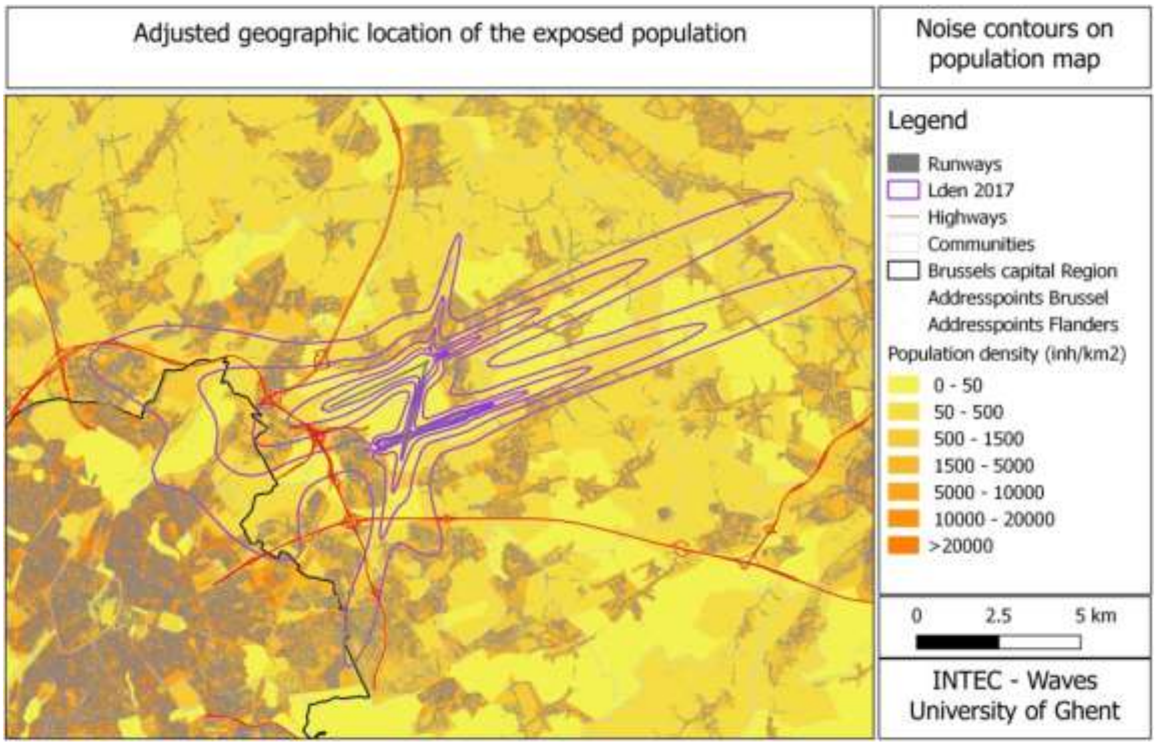
The most recent population data available is used to determine the number of residents living inside the contour zones and the number of people who are potentially seriously inconvenienced. In previous reports, population information was used in accordance with the 10-year population census to determine the population by statistical sector (most recent population on 1/1/2011). In the open data section of the Statistical and Economic Information Administration (also known as the National Statistical Institute), annually adjusted population figures at the level of the statistical sectors are now made available. The most recent dataset available is used to calculate the exposure figures in this report (i.e. population on 1 January 2016). In this way, the evolution of the population up to the level of the statistical sectors is taken into account.

In previous noise contour reports, the exposed population was determined on the basis of a homogeneous distribution of the number of inhabitants over the surface area of the statistical sector. This year, the calculation method has been further refined, improving the geographical distribution within the statistical sector. Based on the address files in the Brussels-Capital Region and Flanders, a number of persons is calculated for each address location. The information on the number of housing units is different in the Brussels-Capital Region and Flanders. In Flanders the number of housing units for each address is known, in the Brussels-Capital Region this information is not available. In Flanders, this makes the exposure more sensitive to apartment buildings within a statistical sector. Not all address points are dwellings. In Flanders the addresses are categorised and, based on this information, the specific addresses of companies are removed. The population in a statistical sector is divided equally between the number of dwellings for the Flemish territory and the number of address points for the Brussels-Capital Region. The figure below shows the population

[4] 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

density by statistical sector (old method, 2011 population data) with the location of the dwellings within these sectors (position only). The L_{den} contour for 2017 and the road network have been added as geographical references.

Figure 1: Geographical location of inhabitants by surface area and by address location.



The method used to calculate the exposure figures in this report takes into account the combined effect of population evolution since 2011 and the optimisation of the geographical location of the inhabitants within the statistical sectors. The combined effect on the evaluation of the potential number of seriously inconvenienced persons is discussed in section 4.4.

1.6 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 Appendix 5.7.

1.7 INM Study results

Brussels Airport Company was also provided with the following files in digital format by way of appendices to the report:

- UGENT_EBBR17_INM_studie.zip (the INM study used)
- UGENT_EBBR17_geluidscontouren.zip (the calculated contours in shape format)
- UGENT_EBBR17_opp_inw.zip (the number of residents and the surface area as calculated within the noise contours)

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 closest 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 ($L_{Aeq,1s,max}$)[5] 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 overflies 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).

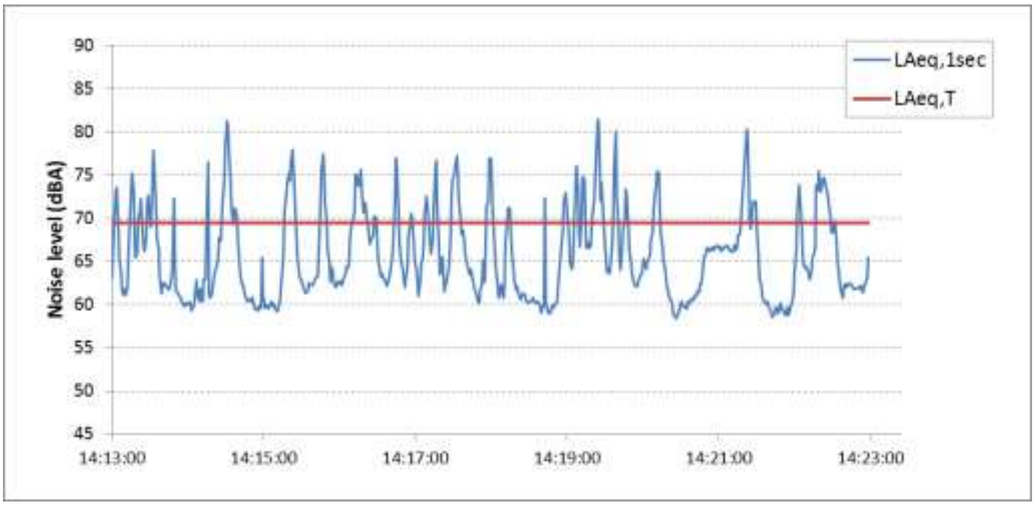
2.1.4 The A-weighted equivalent sound pressure level LAeq,T

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. To represent the noise impact at a specific place and as a result of fluctuating sounds over a period, the A-weighted equivalent sound pressure level $L_{Aeq,T}$ is used (see Figure 2).

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).

[5] The INM calculation program calculates the quantity $L_{Amax,slow}$. However, the values for this quantity are similar to those for the quantity $L_{Aeq,1s,max}$.

Figure 2: Graph of the A-weighted equivalent sound pressure level ($L_{Aeq,T}$) for a period T=10 minutes, together with the instantaneous ($L_{Aeq,1sec}$) from which this is derived.



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:

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

2.1.5 Lden

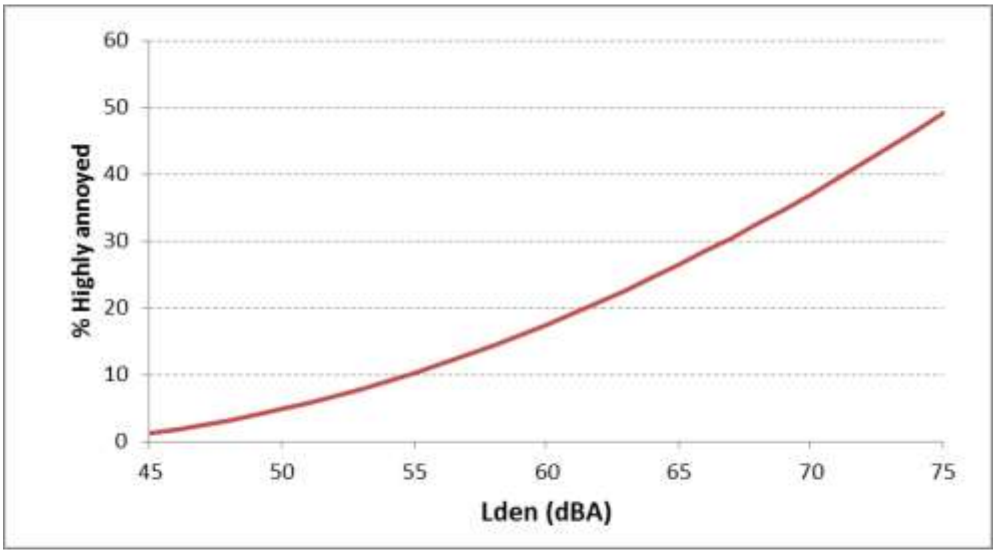
The European directive on the control and assessment of environmental noise (transposed in VLAREM 2), recommends using the L_{den} parameter to determine the annoyance over a longer period. The L_{den} (**L**evel **D**ay-**E**vening-**N**ight)is the A-weighted equivalent sound pressure level over 24 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 division used by section 57 of VLAREM 2 is used, 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 relationship is imposed by VLAREM 2 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 3).

$$\% \text{ seriously inconvenienced} = -9{,}199 \cdot 10^{-5}(L_{den}-42)^3 + 3{,}932 \cdot 10^{-2}(L_{den}-42)^2 + 0{,}2939(L_{den}-42)$$

Figure 3: 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[6] and was adopted by the WG2 Dose/effect of the European Commission[7]. Note that L_{den} only determines around 30% of the variation in reported severe inconvenience[8][9].

[6] 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

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

[8] 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.

[9] 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.

3 Methodology

Noise contours are calculated using the 'Integrated Noise Model' (INM) of the United States Federal Aviation Administration (FAA). This model and the methodology used comply with the methodology prescribed in the VLAREM legislation (chapter 5.57 Airports).

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.
- Execution of the calculations.
- Processing of the contours into a Geographic Information System (GIS).

3.1 Data input

INM calculates noise contours around the airport based on an average day/evening/night input file. An average day is not a typical day on which the airport is used normally. It is based on the data for a complete year, where an average twenty-four hour period is determined by bringing all movements in that year into the calculation, and then dividing it by the number of days in that year.

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.

Information about aircraft movements

The following data is required to specify aircraft movements:

- Aircraft type
- Time
- Nature of the movement (departure/arrival)
- Destination or origin
- Runway used
- SID 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.

A matching INM aircraft type is linked to every aircraft type based on type, engines, registration, etc. In most cases, the aircraft types are present in INM or in the standardised list with valid alternatives. For a minority of aircraft that cannot yet be identified in INM, an equivalent is sought based on other data (the number and type of engines and the MTOW (maximum take-off weight), etc.).

Helicopters are not included specifically in the calculations but they are added proportionally to the movement type (landing/take-off) and the time of day. Helicopter flights represent about 1% of movements. A SID is not available for some departures of aircraft (usually domestic flights with smaller aircraft). These flights are also added proportionally to the flight data (about 0.2 %).

3.1.1 Radar data

A number of SIDs are given per runway in the Aeronautical Information Publication (AIP). These departure descriptions are not geographical stipulations, but are laid down as procedures. They must be followed when a certain height or geographical location is reached. Reaching this height and/or geographical location depends on the aircraft type, weight (and indirectly the destination) and on 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.

Taking into account each individual radar track requires an long calculation time. A method is therefore available in INM to take this distribution into account. This manual method (one action per bundle) is automated from 2015 without using the internal method in INM.

The SIDs are grouped together for the take-off movements in a number of larger bundles and a static division is used for those bundles based on the actual flown paths. This static method is an improvement compared to the built-in methodology of INM which uses a symmetrical distribution of the actual flown paths while the distribution of the paths in bundles is generally asymmetrical. For a number of frequently-used SIDS, the calculations are refined by a further division based on by aircraft type.

Grouping by approach path is not possible for arrivals using the information in the CDB. For this reason, the bundles for arrivals are divided on the basis of geographical data. Approaches for runways 25R and 25L are from the south-east, north or north-west, or from longer distances aligned with the runway. No distinctions are made by aircraft type for approaches because the approach path is not influenced by this factor.

3.1.2 Meteorological data

For the calculation of the contours for 2017, the actual average meteorological conditions are used. The weather data are available via Brussels Airport Company every twenty minutes. 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 that is weighted with 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 2017 are:

- Average headwind (annual average across all runways, take-off and landing): 4.1 kn.
- Average temperature: 12.1 °C or 53.8 °F.

- Average headwind per runway:
  - 25R: 4.8 kn.
  - 25L: 4.8 kn.
  - 07R: 2.6 kn.
  - 07L: 2.9 kn.
  - 19: 4.2 kn.
  - 01: 2.5 kn.

3.1.3 Take-off profile

The weight of the aircraft influences the take-off profile at departure. Given that this actual weight is not available in the CDB, a method proposed by INM is used to factor in this effect (INM parameter stage). 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 others, 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.

3.2 Execution of the contour calculations

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

INM enables calculations at specific locations around the airport. To check the assumptions concerning the input data and the accuracy of the INM, the calculated noise impact is compared with sound measurements taken at 30 locations.

The comparison with measurements provides a validation of the calculations. Note that the noise calculations as well as the noise measurements imply specific uncertainties. For example, the noise calculations group flight movements and do not consider the actual height of an aircraft flying over (this is determined by the assigned INM standard departure profile, 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 for example may affect the measured levels. Although these are removed as far as possible from the measurements (e.g. 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.

3.2.2 Technical data

The calculations are carried out with INM 7.0b with a refinement 11 and tolerance 0.5 within a grid from 8 nmi[10] northwards and southward in relation to the airport reference measuring point, and 18 nmi westwards and 16 nmi eastwards. The altitude of the airport reference measuring point in relation to sea level is 184 ft

3.2.3 Calculation of frequency contours

The noise contours are calculated directly in INM. Frequency contours show the number of times a certain value is exceeded; these contours cannot be provided directly by INM.

INM is able to calculate the maximum noise pressure on a regular grid per aircraft movement. This information is input in GIS to calculate frequency contours with standard functionality.

[10] 1 nmi (nautical mile) = 1.852 km (kilometre)

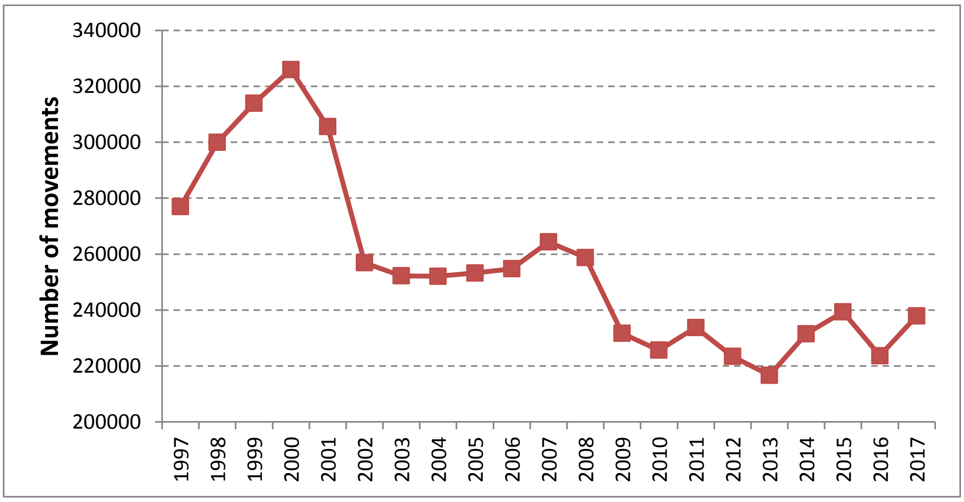
4 Results

4.1 Background information about interpreting the results

4.1.1 Number of flight movements

One of the most important factors in the calculation of 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 the temporary closure and staged restart after the attacks on the airport on 22 March 2016. In 2017, the number of movements increased by 6.3% to 237,888.

Figure 4: Evolution of flight traffic (all movements) at Brussels Airport.



The number of night-time movements (23:00-06:00) rose by 6.8% from 15,751 in 2016 to 16,827 in 2017 (including 5,082 take-offs). This includes helicopter movements and the movements exempt from slot coordination such as government flights and military flights. A comparison with 2015 (due to lower traffic as a result of the attack on 22 March 2016) provides a more accurate picture of the evolution. The number of night-time movements (23:00-06:00) rose in 2017 by 1.9% compared with 2015 (with an increase of 2.,0% for take-offs).

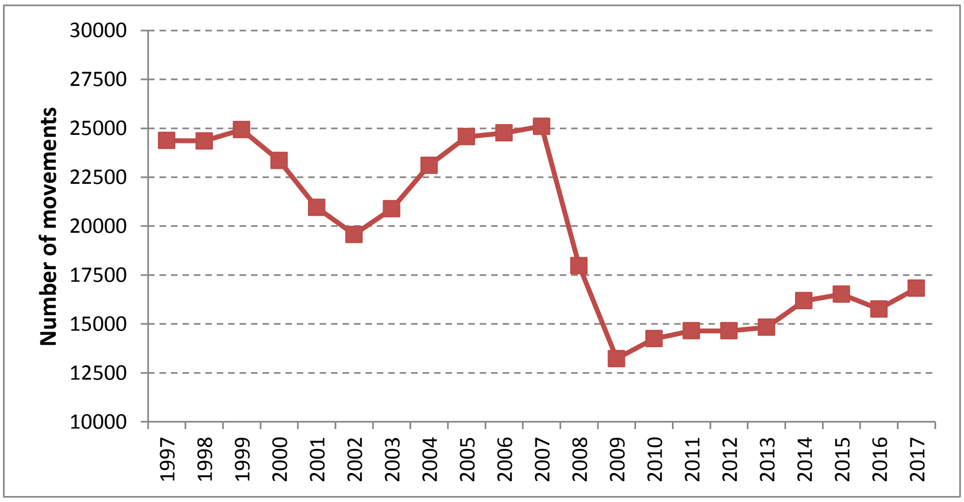
In 2017, the number of assigned night slots[11] for aircraft movements remained at 15,832, including 4,575 for departures, within the limitations imposed on the slot coordinator of Brussels Airport who since 2009 has been authorised to distribute a maximum of 16,000 night slots, of which a maximum

[11] 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 allocating slots at community airports, to use the entire infrastructure required for the exploitation of an air service at the airport of Brussels National on a specified date and at a specified landing and take-off time during the night as assigned by the coordinator;

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 6.3% from 207,937 in 2016 to 221,061 in 2017. In comparison with 2015, this is a decrease of 0.8%.

Figure 5: Evolution of flight traffic during the night (23:00-06:00) at Brussels Airport.



As a result of changes to the Vlarem legislation in 2005, noise contours are no longer measured based on a daily breakdown that coincides with the operating schedule at Brussels Airport, but, rather, the day is split up into a daytime period (07:00 - 19:00), an evening period (19:00 - 23:00) and a night period (23:00 - 07:00). The number of movements in 2017, the data for 2016 and the trend are shown in Table 1. The numbers for the night period are broken down further by operational nights (23:00 - 06:00) and the morning period (06:00 - 07:00).

Table 1: Number of movements (incl. helicopter movements) in 2017 and the change vs 2016 (VLAREM division of the day).

	2016			2017			Relative change versus 2016		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	74,207	74,053	148,260	77,829	79,903	157,732	4.9%	7.9%	6.4%
evening (19:00 - 23:00)	25,215	25,412	50,627	27,312	26,616	53,928	8.3%	4.7%	6.5%
night (23:00 - 07:00)	12,426	12,375	24,801	13,800	12,428	26,228	11.1%	0.4%	5.8%
00:00 - 24:00	111,848	111,840	223,688	118,941	118,947	237,888	6.3%	6.4%	6.3%
06:00 - 23:00	101,038	106,899	207,937	107,196	113,865	221,061	6.1%	6.5%	6.3%
23:00 - 06:00	10,810	4,941	15,751	11,745	5,082	16,827	8.6%	2.9%	6.8%
06:00 - 07:00	1,616	7,434	9,050	2,055	7,346	9,401	27.2%	-1.2%	3.9%

The general increase of 6.3% in the number of movements on an annual basis between 2016 and 2017 is evenly distributed throughout the day (+6.4%), evening (+6.5%) and night (5.8%). However, between 06:00 and 07:00, the increase is significantly smaller (+3.9%).

Table 2: Number of movements (incl. helicopter movements) in 2017 and the change vs 2015 (VLAREM division of the day).

	2015			2017			Relative change versus 2015		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	80,036	80,219	160,255	77,829	79,903	157,732	-2.8%	-0.4%	-1.6%
evening (19:00 - 23:00)	26,188	25,681	51,869	27,312	26,616	53,928	4.3%	3.6%	4.0%
night (23:00 - 07:00)	13,456	13,769	27,225	13,800	12,428	26,228	2.6%	-9.7%	-3.7%
00:00 - 24:00	119,680	119,669	239,349	118,941	118,947	237,888	-0.6%	-0.6%	-0.6%
06:00 - 23:00	108,140	114,688	222,828	107,196	113,865	221,061	-0.9%	-0.7%	-0.8%
23:00 - 06:00	11,540	4,981	16,521	11,745	5,082	16,827	1.8%	2.0%	1.9%
06:00 - 07:00	1,916	8,788	10,704	2,055	7,346	9,401	7.3%	-16.4%	-12.2%

For the sake of completeness, a comparison is made with 2015 in Table 2. The number of departures during the night for which contours have been calculated (23:00 - 07:00) has declined by 3.7%. Between 23:00 and 06:00 there is an increase of 1.9%, between 06:00 and 07:00 there is a decrease of 12.2%. The number of departures fell by 16.4% between 06:00 and 07:00.

4.1.2 Other important evolutions

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

4.1.2.1 Fleet changes during the operational night

The evolution of the most frequently used aircraft types during the operational night (23:00-06:00) in 2017 is available in Table 3 for heavy aircraft (MTOW > 136 tonnes, 'heavies') and in Table 4 for lighter aircraft (MTOW < 136 tonnes).

The most commonly used aircraft is the B752 (15.6% of all movements in 2017), followed by the A320 (15.2%), the B734 (12.8%) and the A306 (10.3%). Four types contribute between 5% and 10% (the A319, B738, B763 and A333). These eight types are responsible for 85% of the night flights.

The number of movements in 2017 with heavy aircraft amounted to 4,423, a decrease of 0.9% compared with 2016. This is a break in the trend.

In terms of departures, the B752 is also the most frequently used aircraft overall (25.5%), followed by the B734 (18.2%), the A306 (16.2%), the B763 (10.6%), the B738 (6.9%) and the A320 (4.9%).

There is only an increase of 1.9% compared with 2016 for departing heavy aircraft, and this is almost entirely due to the B763. The most common heavy aircraft used during the night are the A306 (from 818 to 821), the B763 (from 493 to 537) and the B77L (from 168 to 166).

Table 3: Evolution of the number of flight movements per aircraft type during the operational night period (23:00-06:00) for the (MTOW > 136 tonnes) aircraft types.

	Landings				Departures			
MTOW > 136 ton	2016	2017	Evolution	Evolution (%)	2016	2017	Evolution	Evolution (%)
A333	1103	961	-142	-13%	0	2	2	
A306	864	913	49	6%	818	821	3	0%
B763	472	498	26	6%	493	537	44	9%
A332	339	339	0	0%	61	48	-13	-21%
B788	59	35	-24	-41%	8	4	-4	-50%
B744	38	38	0	0%	18	16	-2	-11%
B77L	3	15	12	400%	168	166	-2	-1%
C17	2	9	7	350%	0	7	7	
B77W	2	0	-2	-100%	1	2	1	100%
A310	1	0	-1	-100%	1	0	-1	-100%
B743	1	0	-1	-100%	0	0	0	
A342	0	0	0		1	0	-1	-100%
B748	0	0	0		1	0	-1	-100%
A343	0	1	1		3	2	-1	-33%
A345	0	1	1		2	0	-2	-100%
B762	0	0	0		1	0	-1	-100%
A400	0	1	1		1	0	-1	-100%
A346	0	0	0		0	1	1	
B772	0	1	1		0	0	0	
B789	0	3	3		0	0	0	
DC10	0	1	1		0	0	0	
E3TF	0	1	1		0	0	0	

Table 4: Evolution of the number of flight movements per aircraft type during the operational night period (23:00-06:00) for the most common light (MTOW < 136 tonnes) aircraft types.

	Landings				Departures			
MTOW < 136 ton	2016	2017	Evolution	Evolution (%)	2016	2017	Evolution	Evolution (%)
B752	1167	1328	161	14%	1132	1296	164	14%
B734	1046	1234	188	18%	873	923	50	6%
B738	1214	1164	-50	-4%	173	350	177	102%
A320	2040	2312	272	13%	394	250	-144	-37%
ATP	73	48	-25	-34%	213	153	-60	-28%
A321	42	33	-9	-21%	99	110	11	11%
EXPL	107	113	6	6%	50	52	2	4%
A319	1121	1591	470	42%	73	45	-28	-38%
AT72	0	15	15		0	40	40	
E145	17	22	5	29%	5	16	11	220%
E190	198	198	0	0%	17	15	-2	-12%
SU95	0	148	148		0	14	14	
C56X	31	29	-2	-6%	15	13	-2	-13%
B733	85	13	-72	-85%	81	11	-70	-86%
LJ45	10	12	2	20%	10	11	1	10%
F900	11	10	-1	-9%	9	11	2	22%
FA7X	17	20	3	18%	14	9	-5	-36%
C25A	12	11	-1	-8%	7	9	2	29%
B737	239	189	-50	-21%	10	8	-2	-20%
RJ1H	169	71	-98	-58%	28	8	-20	-71%
C510	10	11	1	10%	5	7	2	40%
E135	15	4	-11	-73%	13	7	-6	-46%
C425	5	4	-1	-20%	4	6	2	50%
P180	4	4	0	0%	4	6	2	50%
GLF5	14	13	-1	-7%	3	4	1	33%
E170	4	11	7	175%	5	4	-1	-20%
C525	8	10	2	25%	8	4	-4	-50%
F2TH	25	16	-9	-36%	7	3	-4	-57%
CL60	9	7	-2	-22%	6	3	-3	-50%
C25B	10	9	-1	-10%	3	2	-1	-33%
B735	1	115	114		2	1	-1	-50%
E120	0	30	30		0	0	0	
BCS1	0	19	19		0	0	0	

4.1.2.2 Runway and route usage

Preferential runway usage

The preferential runway usage, published in the AIP (Belgocontrol), shows which runway should preferably be used, depending on the time when the movement occurs, and in some cases on the destination and the MTOW of the aircraft. This scheme did not change during the year 2017 (see Table 5).

If the preferential runway configuration cannot be used (for example due to meteorological conditions, works on one of the runways, etc.), then Belgocontrol will choose the most suitable alternative configuration, taking account the weather conditions, the equipment of the runways, the traffic demand, etc. In this respect, conditions are tied to the preferential runway usage arrangements, including wind limits expressed as a maximum crosswind and maximum tailwind at which each runway can be used. If these limits are exceeded, air traffic control must 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 5: Preferential runway usage since 19/09/2013 (local time) (source: AIP)

		Day		Night
		06:00 to 15:59	4:00 PM to 10:59 PM	11:00 PM to 5:59 AM
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]
Wedn, 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.

Runway usage

From 26 July to 20 September 2016, the transverse runway (01-19) was renovated. Runway 19 was used as one of the preferential runways during part of the weekend and also in the nights of Monday to Thursday (see table 4). During the closure of the runway, departures were shifted from runway 19 to runway 25R.

No comparable maintenance work was carried out in 2017 and the airport operated under very normal conditions. There was an increase in the number of departures from runway 19 due to this situation (return to normal situation). There were fewer departures from runways 07L and 07R and fewer arrivals on runways 01, 07R and 07L because the weather conditions required fewer operations according to the alternate mode on an annual basis.

A complete overview of runways used in 2017 is included in appendix 5.1.

Changes to the departure routes (SIDs)

No modifications to the departure routes (SIDs) took place in 2017.

4.2 Noise measurements - $L_{Aeq,24h}$

The INM software enables a number of acoustic parameters to be calculated at a specified location around the airport. By performing this calculation at the locations of the measuring stations of the Noise Monitoring System(NMS), it can be examined to what extent the calculated values correspond to the values registered and processed by the measuring system. Different data sources are used in the NMS system and correlated with each other: noise measurements, CDB, radar tracks and weather. Measurements and calculations are compared for the parameters $L_{Aeq,24h}$, L_{night} and L_{den}.

The calculated values are compared with the values resulting from correlated measured events. Only the acoustic parameters of an event are recorded by the monitoring network. To select the events resulting from aircraft, an automatic link is made in the NMS to the flight and radar data; these events are correlated.

The system of correlation is definitely not perfect and events are regularly 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 only expected 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. On that occasion, the maximum duration of an event was increased from 75 s (for 2014) to 125 s. The probability that this is caused by an aircraft is very small for longer events. Note that a correlation is also necessary with a registered aircraft movement besides the conditions relating to the event duration and trigger level.

The table below compares the values simulated in the INM at the different measuring station locations and the values calculated on the basis of the correlated events for the parameters $L_{Aeq,24h}$, L_{night} and L_{den}. The results of the LNE measuring stations (with codes NMT 40-1 and higher) are recorded in addition to the measuring stations of Brussels Airport Company. The measuring data of these measuring stations are input and linked to flight data within the NMS of the airport. In 2017 one measuring station was moved (Grimbergen 13-01 was replaced by 13-02). For measuring stations of the BIM in the Brussels-Capital Region, this procedure is not possible because the measuring data is bot supplied to BAC (until 2009, the measuring data of the BIM for two measuring stations - Haren and Evere - were made available to BAC). An overview of the locations of all measuring stations is included in Appendix 5.2.

The measuring stations NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1 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, or a combination of both. 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 these are consequently not considered in the comparison of simulations and measurements.

The fraction of time that the measuring system is active (so-called uptime) is very high with an average of 99.6 % across all measuring stations. This is comparable with 2016. It is expected that practically no noise events are missed when the measuring stations are off-line. The lowest uptime fraction was recorded at measuring station Neder-Over-Heembeek (NMT10-1), but this was still 93.4%. This is lower than the worst measuring station last year but it is an exception in the full set. The lowest uptime across all other measuring stations was 98.7%.

The comparison between calculations and measurements based on the $L_{Aeq,24h}$ shows that the discrepancy between the calculated value and the measured value for all the measuring stations, except NMT09-2 (Perk) and NMT48-3 (Bertem), and after exclusion of the measuring points NMT01-2, NMT03-3, NMT15-3 and NMT23-1 (see previous paragraph) remains limited to 2 dB(A). Both monitoring stations have few overflights. The resulting margin for error is large and that is reflected in the comparison between the measurements and the calculations. At 10 measuring stations, the deviation is limited to up to 0.5 dB(A). The global discrepancy between simulations and measurements is 0.8 dB(A) ("root-mean-square error", RMSE), when Perk and Bertem are excluded from this evaluation.

The overall deviation between measurements and simulations for L_{night} is slightly higher (1.1 dB(A) RMSE, excluding measuring points NMT01-2, NMT03-3, NMT15-3 and NMT23-1, NMT09-2, NMT48-3). For 2016, this value was 1.4 dB(A). At measuring locations Perk and Meise, the predicted level is too high when compared with the measurements (more than 1.5 dB(A)). The simulations show a limited linear average difference globally across all relevant measuring locations (+0.4 dB(A), excluding measuring points NMT01-2, NMT03-3, NMT15-3, NMT23-1, NMT09-2 and NMT 48-3).

For the noise indicator L_{den} the RMSE is 1.5 dB(A) (excluding NMT01-2, NMT03-3, NMT15-3, NMT23-1). When the measuring stations NMT01-2, NMT03-3, NMT15-3, NMT23-1, Perk and Bertem (see previous paragraphs) are not considered, the maximum underestimation of the measurements appears to be 0.9 dB(A) (Kraainem and Grimbergen).

Table 6: 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	measurements (dB(A))	calculations (dB(A))	difference (dB(A))
NMT01-2	STEENOKKERZEEL	58.1	63.6	-5.5
NMT02-2	KORTENBERG	68.3	68.0	0.3
NMT03-3	HUMELGEM-Airside	63.7	63.1	0.6
NMT04-1	NOSSEGEM	62.2	60.9	1.3
NMT06-1	EVERE	52.0	50.5	1.5
NMT07-1	STERREBEEK	48.6	47.5	1.1
NMT08-1	KAMPENHOUT	55.6	55.2	0.4
NMT09-2	PERK	41.9	47.1	-5.2
NMT10-1	NEDER-OVER-HEEMBEEK	55.1	55.5	-0.4
NMT11-2	SINT-PIETERS-WOLUWE	51.6	50.7	0.8
NMT12-1	DUISBURG	47.0	46.7	0.3
NMT13-2	GRIMBERGEN	45.5	46.2	-0.7
NMT14-1	WEMMEL	47.8	48.2	-0.4
NMT15-3	ZAVENTEM	44.4	54.8	-10.4
NMT16-2	VELTEM	57.5	56.4	1.1
NMT19-3	VILVOORDE	53.8	53.2	0.6
NMT20-2	MACHELEN	54.7	55.0	-0.3
NMT21-1	STROMBEEK-BEVER	52.3	51.0	1.2
NMT23-1	STEENOKKERZEEL	65.6	68.1	-2.4
NMT24-1	KRAAINEM	54.2	52.4	1.7
NMT26-2	BRUSSEL	47.8	47.4	0.4
NMT40-1*	KONINGSLO	53.2	52.6	0.6
NMT41-1*	GRIMBERGEN	48.2	48.8	-0.6
NMT42-2*	DIEGEM	64.3	64.8	-0.5
NMT43-2*	ERPS-KWERPS	56.0	56.4	-0.4
NMT44-2*	TERVUREN	46.0	46.8	-0.8
NMT45-1*	MEISE	45.6	46.1	-0.4
NMT46-2*	WEZEMBEEK-OPPEM	54.5	53.6	1.0
NMT47-3*	WEZEMBEEK-OPPEM	49.5	48.9	0.6
NMT48-3*	BERTEM	28.8	31.1	-2.2

* LNE noise data off-line correlated by the NMS

Table 7: 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	measurements (dB(A))	calculations (dB(A))	difference (dB(A))
NMT01-2	STEENOKKERZEEL	55.9	65.9	-10.0
NMT02-2	KORTENBERG	64.1	63.7	0.4
NMT03-3	HUMELGEM-Airside	58.3	58.1	0.2
NMT04-1	NOSSEGEM	60.2	58.2	2.0
NMT06-1	EVERE	44.2	43.4	0.8
NMT07-1	STERREBEEK	49.5	47.9	1.6
NMT08-1	KAMPENHOUT	53.5	53.3	0.2
NMT09-2	PERK	41.2	44.8	-3.6
NMT10-1	NEDER-OVER-HEEMBEEK	50.3	50.3	0.0
NMT11-2	SINT-PIETERS-WOLUWE	46.6	45.7	0.9
NMT12-1	DUISBURG	44.2	43.2	1.0
NMT13-2	GRIMBERGEN	38.3	39.6	-1.3
NMT14-1	WEMMEL	42.0	43.3	-1.3
NMT15-3	ZAVENTEM	47.0	51.3	-4.3
NMT16-2	VELTEM	53.1	52.2	0.9
NMT19-3	VILVOORDE	49.3	48.6	0.7
NMT20-2	MACHELEN	50.8	50.8	0.0
NMT21-1	STROMBEEK-BEVER	47.9	46.8	1.1
NMT23-1	STEENOKKERZEEL	64.4	66.6	-2.2
NMT24-1	KRAAINEM	48.6	47.0	1.6
NMT26-2	BRUSSEL	43.5	43.4	0.1
NMT40-1*	KONINGSLO	48.6	48.0	0.6
NMT41-1*	GRIMBERGEN	42.5	43.5	-1.0
NMT42-2*	DIEGEM	59.1	58.7	0.4
NMT43-2*	ERPS-KWERPS	51.1	51.8	-0.7
NMT44-2*	TERVUREN	45.8	45.2	0.6
NMT45-1*	MEISE	38.6	40.4	-1.8
NMT46-2*	WEZEMBEEK-OPPEM	49.4	48.6	0.8
NMT47-3*	WEZEMBEEK-OPPEM	50.3	48.4	1.9
NMT48-3*	BERTEM	18.3	27.2	-8.9

* LNE noise data off-line correlated by the NMS

Table 8: 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	measurements (dB(A))	calculations (dB(A))	difference (dB(A))
NMT01-2	STEENOKKERZEEL	63.1	71.6	-8.5
NMT02-2	KORTENBERG	72.4	72.1	0.3
NMT03-3	HUMELGEM-Airside	67.3	66.8	0.5
NMT04-1	NOSSEGEM	67.5	65.8	1.7
NMT06-1	EVERE	55.0	53.7	1.3
NMT07-1	STERREBEEK	55.5	54.1	1.4
NMT08-1	KAMPENHOUT	60.8	60.4	0.4
NMT09-2	PERK	47.6	52.1	-4.5
NMT10-1	NEDER-OVER-HEEMBEEK	58.9	59.4	-0.5
NMT11-2	SINT-PIETERS-WOLUWE	55.5	54.7	0.8
NMT12-1	DUISBURG	51.7	51.1	0.6
NMT13-2	GRIMBERGEN	48.8	49.7	-0.9
NMT14-1	WEMMEL	51.5	52.0	-0.5
NMT15-3	ZAVENTEM	52.7	59.2	-6.5
NMT16-2	VELTEM	61.5	60.5	1.0
NMT19-3	VILVOORDE	57.8	57.3	0.5
NMT20-2	MACHELEN	58.9	59.1	-0.2
NMT21-1	STROMBEEK-BEVER	56.3	55.1	1.2
NMT23-1	STEENOKKERZEEL	71.3	73.6	-2.3
NMT24-1	KRAAINEM	57.9	56.2	1.7
NMT26-2	BRUSSEL	52.1	51.6	0.5
NMT40-1*	KONINGSLO	57.1	56.6	0.5
NMT41-1*	GRIMBERGEN	51.8	52.5	-0.7
NMT42-2*	DIEGEM	67.9	68.3	-0.4
NMT43-2*	ERPS-KWERPS	59.8	60.4	-0.6
NMT44-2*	TERVUREN	52.1	52.2	-0.1
NMT45-1*	MEISE	48.8	49.7	-0.9
NMT46-2*	WEZEMBEEK-OPPEM	58.4	57.5	0.9
NMT47-3*	WEZEMBEEK-OPPEM	56.4	54.9	1.5
NMT48-3*	BERTEM	30.9	35.4	-4.5

*LNE noise data off-line correlated by the NMS

4.3 Noise contours

The results of the noise contour calculations for the parameters described above (L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70, and freq.60) are presented in appendix 5.3 and appendix 5.5.

The surface and the number of residents is calculated for each noise contour. The evaluation of the number of exposed inhabitants for 2017 will be carried out according to a more refined method (see 1.5). On the basis of the L_{den} contours, the number of potentially seriously inconvenienced persons is calculated according to the method described in chapter 2.2. The results are available per municipality in appendix 5.3. The contours of 2016 and 2017 are compared in appendix 5.5 . Appendix 5.6 contains the evolution of the surface area and the number of residents per contour zone.

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 2016 and 2017 is shown in Figure 6.

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 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 1 is generally applied.

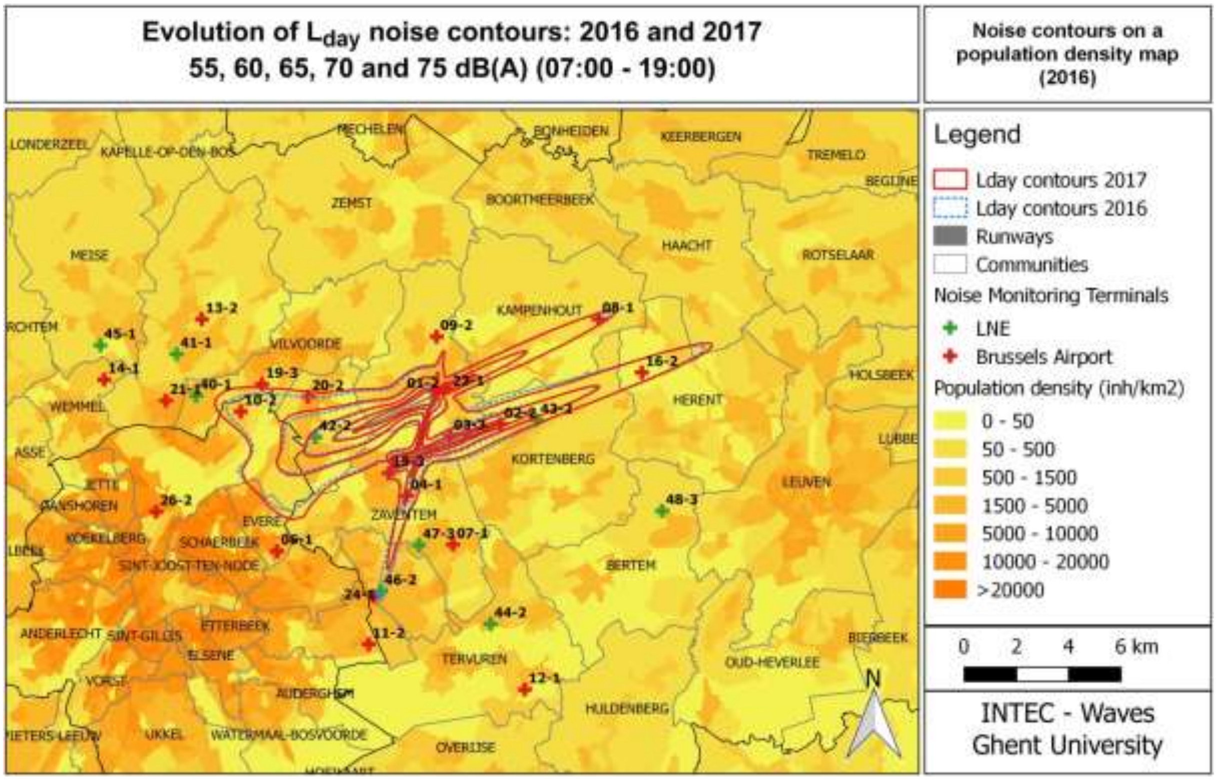
There are hardly any visible changes in the contours to the east of Brussels Airport, with the exception of a small extension of the 55 dB contour, which is in line with the increase in the number of landings on runways 25L and 25R. There are no significant shifts in the distribution of landing traffic between these two runways between 2016 and 2017. There are, however, significantly fewer departures on 07R (from 11,670 to 7,926). This is visible in the narrowing of the 55 dB contour for runway 07R.

To the west of Brussels Airport, the 55 and 60 dB contours change as a result of an increase in the number of departures from runway 25R (+ 14% or +8,563 movements). The use of this runway as a take-off runway increased from 81.1% to 85.8% because less had to be done to deviate from the preferential runway use schedule (less easterly wind in 2017). This growth is divided more or less equally between routes with a right turn (+13%), routes straight on (+14%) and routes with a left turn (+16%). On average, the bend to the right is cut a little earlier, so that this lobe, in addition to an increase in the number of movements, shifts slightly northwards. The increase in the lobe due to the departure routes from runway 25R with a turn to the left is in line with the increased use of these routes. The increase in the number of departures straight ahead does not translate into an increase in the noise contour in this direction, because this increase is offset by the decrease in the number of landings on runway 07L and because air traffic on the delta routes (used by the 747 cargo aircraft), which also make an important contribution in this zone, remained the same. To the south of Brussels

Airport, the most remarkable change is the sharp contraction of the 55 dB(A) contour in line with runway 19 as a result of a 30% drop in the number of landings on runway 01 (i.e. 2,826 fewer landings), a consequence of less use of the alternate mode. The number of departures from runway 19 doubled (i.e. an increase of 1,236 departures), which is visible in an increase in the bulge on the contour in an easterly direction.

There are no changes to the north of Brussels Airport. There are virtually no departures from runway 01 (53 in 2017 instead of 54 in 2016), and the number of landings on runway 19 rose only slightly (from 1,219 in 2016 to 1,348 in 2017).

Figure 6: L_{day} noise contours around Brussels Airport in 2016 (dotted blue) and 2017 (solid red).



The total surface area inside the L_{day} contour of 55 dB(A) rose in 2017 by about 3.2% compared to 2016 (from 4,723 to 4,876 ha). The number of residents inside the L_{day} contour of 55 dB(A) rose by 9.7% (from 31,057 to 34,062), but remains 2.8% below the value for 2015.

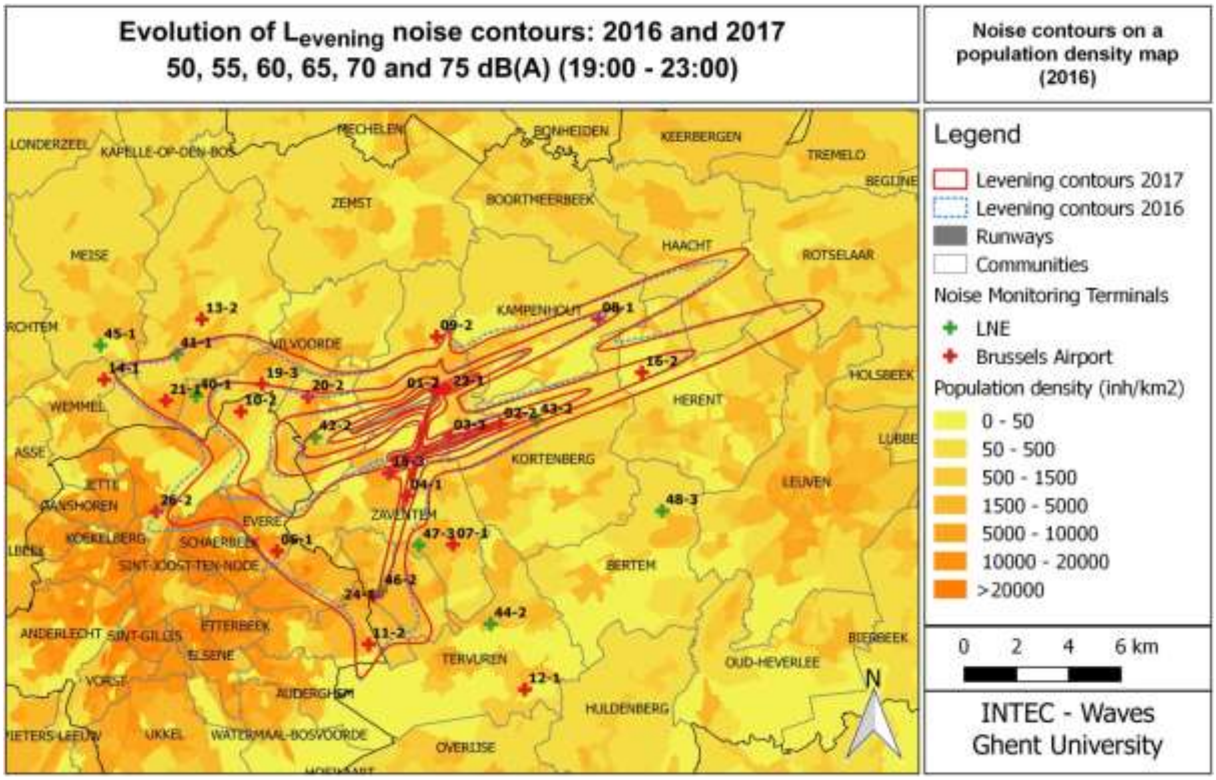
4.3.2 $L_{evening}$ contours

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 2016 and 2017 is shown in Figure 7. Because a lower level is reported compared with L_{day}, there is a visually enlarging 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. The average traffic congestion during the evening period on Brussels Airport is highly comparable to the day period. The average number of flights per hour in 2017 is 35.9 during the day period compared with 36.8 during the evening period, a comparable ratio between day and evening for 2016. During the evening period there were an average of 18.2 departures per hour in 2017 compared with 18.7 arrivals per hour. The number of landings in the evening period increased more (+8.3%) than the number of departures (+4.7%). A reverse movement can be seen for the daytime period (+4.9% for landings and +7.9% for departures).

The change in the $L_{evening}$ 50 dB(A) contour due to the sharper turn to the right from runway 25R is more pronounced than during the day, but the extension of the departure contour that was visible for the daytime period is not visible in the evening period. There is a shrinkage of the contour in line with runway 25R, mainly as a result of a decrease in the number of flights on the delta routes (747 cargo aircraft). To the south of Brussels Airport, the increase in the number of departures from runway 25R with a turn to the left offsets the decrease in the number of landings on runway 01, as a result of which the contour does not change much. The landing contour on runway 25R has grown slightly and the landing contour on runway 25L has not changed. The effect of the increase in the number of landings on 25L is offset by the decrease in the number of departures on 07R.

Figure 7:$L_{evening}$ noise contours around Brussels Airport for 2016 (dotted blue) and 2017 (solid red).



The total surface area inside the $L_{evening}$ contour of 50 dB(A) rose in 2017 by about 0.8% compared with 2016 (from 13,488 ha to 13,590 ha). The number of residents inside the $L_{evening}$ contour of 50 dB(A) dropped by 0.3% (from 245,949 to 245,344). The expansion of the $L_{evening}$ contour occurs in the less densely populated zones, the shrinkage of the contours in the densely populated zones.

4.3.3 L_{night} contours

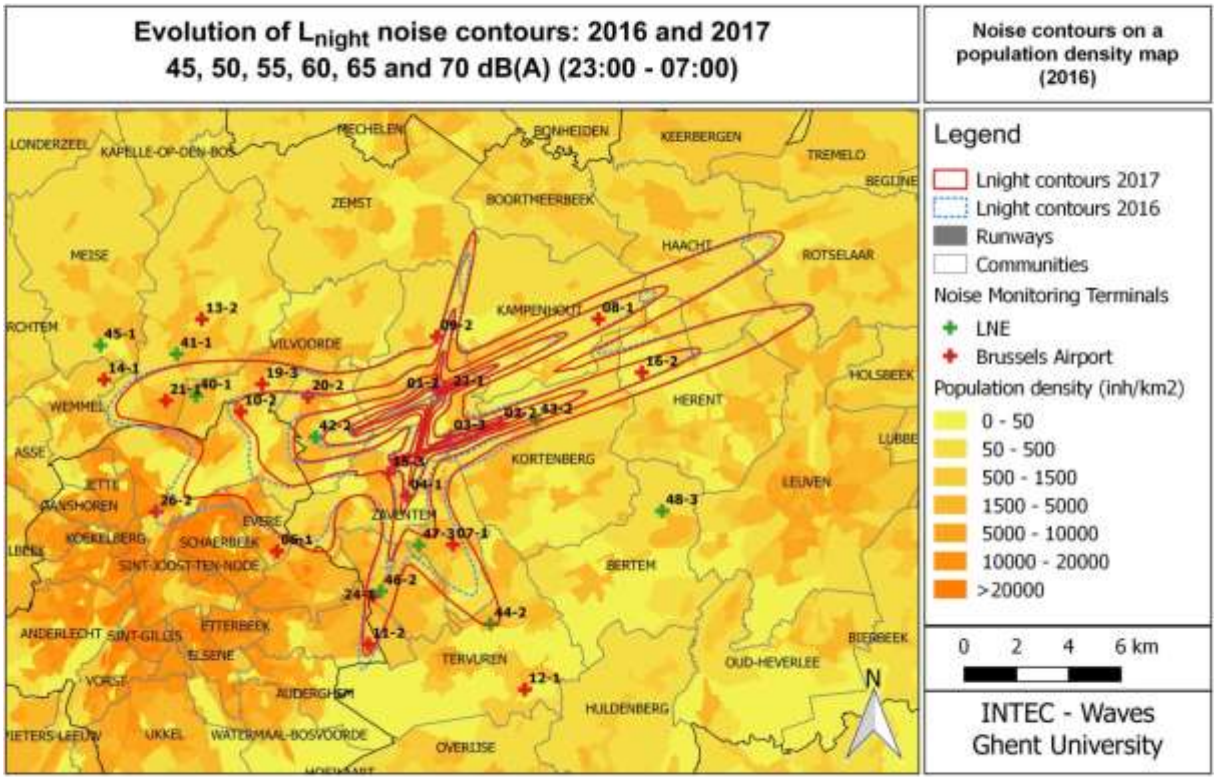
The L_{night} contours represent the A-weighted equivalent sound pressure level for the period 23:00 to 07:00 and are reported from 45 dB(A) to 70 dB(A) in steps of 5 dB(A). The evolution of the contours from 2016 to 2017 is shown in **Error! Reference source not found.**. Since an additional contour is reported, this creates a visually enlarging effect between the day and the evening. As a result of the 10 dB(A) correction, the 45 dB(A) night contour is larger than the 55 dB(A) contour for daytime and is now at least equally significant for the calculation of L_{den} 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 comprises the flights of 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.

The number of departures during the night rose slightly (+0.4%). The busy departure hour from 06:00 and 07:00 contributes the most to the L_{night} contours. In 2017, 59.1% of the departures during the night hours took place between 06:00 and 07:00, slightly fewer than the 60.1% in 2016.

The number of landings during the night rose by 11.0%. The share of landings between 06h and 07h is approximately 15%, which is comparable with 2016.

Figure 8: L_{night} noise contours around Brussels Airport in 2016 (dotted blue) and 2017 (solid red).



To the west of Brussels Airport, the noise contours are shrinking in line with runway 25R as a result of a 16% reduction in the use of these departure routes and the fewer landings made on runway 07L. In spite of the status quo in the number of movements with a bend to the right, this contour also shows a small decrease. Use of the routes with a turn to the left increased by 13%, which also translates into an increase in this noise contour. To the east of the airport, the landing contour on runway 25R increased more than on runway 25L, in accordance with the relatively larger proportion of landings made on runway 25R. Due to the reduction in the use of the alternate mode in 2017, there were also fewer departures from runway 07R. To the south of Brussels Airport, the surface area of all contours increased through the increase in the use of runway 19 for take-off (from 1,408 departures in 2016 to 1,959 departures in 2017). This is rather a return to the normal situation, because in 2016 runway 19 was closed for a period of time due to maintenance. Despite these works in 2016, the number of landings on runway 01 fell from 1,126 to 936 due to the lower incidence of the alternate mode.

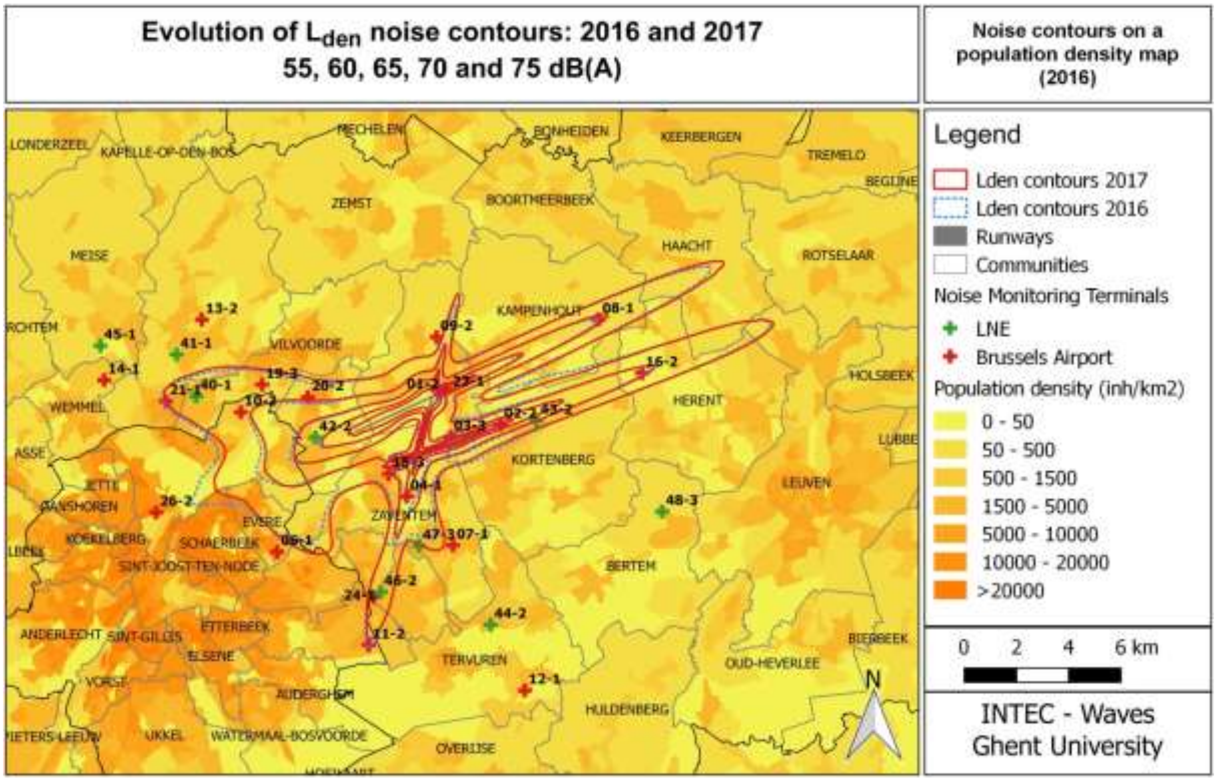
To the north of the airport, noise contours increased as a result of an increase in the number of landings on runway 19 from 608 to 874.

The total surface area inside the L_{night} contour of 45 dB(A) rose in 2017 by just 0.04% compared with 2016 (from 12,748 ha to 12,754 ha). The number of residents inside the L_{night} contour of 45 dB(A) dropped by 11.9% (from 161,216 to 142,110).

4.3.4 L_{den} contours

The L_{den} unit is a combination of L_{day}, $L_{evening}$ and L_{night}. The evening movements are penalised with 5 dB(A), the night movements with 10 dB(A). In Figure 9 you can see the evolution of the L_{den} contours for 2016 and 2017. The L_{den} contours are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A).

Figure 9: L_{den} noise contours around Brussels Airport in 2016 (dotted blue) and 2017 (solid red).



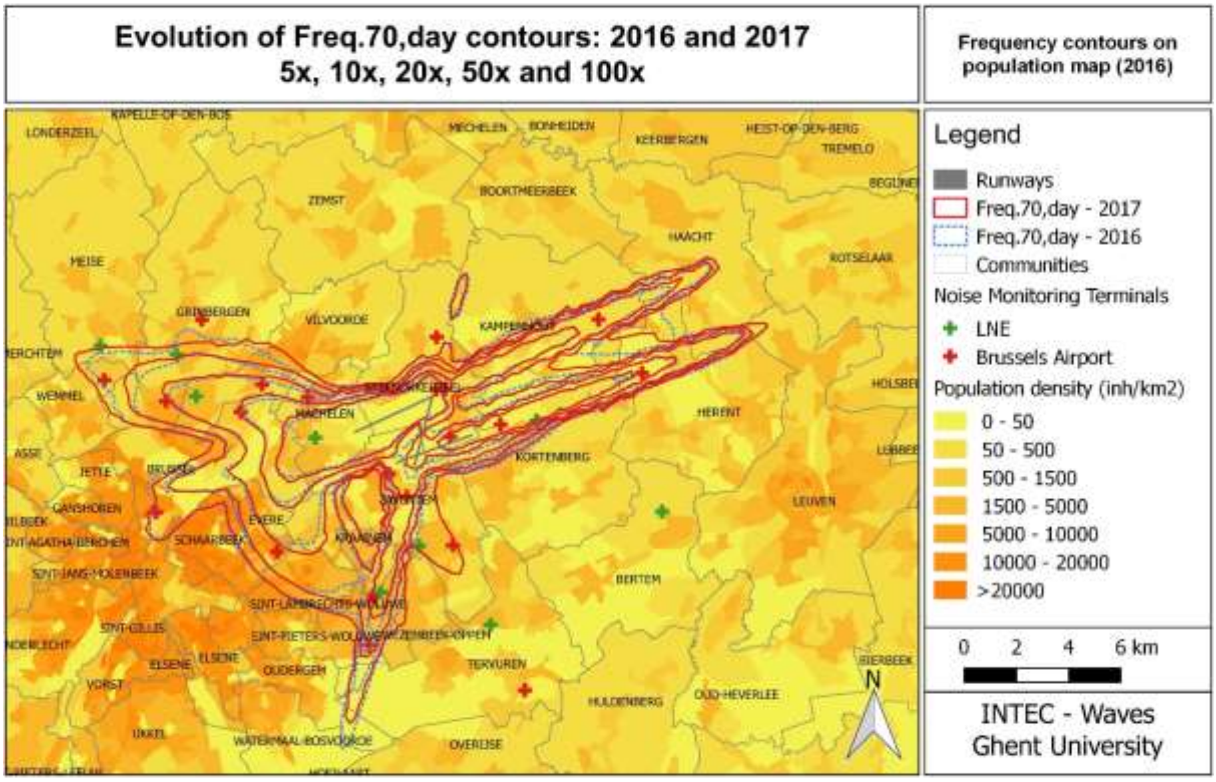
The changed form is a weighted combination of all effects which clarified in detail in the discussion of L_{day}, $L_{evening}$ and L_{night} contours. A slight shift to the north is visible for the right-hand bend from runway 25R. Straight ahead it shows a significant shrinkage, and the contour for the left turn expands. A possible increase in the noise contour as a result of an increase in the number of landings on runway 25L in 2017 is offset by the lower number of departures in alternate mode from runway 07R. In the southern direction, there is an extension of the departures with a left turn from runway 19, a change that is entirely caused by the evolution in runway use during the night (return to normal situation in 2017 after the maintenance on runway 19 in 2016).

The total surface area inside the L_{den} noise contour of 55 dB(A) rose in 2017 by about 0.3% compared with 2016 (from 8,974 ha to 9,000 ha). The number of residents inside the L_{den} contour of 55 dB(A) dropped by 6.4% (from 99,680 to 93,305).

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

The Freq.70, day contours are calculated for an evaluation period that consists of the evaluation periods of L_{day} and $L_{evening}$ together. The evolution of the Freq.70, day contours reflects the changes in the runway usage and the changes in the use of routes (see Figure 10).

Figure 10: Freq.70, day frequency contours around Brussels Airport for 2016 and 2017.



There are minor extensions of the contour for departures from runway 25R for the left and right turns and a status quo for flights straight ahead. The increase in the number of departures from runway 19 with bends to the left is clearly visible as in the previous maps. The landing contour for runway 01 has shrunk slightly.

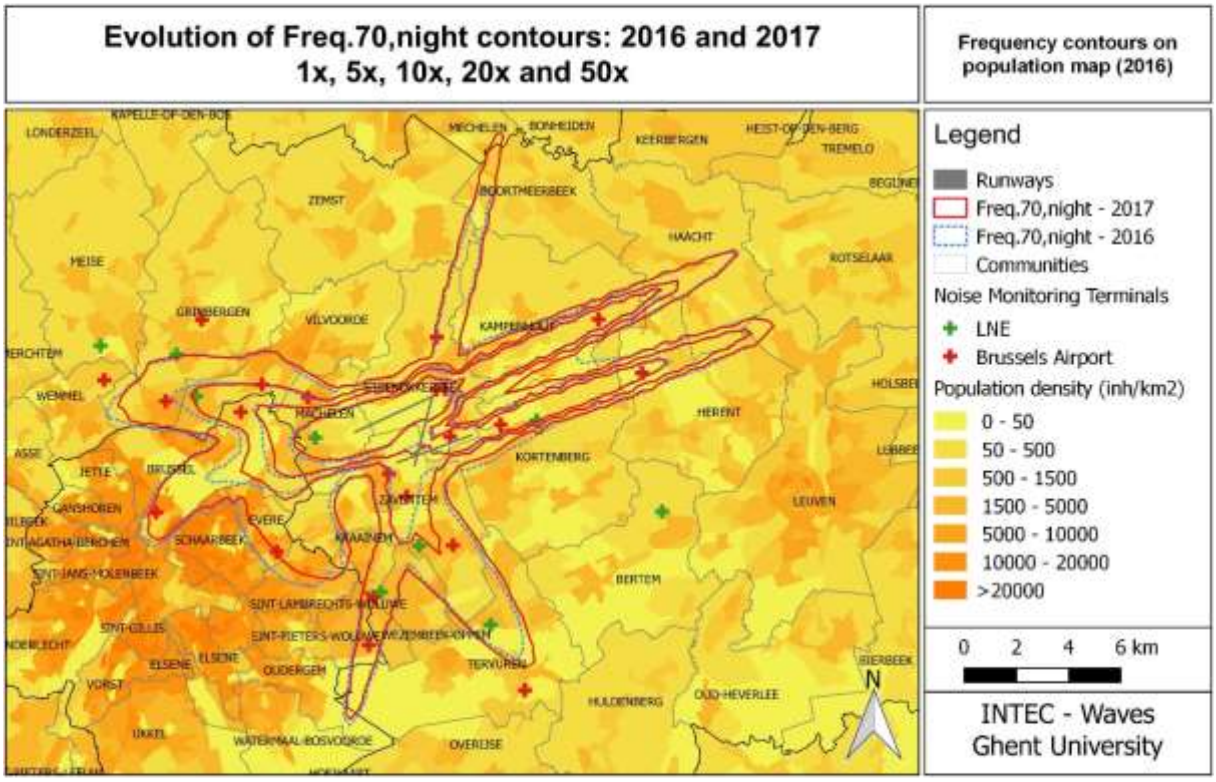
The total surface area inside the contour of 5x above 70 dB(A) rose in 2017 by 1.7% compared with 2016 (from 13,491 ha to 13,722). The number of residents inside the Freq.70, day contour of 5 events rose by 11.7% (from 243,235 to 271,622), but remains 18.7% below the value for 2015.

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 changes in the runway and route usage that were discussed for L_{night}. There are slight shifts in the contour for departures from runway 25R. The change is most pronounced in the bend to the left where a shift to the north is observed. The turn to the left for departures from runway 19 is slightly larger. The increase in the number of landings on runway 19 is also reflected in the size of the noise contour north of the airport.

The total surface area inside the 1x above the 70 dB(A) contour during the night dropped in 2017 by 1.9% compared with 2016 (from 13,690 ha to 13,427 ha). The number of residences inside this contour dropped by 12.4% (from 222,622 to 194,930).

Figure 11: Freq.70, night frequency contours around Brussels Airport for 2016 and 2017.



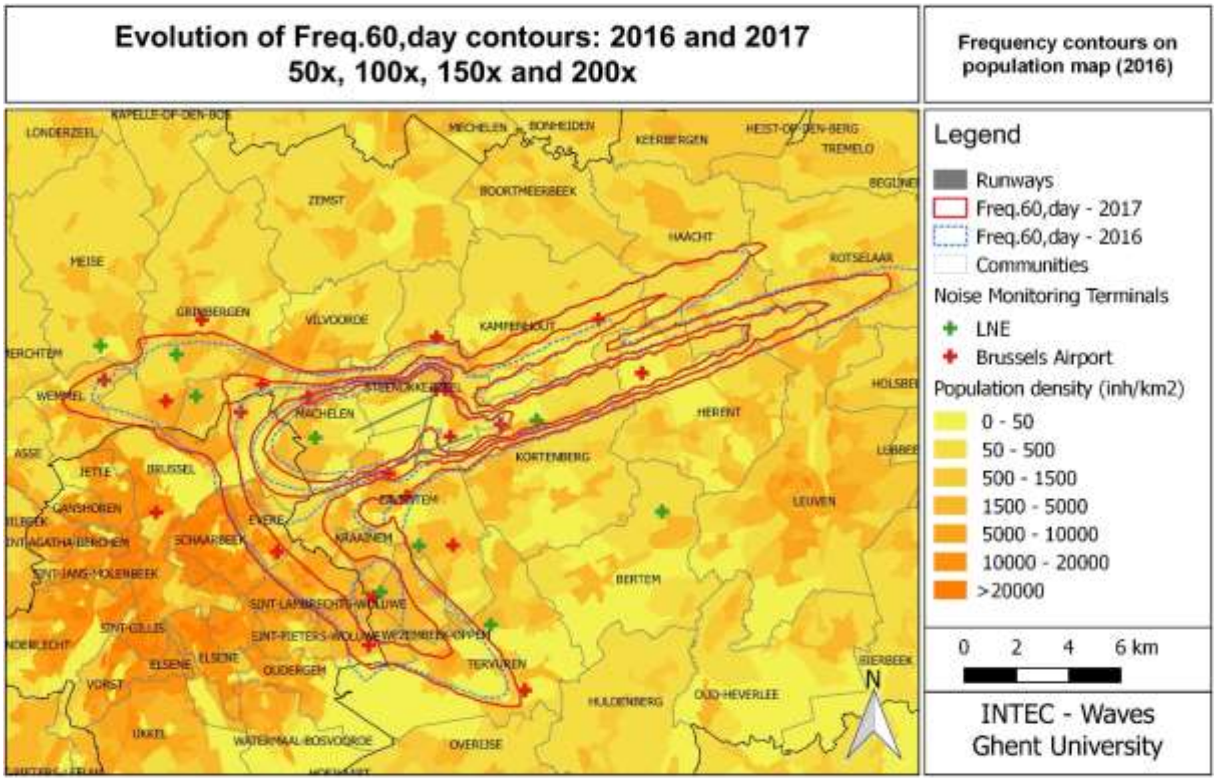
4.3.7 Freq.60, day contours (day 07:00-23:00)

The Freq.60, day contours are calculated for an evaluation period that consists of the evaluation periods of L_{day} and $L_{evening}$ together. The 50x freq.60, day contour shows no bulge in line with runway 25R because there are not 50 flights a day that fly straight ahead. The evolution of the Freq.60, day contours reflects the changes in the runway usage and the changes that have been discussed. The

100x contour through the departures with a bend to the left from runway 25R is now connected to the landing zone on runway 01.

The total surface area inside the Freq.60, day contour of 50x above 60 dB(A) rose in 2017 by about 2.3% compared with 2016 (from 15,760 ha to 15,760 ha), but remains just below the value for 2015 (16,203 ha). The number of residents inside the Freq.60, day contour of 50x above 60 dB(A) rose by 12.7% (from 238,939 to 269,167).

Figure 12: Freq.60, day frequency contours around Brussels Airport for 2016 and 2017.

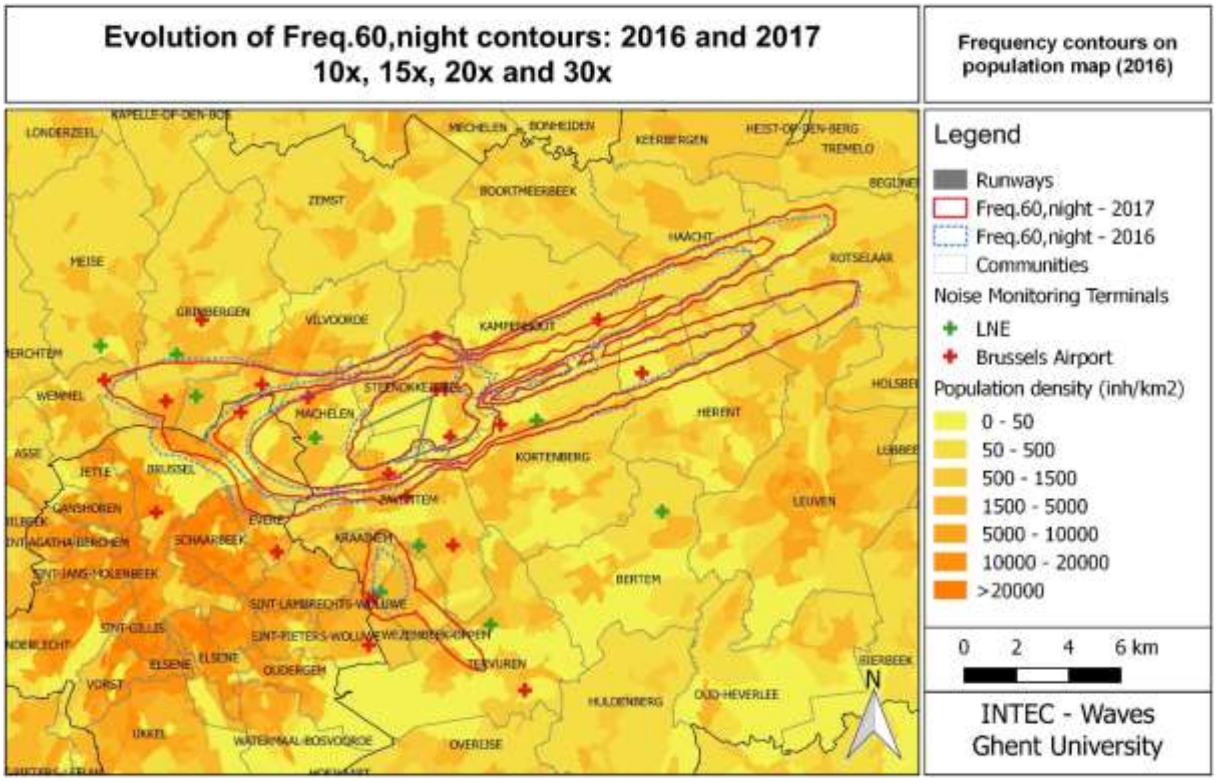


4.3.8 Freq.60, night contours (night 23:00-07:00)

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 changes in the runway and route usage. The outer contour for the right-hand bend from runway 25R became slightly narrower but remained the same length. The flight paths are more concentrated above the ring road in 2017 compared with 2016. The zone 10x above 60 dB(A) as a result of the combination of flights with a turn to the left from runway 25R and landings on runway 01 shows the most striking increase.

The total surface area inside the Freq.60, night frequency contour with 10x above 60 dB(A) rose in 2017 by about 3.3% compared with 2016 (from 12,052 ha to 12,454 ha). The number of residents inside the Freq.60, night contour of 10x above 60 dB(A) increased by 7.6% (from 132,238 to 142,245).

Figure 13: Freq.60, night frequency contours around Brussels Airport for 2016 and 2017.



4.4 Number of people who are potentially highly 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 stipulated in VLAREM 2 is included (see 2.2). Number of people who are potentially seriously inconvenienced per municipality. The more refined methodology for positioning the population is indicated in detail in 1.5 and appendix 5.3. More recent population figures are also available this year (1 January 2016 compared with 1 January 2011 in the reports of the past 2 years).

Table 9 shows the results for the number of potentially highly inconvenienced persons. The results are also shown graphically in Figure 14.

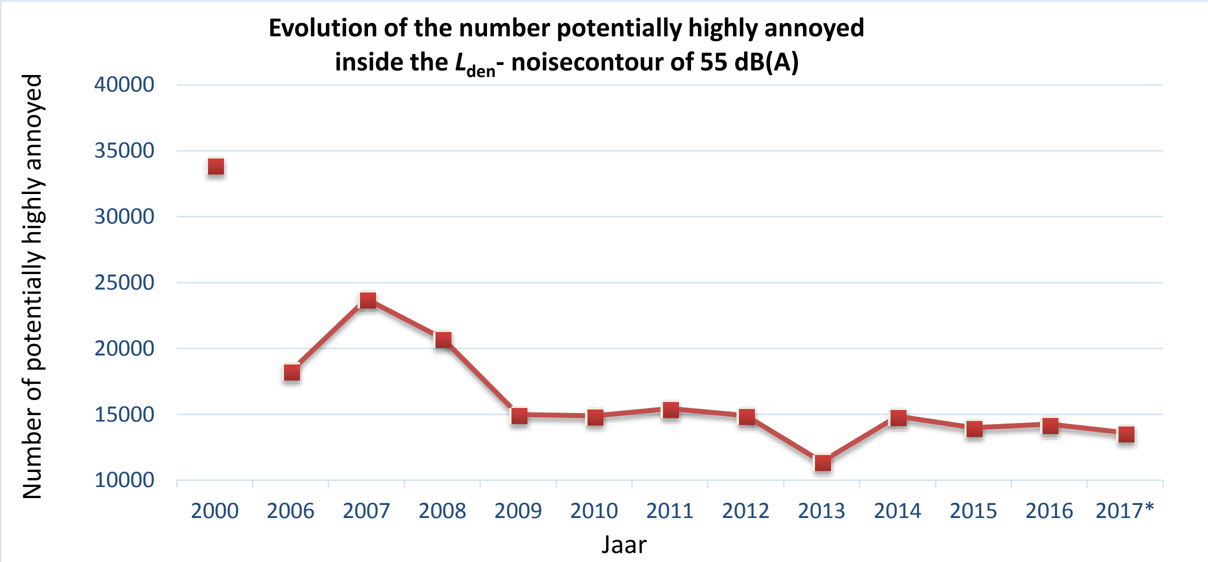
The total number of potentially highly inconvenienced persons in 2017 within the contour of 55 dB(A) is 13,575 (inhabitants by address point and population figures as per 1/1/2016). The inconvenience thus dropped by 4.6% between 2016 and 2017[12].

Table 9: 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
INM version	6.0c	6.0c	6.0c	6.0c	6.0c	6.0c	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b
Method	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	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
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
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
Grimbergen	3,111	479	1,305	638	202	132	193	120	0	175	428	517	449
Haacht	96	103	119	58	36	31	37	37	24	50	115	70	78
Herent	186	88	140	162	119	115	123	134	107	152	111	161	133
Huldenberg	112	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
Kortenberg	664	548	621	604	512	526	497	422	603	443	366	438	431
Kraainem	1,453	934	1,373	1,277	673	669	667	500	589	111	368	379	388
Leuven	70		9	22	2	1	3	5	0	11	0	0	13
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
Meise	506	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
Rotselaar	9	0	0	0	0	0	0	0	0	0	0	0	0
Schaarbeek	2,026	995	1,937	1,440	603	1,153	1,652	1,703	76	1,647	354	956	6
Sint-L.-Woluwe	1,515	382	1,218	994	489	290	196	150	0	0	0	1	142
Sint-P.-Woluwe	642	411	798	607	396	477	270	82	390	0	79	102	90
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
Tervuren	1,550	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
Wemmel	142	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
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
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**

[12] If 2017 is compared with the results for 2016, calculated according to the new method (inhabitants by address point, population as per 1/1/2016), this means a decrease of 8.4%. See appendix 5.3 for further details.

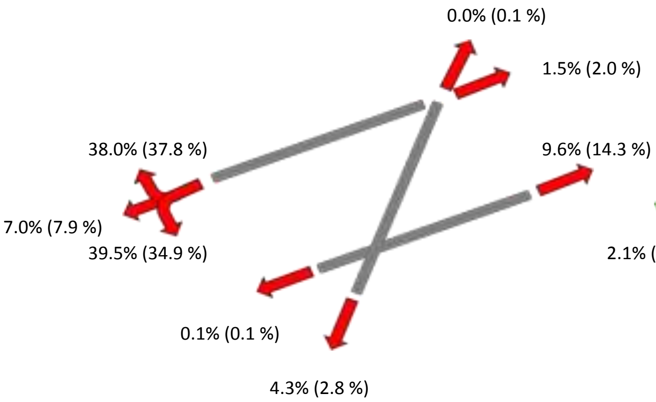
Figure 14: Evolution of the number of people who are potentially seriously inconvenienced inside the L_{den} 55 dB(A) noise contour. For 2017, the new methodology is accented with * (address points).

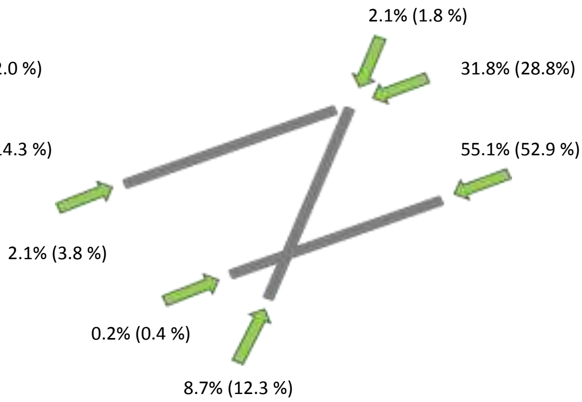


5 Appendices

5.1 Runway and route usage

Table 10: Overview of the number of departures and arrivals annually per runway including changes vs the previous year (all flights, day, evening and night). The figures between brackets are the data for 2016.

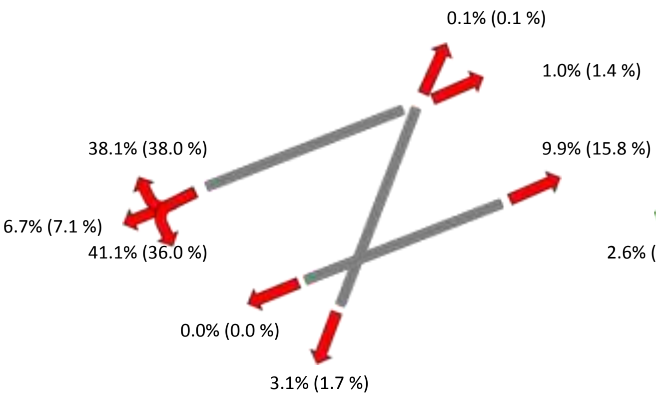


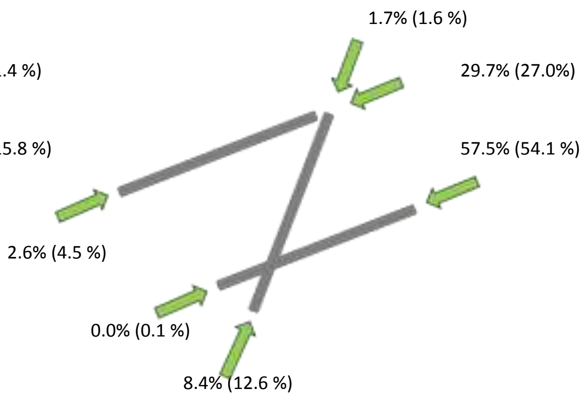


All flights (day. evening. night)				
Departures				
	Number		Percentage	
Runway	2016	2017	2016	2017
01	69	57	0.1%	0.0%
07L	2,244	1,763	2.0%	1.5%
07R	16,039	11,376	14.3%	9.6%
19	3,139	5,104	2.8%	4.3%
25L	149	147	0.1%	0.1%
25R	90,180	100,487	80.6%	84.5%

All flights (day. evening. night)				
Landings				
	Number		Percentage	
Runway	2016	2017	2016	2017
01	13,768	10,391	12.3%	8.7%
07L	4,202	2,460	3.8%	2.1%
07R	419	271	0.4%	0.2%
19	2,052	2,455	1.8%	2.1%
25L	59,190	65,481	52.9%	55.1%
25R	32,208	37,878	28.8%	31.8%

Table 11: Overview of the number of departures and arrivals annually per runway including changes vs the previous year: day. The figures between brackets are the data for 2016.

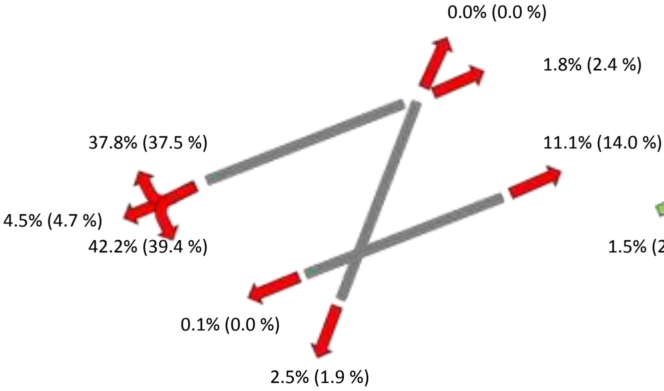


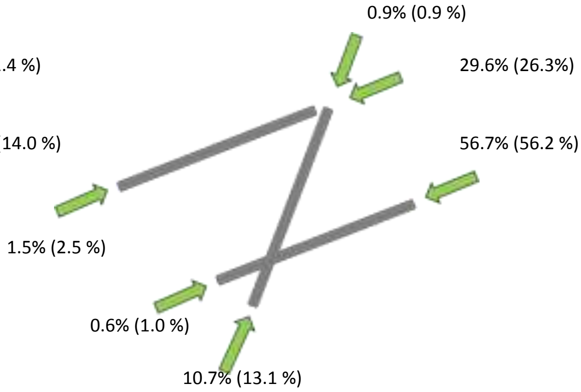


Flights day				
Departures				
	Number		Percentage	
Runway	2016	2017	2016	2017
01	54	53	0.1%	0.1%
07L	1,033	826	1.4%	1.0%
07R	11,667	7,926	15.8%	9.9%
19	1,239	2,479	1.7%	3.1%
25L	24	33	0.0%	0.0%
25R	60,019	68,582	81.1%	85.8%

Flights day				
Landings				
	Number		Percentage	
Runway	2016	2017	2016	2017
01	9,349	6,524	12.6%	8.4%
07L	3,370	2,032	4.5%	2.6%
07R	87	11	0.1%	0.0%
19	1,217	1,348	1.6%	1.7%
25L	40,172	44,769	54.1%	57.5%
25R	19,996	23,141	27.0%	29.7%

Table 12: Overview of the number of departures and arrivals annually per runway including changes vs the previous year: evening. The figures between brackets are the data for 2016.

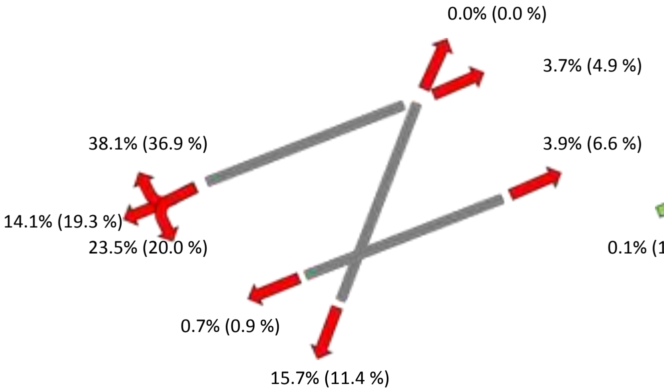


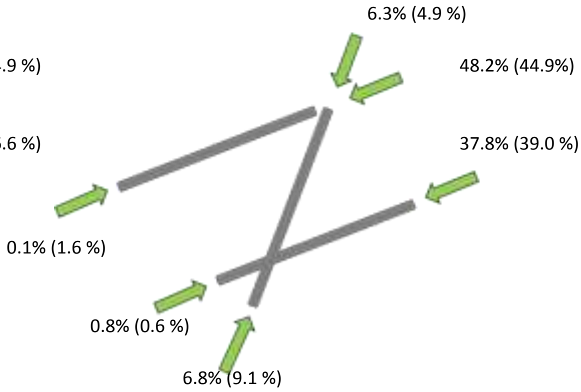


Flights evening – Departures				
	Number		Percentage	
Runway	**2016**	**2017**	**2016**	**2017**
01	10	3	0.0%	0.0%
07L	610	472	2.4%	1.8%
07R	3,550	2,960	14.0%	11.1%
19	492	669	1.9%	2.5%
25L	8	21	0.0%	0.1%
25R	20,736	22,490	81.6%	84.5%

Flights evening – Landings				
	Number		Percentage	
Runway	**2016**	**2017**	**2016**	**2017**
01	3,293	2,931	13.1%	10.7%
07L	636	412	2.5%	1.5%
07R	263	154	1.0%	0.6%
19	227	233	0.9%	0.9%
25L	14,168	15,489	56.2%	56.7%
25R	6,622	8,092	26.3%	29.6%

Table 13: Overview of the number of departures and arrivals annually per runway including changes vs the previous year: night. The figures between brackets are the data for 2016.





Flights night – Departures				
	Number		Percentage	
Runway	**2016**	**2017**	**2016**	**2017**
01	5	1	0.0%	0.0%
07L	601	465	4.9%	3.7%
07R	822	490	6.6%	3.9%
19	1,408	1,956	11.4%	15.7%
25L	117	93	0.9%	0.7%
25R	9,425	9,415	76.1%	75.8%

Flights night – Landings				
	Number		Percentage	
Runway	**2016**	**2017**	**2016**	**2017**
01	1,126	936	9.1%	6.8%
07L	196	16	1.6%	0.1%
07R	69	106	0.6%	0.8%
19	608	874	4.9%	6.3%
25L	4,850	5,223	39.0%	37.8%
25R	5,590	6,645	44.9%	48.2%

5.2 Location of the measuring stations

Figure 15: Location of the measuring stations.

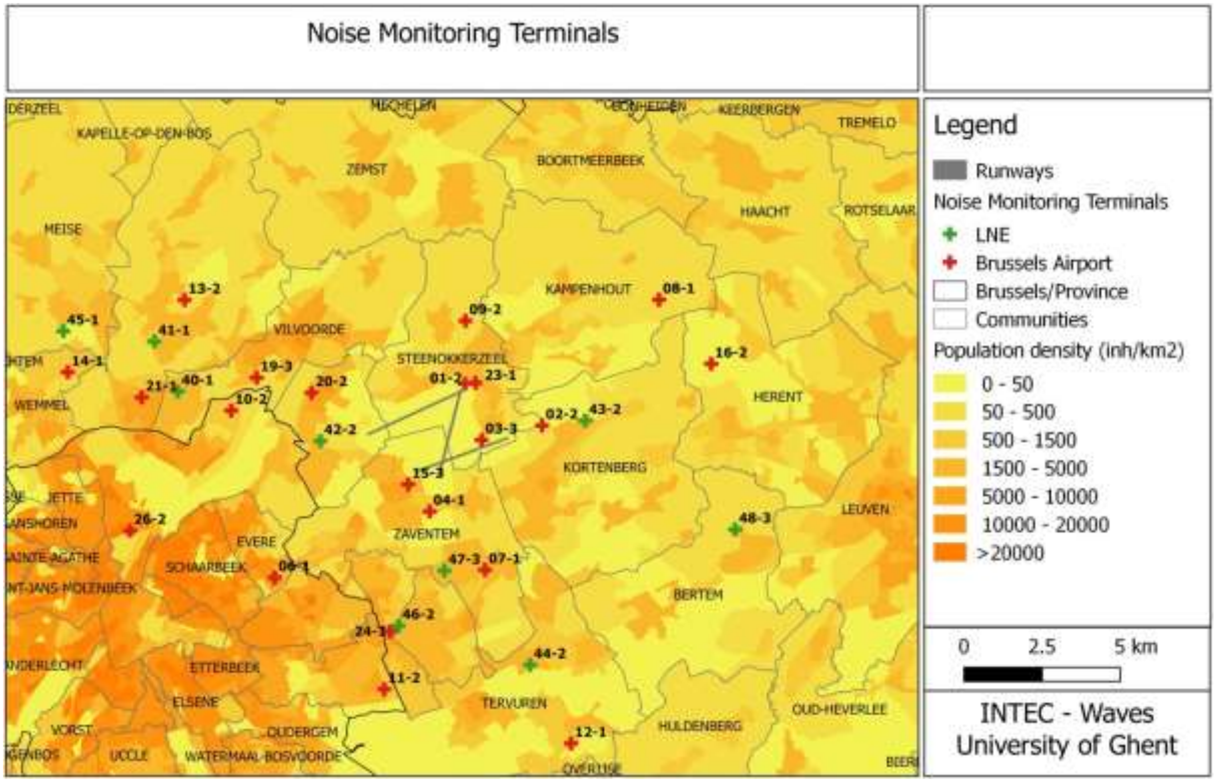


Table 14: Overview of the measuring points.

Code	Name
NMT01-2	STEENOKKERZEEL
NMT02-2	KORTENBERG
NMT03-3	HUMELGEM-Airside
NMT04-1	NOSSEGEM
NMT06-1	EVERE
NMT07-1	STERREBEEK
NMT08-1	KAMPENHOUT
NMT09-2	PERK
NMT10-1	NEDER-OVER-HEEMBEEK
NMT11-2	SINT-PIETERS-WOLUWE
NMT12-1	DUISBURG
NMT13-2	GRIMBERGEN
NMT14-1	WEMMEL
NMT15-3	ZAVENTEM
NMT16-2	VELTEM
NMT19-3	VILVOORDE

Code	Name
NMT20-2	MACHELEN
NMT21-1	STROMBEEK-BEVER
NMT23-1	STEENOKKERZEEL
NMT24-1	KRAAINEM
NMT26-2	BRUSSEL
NMT40-1	KONINGSLO
NMT41-1	GRIMBERGEN
NMT42-2	DIEGEM
NMT43-2	ERPS-KWERPS
NMT44-2	TERVUREN
NMT45-1	MEISE
NMT46-2	WEZEMBEEK-OPPEM
NMT47-3	WEZEMBEEK-OPPEM
NMT48-3	BERTEM

5.3 Potentially seriously inconvenienced persons: comparison of the method according to surface area and by address point

Table 15 shows a comparison for the years 2015 up to and including 2017 between the results of the number of potentially seriously inconvenienced persons based on two different methods for counting the number of inhabitants within the noise contours.

- 'Old method', in which the inhabitants are divided evenly over the surface area of the static sector and the population figures as at 1/1/2011 are applied. This method was used in the noise contour reports for 2015 and 2016.
- 'New method' (see also paragraph 1.5), in which the distribution of inhabitants by statistical sector is based on the address points and the population figures applied as of 1/1/2016. This method is used in this noise contour report.

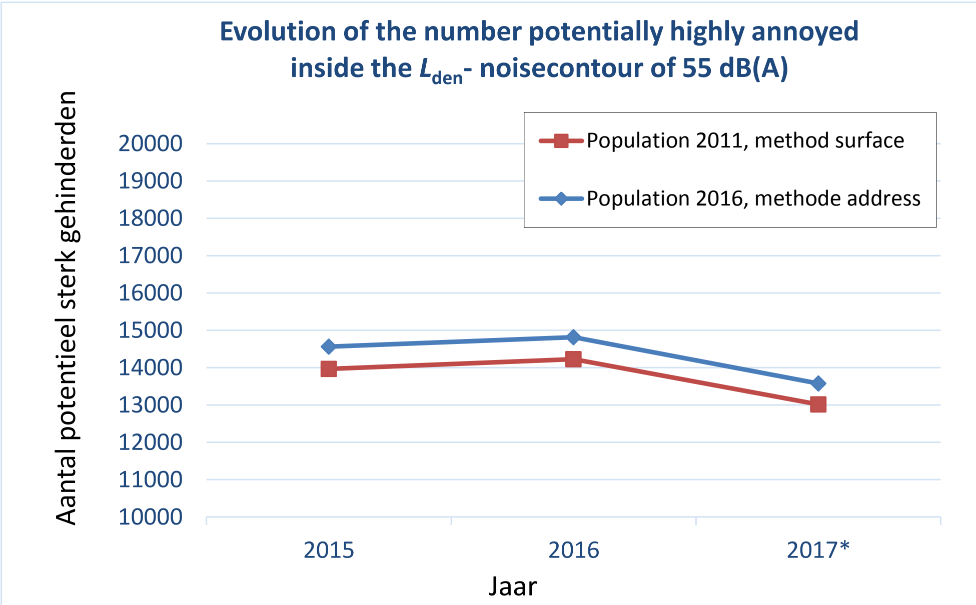
Table 15: Effect of the methodological change for calculating the number of potentially seriously inconvenienced persons within the L_{den} 55 dB(A) contour.

Year	2015	2015*	2016	2016*	2017	2017*
INM version	7.0b	7.0b	7.0b	*7.0b*	*7.0b*	7.0b
Method	opp	*adres*	opp	*adres*	*opp*	adres
Population data	1jan'11	1jan'16	1jan'11	*1jan'16*	*1jan'11*	1jan'16
Brussel	1,739	2,171	1,789	2,226	1,430	1,803
Evere	1,443	1,428	1,850	1,837	1,530	1,505
Grimbergen	428	377	517	483	480	449
Haacht	115	95	70	52	99	78
Herent	111	106	161	130	169	133
Huldenberg	0	0	0	0	0	0
Kampenhout	648	553	566	479	539	457
Kortenberg	366	386	438	467	403	431
Kraainem	368	382	379	404	362	388
Leuven	0	0	0	8	0	13
Machelen	2,598	2,868	2,649	2,923	2,734	3,015
Meise	0	0	0	0	0	0
Overijse	0	0	0	0	0	0
Rotselaar	0	0	0	0	0	0
Schaarbeek	354	323	956	991	30	6
Sint-L.-Woluwe	0	0	1	10	88	142
Sint-P.-Woluwe	79	79	102	126	59	90
Steenokkerzeel	1,675	1,657	1,525	1,484	1,540	1,506
Tervuren	0	0	0	0	0	0
Vilvoorde	1,120	1,112	1,136	1,130	1,156	1,146
Wemmel	0	0	0	0	0	0
Wezembeek-O.	282	310	252	274	243	268
Zaventem	2,638	2,713	1,835	1,792	2,155	2,144
Total	***13,965***	***14,560***	***14,226***	***14,815***	***13,016***	***13,575***

The modified method combines two effects: a more detailed localisation of the population within the statistical sector by applying the effective position of the dwellings and the evolution of the population since 2011, which varies greatly depending on the statistical sector. For the larger statistical sectors with predominantly dispersed populations, this usually means a shift to lower exposure contours. In the smaller and usually more densely populated statistical sectors (communities), the effects of the use of the address points are less important.

The number of potentially seriously inconvenienced persons is higher according to the new methodology. The graphic representation shows the compatibility of the two methods. In the follow-up to the report, the new methodology will be presented for 2017. The new methodology results in a number of potentially seriously inconvenienced persons that is 4.3% higher than the old methodology. This is mainly due to the increase in the population between 2011 and 2016.

Figure 16: Comparison of the potentially highly inconvenienced persons according to the different methods.



5.4 Results of contour calculations for 2017

5.4.1 Surface area per contour zone and per municipality

Table 16: Surface area per L_{day} contour zone and municipality – 2017.

Area (ha)	L_{day} contour zone in dB(A) (day 07:00-19:00)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	649	131	0	-	-	780
Evere	70	-	-	-	-	70
Haacht	29	-	-	-	-	29
Herent	225	-	-	-	-	225
Kampenhout	321	59	-	-	-	380
Kortenberg	369	180	37	3	-	589
Kraainem	14	-	-	-	-	14
Machelen	330	305	208	65	10	917
Steenokkerzeel	452	304	186	118	80	1,140
Vilvoorde	122	-	-	-	-	122
Wezembeek-Oppem	2	-	-	-	-	2
Zaventem	408	130	40	30	-	608
Totaal	**2,990**	**1,109**	**471**	**216**	**90**	**4,876**

Table 17: Surface area per $L_{evening}$ contour zone and municipality – 2017.

Area (ha)	$L_{evening}$ contour zone in dB(A) (evening 19:00-23:00)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	434	666	159	1	-	-	1,260
Evere	408	92	-	-	-	-	500
Grimbergen	827	-	-	-	-	-	827
Haacht	619	2	-	-	-	-	621
Herent	522	183	-	-	-	-	704
Kampenhout	1,043	363	73	0	-	-	1,480
Kortenberg	421	361	155	31	2	-	970
Kraainem	469	36	-	-	-	-	505
Leuven	212	-	-	-	-	-	212
Machelen	194	352	294	198	63	14	1,114
Meise	13	-	-	-	-	-	13
Rotselaar	53	-	-	-	-	-	53
Schaarbeek	170	-	-	-	-	-	170
Sint-Lambrechts-Woluwe	436	-	-	-	-	-	436
Sint-Pieters-Woluwe	278	-	-	-	-	-	278
Steenokkerzeel	413	466	306	188	112	78	1,563
Tervuren	40	-	-	-	-	-	40
Vilvoorde	552	203	-	-	-	-	755
Wemmel	26	-	-	-	-	-	26
Wezembeek-Oppem	340	20	-	-	-	-	360
Zaventem	1,086	430	122	38	28	-	1,704
Total	**8,556**	**3,172**	**1,108**	**457**	**205**	**92**	**13,590**

Table 18: Surface area per L_{night} contour zone and municipality – 2017.

Area (ha)	L_{night} contour zone in dB(A) (night 23:00-07:00)						
Municipality	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
Brussel	763	464	17	-	-	-	1,245
Evere	255	-	-	-	-	-	255
Grimbergen	593	-	-	-	-	-	593
Haacht	764	47	-	-	-	-	811
Herent	533	200	-	-	-	-	733
Kampenhout	931	478	146	16	-	-	1,571
Kortenberg	400	311	134	27	2	-	873
Kraainem	200	10	-	-	-	-	210
Leuven	203	-	-	-	-	-	203
Machelen	267	380	312	121	28	7	1,115
Rotselaar	133	-	-	-	-	-	133
Schaarbeek	17	-	-	-	-	-	17
Sint-Lambrechts-Woluwe	12	-	-	-	-	-	12
Sint-Pieters-Woluwe	66	-	-	-	-	-	66
Steenokkerzeel	507	465	303	208	138	89	1,710
Tervuren	69	-	-	-	-	-	69
Vilvoorde	617	41	-	-	-	-	658
Wezembeek-Oppem	227	3	-	-	-	-	230
Zaventem	1,415	530	201	55	19	8	2,228
Zemst	23	-	-	-	-	-	23
Total	**7,995**	**2,929**	**1,112**	**427**	**186**	**104**	**12,754**

Table 19: Surface area per L_{den} contour zone and municipality – 2017.

Area (ha)	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	645	352	17	-	-	1,014
Evere	263	-	-	-	-	263
Grimbergen	165	-	-	-	-	165
Haacht	404	-	-	-	-	404
Herent	452	54	-	-	-	506
Kampenhout	699	275	53	-	-	1,027
Kortenberg	365	294	86	15	-	761
Kraainem	160	-	-	-	-	160
Leuven	55	-	-	-	-	55
Machelen	293	352	271	114	28	1,057
Schaarbeek	9	-	-	-	-	9
Sint-Lambrechts-Woluwe	23	-	-	-	-	23
Sint-Pieters-Woluwe	19	-	-	-	-	19
Steenokkerzeel	507	404	264	166	165	1,506
Vilvoorde	508	17	-	-	-	525
Wezembeek-Oppem	99	-	-	-	-	99
Zaventem	914	341	104	31	20	1,409
Total	**5,579**	**2,088**	**795**	**325**	**213**	**9,000**

Table 20: Surface area per Freq.70, day contour zone and municipality – 2017.

Area (ha)	Freq.70,day contour zone (07:00-23:00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	420	299	312	397	145	1,574
Evere	32	252	225	4	-	513
Grimbergen	423	559	99	-	-	1,082
Haacht	110	146	164	-	-	420
Herent	194	113	189	118	13	627
Kampenhout	249	423	508	251	2	1,434
Kortenberg	199	121	208	182	342	1,052
Kraainem	132	208	100	-	-	440
Leuven	27	3	-	-	-	30
Machelen	40	75	152	174	597	1,038
Meise	119	4	-	-	-	122
Oudergem	15	-	-	-	-	15
Schaarbeek	191	5	-	-	-	196
Sint-Lambrechts-Woluwe	150	379	28	-	-	557
Sint-Pieters-Woluwe	119	147	0	-	-	265
Steenokkerzeel	122	127	267	340	561	1,418
Tervuren	99	-	-	-	-	99
Vilvoorde	130	150	406	30	-	714
Wemmel	179	2	-	-	-	182
Wezembeek-Oppem	89	65	68	-	-	223
Zaventem	517	338	648	128	89	1,721
Total	**3,556**	**3,415**	**3,375**	**1,625**	**1,750**	**13,722**

Table 21: Surface area per Freq.70, night contour zone and municipality – 2017.

Area (ha)	Freq.70,night contour zone (23:00-07:00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	199	-	-	-	199
Brussel	813	483	223	12	1,531
Evere	361	2	-	-	363
Grimbergen	706	-	-	-	706
Haacht	288	156	19	-	463
Herent	227	218	96	-	542
Kampenhout	640	241	550	-	1,432
Kortenberg	244	169	406	-	820
Kraainem	277	-	-	-	277
Leuven	60	1	-	-	61
Machelen	218	152	257	412	1,039
Mechelen	16	-	-	-	16
Oudergem	9	-	-	-	9
Schaarbeek	57	-	-	-	57
Sint-Lambrechts-Woluwe	191	-	-	-	191
Sint-Pieters-Woluwe	157	-	-	-	157
Steenokkerzeel	513	210	441	471	1,636
Tervuren	609	-	-	-	609
Vilvoorde	413	253	9	-	675
Wezembeek-Oppem	278	0	-	-	278
Zaventem	1,449	625	141	64	2,280
Zemst	89	-	-	-	89
Total	**7,813**	**2,512**	**2,142**	**959**	**13,427**

Table 22: Surface area per Freq.60, day contour zone and municipality – 2017.

Area (ha)	Freq.60,day contour zone (day 07:00-23:00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	351	359	273	209	1,193
Evere	277	236	-	-	513
Grimbergen	1,202	1	-	-	1,203
Haacht	611	70	139	-	819
Herent	352	197	365	-	914
Kampenhout	973	455	19	-	1,447
Kortenberg	254	159	567	65	1,046
Kraainem	277	304	-	-	581
Leuven	114	171	4	-	288
Machelen	99	99	151	779	1,129
Meise	29	-	-	-	29
Rotselaar	476	36	-	-	512
Schaarbeek	79	-	-	-	79
Sint-Lambrechts-Woluwe	296	238	-	-	534
Sint-Pieters-Woluwe	245	126	-	-	370
Steenokkerzeel	284	264	190	898	1,636
Tervuren	774	94	-	-	869
Vilvoorde	478	200	2	-	680
Wemmel	260	-	-	-	260
Wezembeek-Oppem	309	308	-	-	617
Zaventem	575	476	86	271	1,408
Total	**8,315**	**3,795**	**1,795**	**2,223**	**16,129**

Table 23: Surface area per Freq.60, night contour zone and municipality – 2017.

Area (ha)	Freq.60,night contour zone (23:00-07:00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	381	433	337	-	1,150
Evere	174	-	-	-	174
Grimbergen	592	-	-	-	592
Haacht	445	614	1	-	1,060
Herent	466	404	8	-	878
Kampenhout	369	697	428	0	1,495
Kortenberg	285	631	37	-	953
Kraainem	226	-	-	-	226
Leuven	268	10	-	-	278
Machelen	105	113	831	75	1,124
Meise	2	-	-	-	2
Rotselaar	713	49	-	-	763
Sint-Pieters-Woluwe	10	-	-	-	10
Steenokkerzeel	134	188	491	871	1,684
Tervuren	158	-	-	-	158
Vilvoorde	572	40	0	-	612
Wemmel	30	-	-	-	30
Wezembeek-Oppem	412	-	-	-	412
Zaventem	269	130	216	237	852
Total	**5,612**	**3,310**	**2,349**	**1,183**	**12,454**

5.4.2 Number of residents per contour zone and per municipality

Table 24: Number of residents per L_{day} contour zone and municipality – 2017.

Number of Inhabitants	L_{day} contour zone in dB(A) (day 07:00-19:00)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	3,848	2,843	7	-	-	6,698
Evere	1,824	-	-	-	-	1,824
Haacht	7	-	-	-	-	7
Herent	610	-	-	-	-	610
Kampenhout	788	186	-	-	-	974
Kortenberg	1,475	219	-	-	-	1,694
Kraainem	38	-	-	-	-	38
Machelen	4,621	4,371	2,971	-	-	11,963
Steenokkerzeel	4,568	996	130	-	-	5,694
Vilvoorde	579	-	-	-	-	579
Wezembeek-Oppem	-	-	-	-	-	-
Zaventem	3,592	388	-	-	-	3,981
Total	**21,950**	**9,003**	**3,108**	**-**	**-**	**34,062**

Table 25: Number of residents per $L_{evening}$ contour zone and municipality – 2017.

Number of Inhabitants	$L_{evening}$ contour zone in dB(A) (evening 19:00-23:00)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	13,774	3,930	3,496	38	-	-	21,238
Evere	34,816	3,363	-	-	-	-	38,179
Grimbergen	17,091	-	-	-	-	-	17,091
Haacht	1,484	-	-	-	-	-	1,484
Herent	788	389	-	-	-	-	1,177
Kampenhout	3,988	1,037	222	-	-	-	5,247
Kortenberg	2,570	1,380	161	-	-	-	4,111
Kraainem	12,739	241	-	-	-	-	12,980
Leuven	581	-	-	-	-	-	581
Machelen	2,618	5,114	3,940	2,960	5	-	14,638
Meise	178	-	-	-	-	-	178
Rotselaar	89	-	-	-	-	-	89
Schaarbeek	35,121	-	-	-	-	-	35,121
Sint-Lambrechts-Woluwe	22,396	-	-	-	-	-	22,396
Sint-Pieters-Woluwe	12,019	-	-	-	-	-	12,019
Steenokkerzeel	2,954	4,691	1,029	175	-	-	8,848
Tervuren	117	-	-	-	-	-	117
Vilvoorde	16,791	1,263	-	-	-	-	18,054
Wemmel	264	-	-	-	-	-	264
Wezembeek-Oppem	8,260	398	-	-	-	-	8,658
Zaventem	17,581	5,073	208	-	-	-	22,863
Total	**206,220**	**26,880**	**9,055**	**3,173**	**5**	**-**	**245,334**

Table 26: Number of residents per L_{night} contour zone and municipality – 2017.

Number of Inhabitants	L_{night} contour zone in dB(A) (night 23:00-07:00)						
Municipality	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
Brussel	16,174	4,988	94	-	-	-	21,256
Evere	12,671	-	-	-	-	-	12,671
Grimbergen	15,036	-	-	-	-	-	15,036
Haacht	2,323	9	-	-	-	-	2,332
Herent	762	488	-	-	-	-	1,250
Kampenhout	3,593	1,315	286	142	-	-	5,335
Kortenberg	2,137	1,201	109	-	-	-	3,447
Kraainem	4,656	2	-	-	-	-	4,658
Leuven	550	-	-	-	-	-	550
Machelen	3,176	6,130	5,256	62	-	-	14,623
Rotselaar	61	-	-	-	-	-	61
Schaarbeek	1,085	-	-	-	-	-	1,085
Sint-Lambrechts-Woluwe	1,020	-	-	-	-	-	1,020
Sint-Pieters-Woluwe	2,289	-	-	-	-	-	2,289
Steenokkerzeel	2,604	4,890	1,666	266	66	-	9,492
Tervuren	1,244	-	-	-	-	-	1,244
Vilvoorde	14,459	139	-	-	-	-	14,599
Wezembeek-Oppem	4,652	5	-	-	-	-	4,657
Zaventem	18,417	7,959	72	-	-	-	26,448
Zemst	57	-	-	-	-	-	57
Total	**106,964**	**27,127**	**7,484**	**469**	**66**	**-**	**142,110**

Table 27: Number of residents per L_{den} contour zone and municipality – 2017.

Number of Inhabitants	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	6,347	4,818	98	-	-	11,263
Evere	13,544	-	-	-	-	13,544
Grimbergen	4,354	-	-	-	-	4,354
Haacht	724	-	-	-	-	724
Herent	948	29	-	-	-	978
Kampenhout	2,073	732	169	-	-	2,973
Kortenberg	2,092	791	38	-	-	2,922
Kraainem	3,504	-	-	-	-	3,504
Leuven	124	-	-	-	-	124
Machelen	3,888	5,416	4,319	132	-	13,755
Schaarbeek	57	-	-	-	-	57
Sint-Lambrechts-Woluwe	1,379	-	-	-	-	1,379
Sint-Pieters-Woluwe	882	-	-	-	-	882
Steenokkerzeel	4,131	3,484	640	126	-	8,381
Vilvoorde	9,830	80	-	-	-	9,909
Wezembeek-Oppem	2,313	-	-	-	-	2,313
Zaventem	13,949	2,294	0	-	-	16,244
Total	**70,139**	**17,645**	**5,264**	**257**	**-**	**93,305**

Table 28: Number of residents per Freq.70, day contour zone and municipality – 2017.

Number of Inhabitants	Freq.70,day contour zone (07:00-23:00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	27,329	4,506	2,189	2,496	2,817	39,337
Evere	4,369	24,745	10,451	22	-	39,586
Grimbergen	6,055	12,082	2,543	-	-	20,680
Haacht	379	240	137	-	-	756
Herent	196	126	661	100	-	1,084
Kampenhout	964	1,436	1,316	722	-	4,438
Kortenberg	1,114	1,138	985	988	722	4,948
Kraainem	4,285	5,808	2,320	-	-	12,412
Leuven	56	-	-	-	-	56
Machelen	652	1,150	2,500	2,131	7,087	13,520
Meise	985	37	-	-	-	1,022
Schaarbeek	28,044	44	-	-	-	28,088
Sint-Lambrechts-Woluwe	12,408	20,193	934	-	-	33,535
Sint-Pieters-Woluwe	4,122	7,560	-	-	-	11,683
Steenokkerzeel	994	1,159	2,148	2,325	1,197	7,823
Vilvoorde	5,937	4,596	7,541	131	-	18,205
Wemmel	1,552	-	-	-	-	1,552
Wezembeek-Oppem	2,229	1,655	1,565	-	-	5,449
Zaventem	9,348	5,560	4,835	1,450	871	22,063
Total	**111,019**	**92,035**	**40,125**	**10,365**	**12,694**	**266,238**

Table 29: Number of residents per Freq.70, night contour zone and municipality – 2017.

Number of Inhabitants	Freq.70,night contour zone (23:00-07:00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	763	-	-	-	763
Brussel	29,201	2,634	3,985	74	35,895
Evere	20,252	-	-	-	20,252
Grimbergen	16,845	-	-	-	16,845
Haacht	851	135	2	-	987
Herent	245	732	37	-	1,014
Kampenhout	2,071	927	1,462	-	4,460
Kortenberg	1,257	1,195	964	-	3,416
Kraainem	6,736	-	-	-	6,736
Leuven	144	-	-	-	144
Machelen	2,876	2,568	3,928	4,072	13,445
Schaarbeek	11,237	-	-	-	11,237
Sint-Lambrechts-Woluwe	10,750	-	-	-	10,750
Sint-Pieters-Woluwe	5,581	-	-	-	5,581
Steenokkerzeel	3,379	1,726	2,416	1,572	9,093
Tervuren	3,993	-	-	-	3,993
Vilvoorde	13,149	3,742	64	-	16,955
Wezembeek-Oppem	5,619	-	-	-	5,619
Zaventem	20,186	5,751	1,551	136	27,623
Zemst	124	-	-	-	124
Total	**155,257**	**19,411**	**14,408**	**5,854**	**194,930**

Table 30: Number of residents per Freq.60, day contour zone and municipality – 2017.

Number of Inhabitants	Freq.60,day contour zone (07:00-23:00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	24,310	1,635	1,116	4,324	31,385
Evere	27,471	12,115	-	-	39,586
Grimbergen	22,268	-	-	-	22,268
Haacht	1,967	114	142	-	2,222
Herent	638	154	879	-	1,671
Kampenhout	3,673	886	-	-	4,559
Kortenberg	988	895	2,427	-	4,311
Kraainem	5,570	8,150	-	-	13,720
Leuven	780	393	-	-	1,173
Machelen	1,364	1,505	1,983	9,877	14,729
Meise	459	-	-	-	459
Rotselaar	2,884	19	-	-	2,904
Schaarbeek	9,974	-	-	-	9,974
Sint-Lambrechts-Woluwe	19,730	10,409	-	-	30,139
Sint-Pieters-Woluwe	10,173	7,068	-	-	17,241
Steenokkerzeel	1,971	1,444	1,642	4,427	9,484
Tervuren	7,542	2,240	-	-	9,782
Vilvoorde	13,782	1,822	-	-	15,604
Wemmel	4,073	-	-	-	4,073
Wezembeek-Oppem	5,738	7,243	-	-	12,981
Zaventem	8,713	6,608	1,472	4,108	20,902
Total	**174,069**	**62,701**	**9,661**	**22,736**	**269,167**

Table 31: Number of residents per Freq.60, night contour zone and municipality – 2017.

Number of Inhabitants	Freq.60,night contour zone (23:00-07:00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	22,584	3,707	4,773	-	31,064
Evere	12,014	-	-	-	12,014
Grimbergen	13,478	-	-	-	13,478
Haacht	1,647	1,640	-	-	3,286
Herent	647	887	-	-	1,534
Kampenhout	1,872	2,436	1,338	-	5,646
Kortenberg	1,414	2,376	-	-	3,790
Kraainem	5,903	-	-	-	5,903
Leuven	1,072	5	-	-	1,077
Machelen	1,478	1,564	11,617	4	14,663
Meise	7	-	-	-	7
Rotselaar	3,957	-	-	-	3,957
Sint-Pieters-Woluwe	882	-	-	-	882
Steenokkerzeel	949	1,118	2,032	5,813	9,911
Tervuren	1,402	-	-	-	1,402
Vilvoorde	12,591	139	-	-	12,730
Wemmel	247	-	-	-	247
Wezembeek-Oppem	8,914	-	-	-	8,914
Zaventem	2,475	1,815	3,728	3,721	11,740
Total	**93,532**	**15,687**	**23,488**	**9,538**	**142,245**

5.5 Noise contour maps: evolution 2016-2017

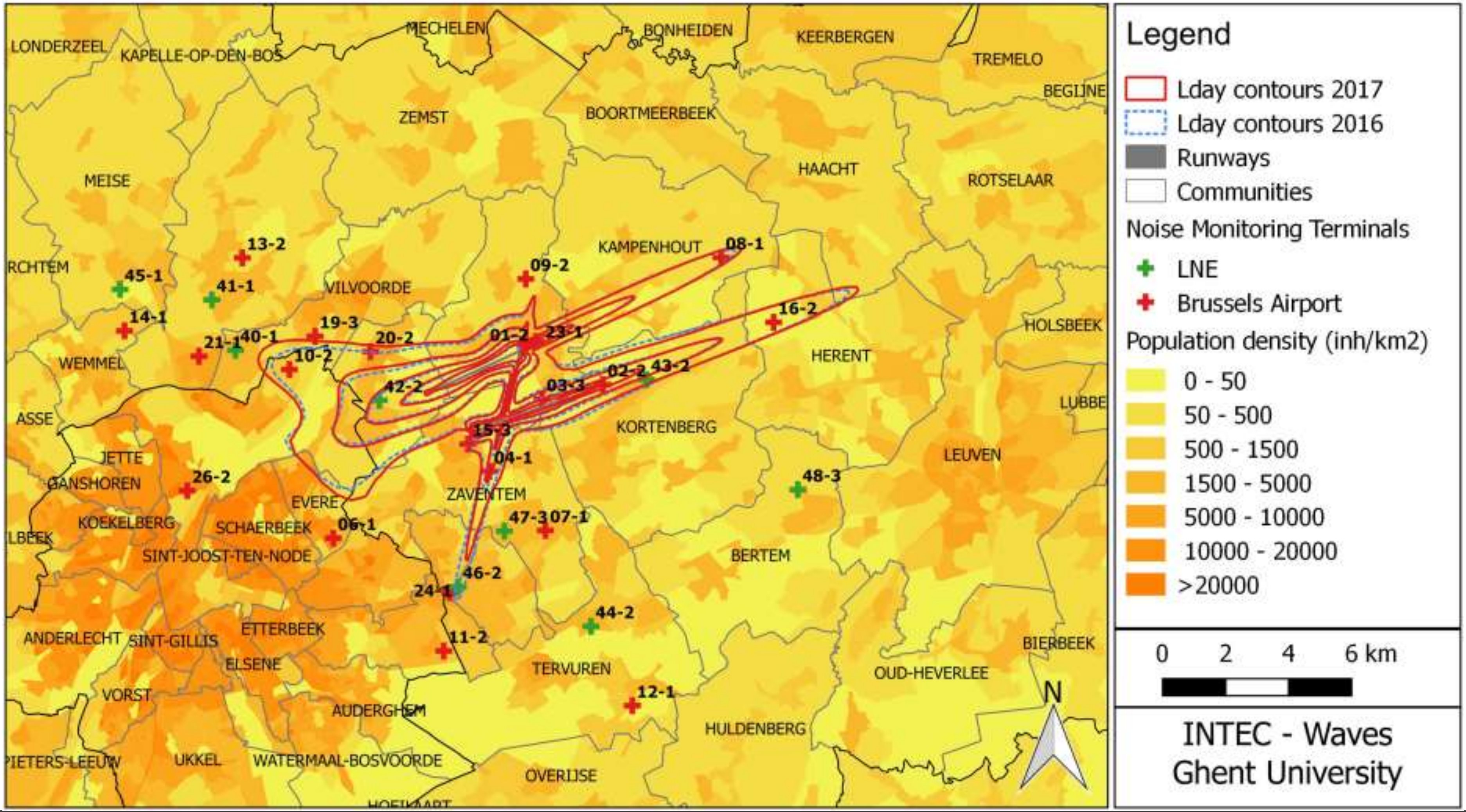
This appendix includes noise maps in A4 format.

- L_{day} noise contours for 2016 and 2017, background population map – 2016
- $L_{evening}$ noise contours for 2016 and 2017, background population map – 2016
- L_{night} noise contours for 2016 and 2017, background population map – 2016
- L_{den} noise contours for 2016 and 2017, background population map – 2016
- Freq.70, day noise contours for 2016 and 2017, background population map – 2016
- Freq.70, night noise contours for 2016 and 2017, background population map – 2016
- Freq.60, day noise contours for 2016 and 2017, background population map – 2016
- Freq.60, night noise contours for 2016 and 2017, background population map – 2016

- L_{day} noise contours for 2016 and 2017, background NGI topographical map
- $L_{evening}$ noise contours for 2016 and 2017, background NGI topographical map
- L_{night} noise contours for 2016 and 2017, background NGI topographical map
- L_{den} noise contours for 2016 and 2017, background NGI topographical map
- Freq.70, day noise contours for 2016 and 2017, background NGI topographical map
- Freq.70, night noise contours for 2016 and 2017, background NGI topographical map
- Freq.60, day noise contours for 2016 and 2017, background NGI topographical map
- Freq.60, night noise contours for 2016 and 2017, background NGI topographical map

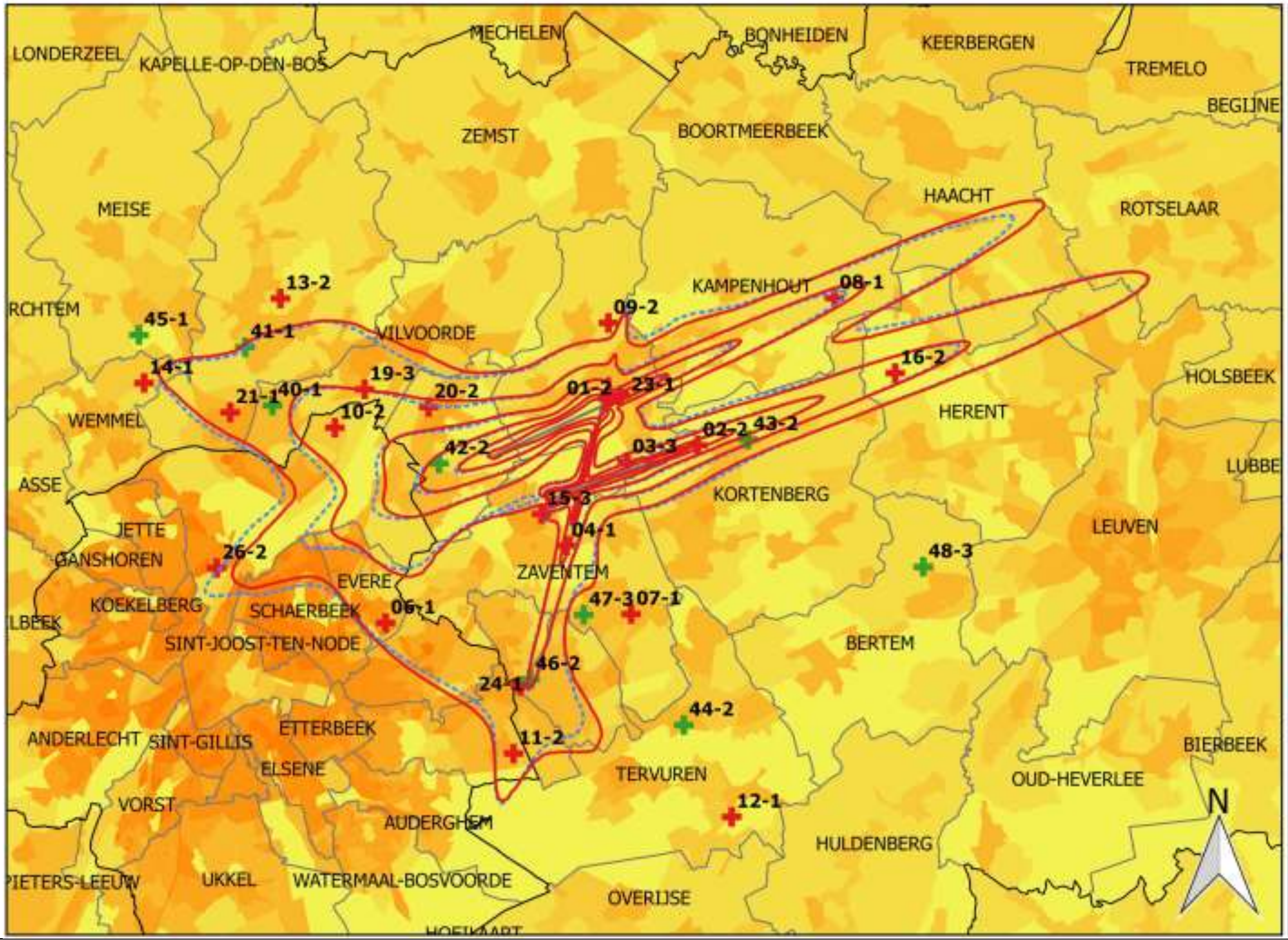
Evolution of L_{day} noise contours: 2016 and 2017
55, 60, 65, 70 and 75 dB(A) (07:00 - 19:00)

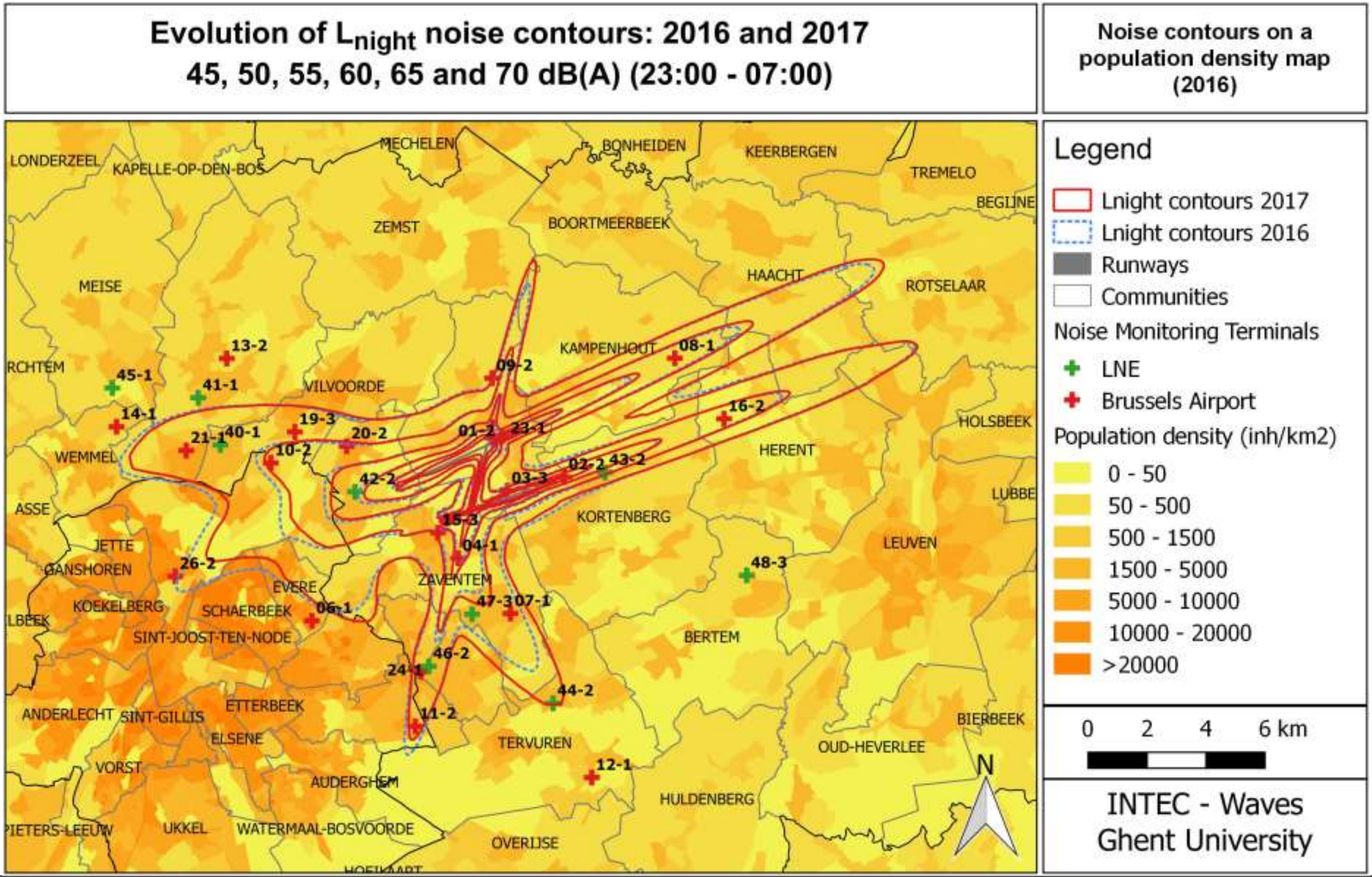
Noise contours on a population density map (2016)



Evolution of $L_{evening}$ noise contours: 2016 and 2017
50, 55, 60, 65, 70 and 75 dB(A) (19:00 - 23:00)

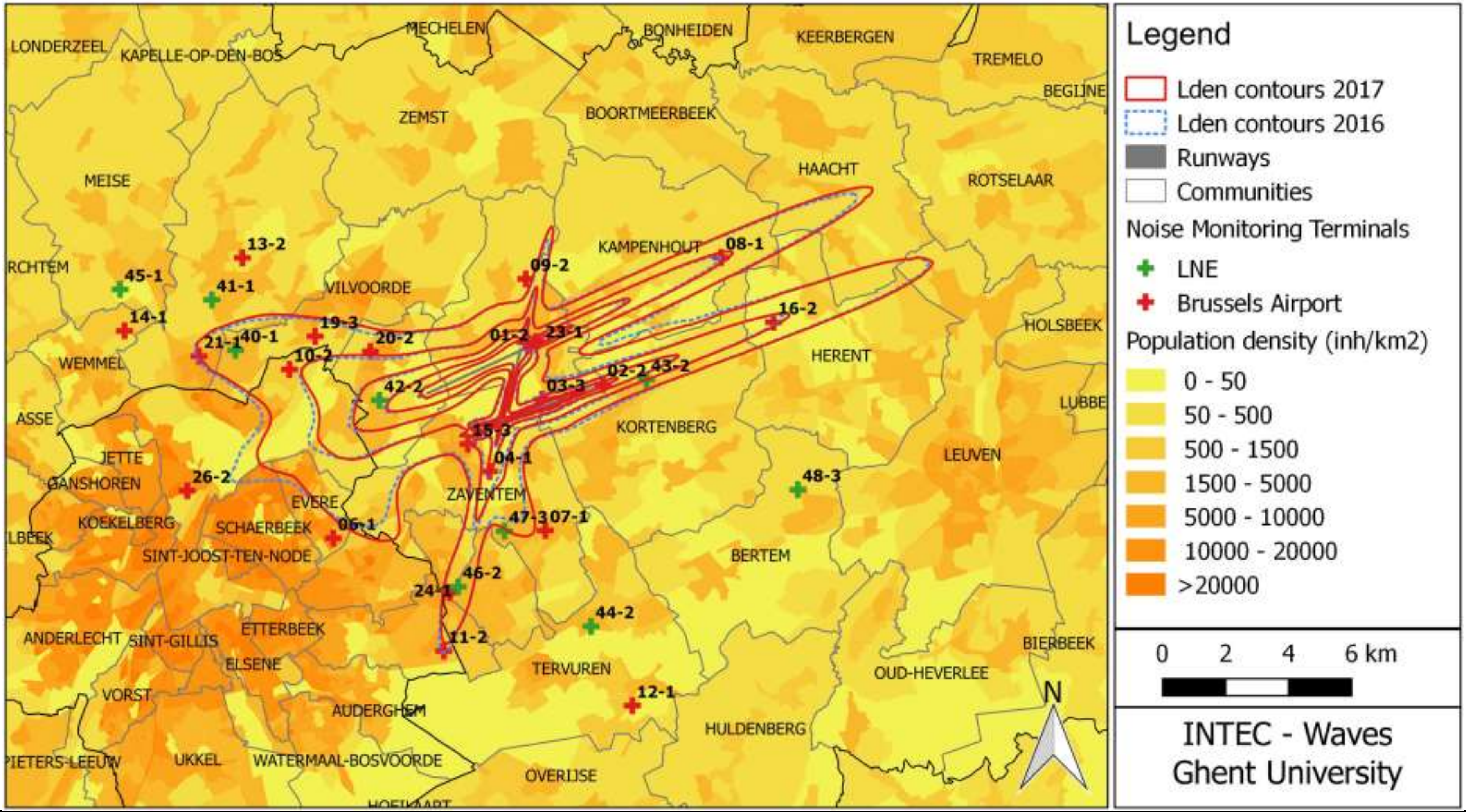
Noise contours on a population density map (2016)




Evolution of Lnight noise contours: 2016 and 2017
45, 50, 55, 60, 65 and 70 dB(A) (23:00 - 07:00)
Noise contours on a population density map (2016)
Legend
Lnight contours 2017
Lnight contours 2016
Runways
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
KAMPENHOUT
VILVOORDE
HOLSBEEK
WEMMEL
HERENT
ASSE
KORTENBERG
LUBBE
JETTE
LEUVEN
GANSHOREN
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
ANDERLECHT
SINT-GILLIS
ETTERBEEK
ELSENE
BIERBEEK
TERVUREN
OUD-HEVERLEE
VORST
AUDERGHEM
HULDENBERG
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
13-2
45-1
41-1
14-1
21-1
40-1
19-3
20-2
10-2
09-2
08-1
01-2
23-1
16-2
42-2
02-2
43-2
03-3
15-3
04-1
26-2
48-3
06-1
47-3
07-1
46-2
24-1
44-2
11-2
12-1

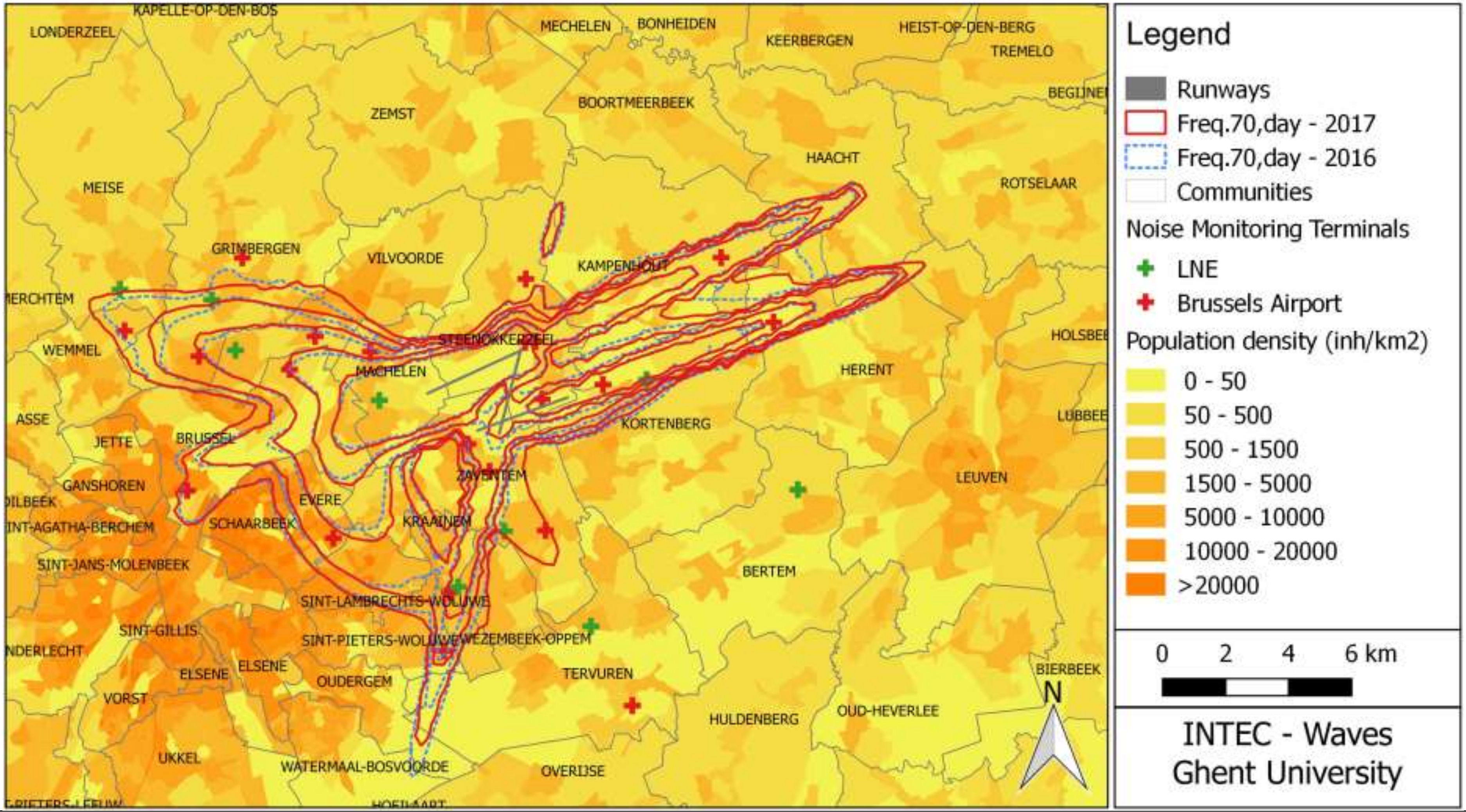
Evolution of L_{den} noise contours: 2016 and 2017
55, 60, 65, 70 and 75 dB(A)

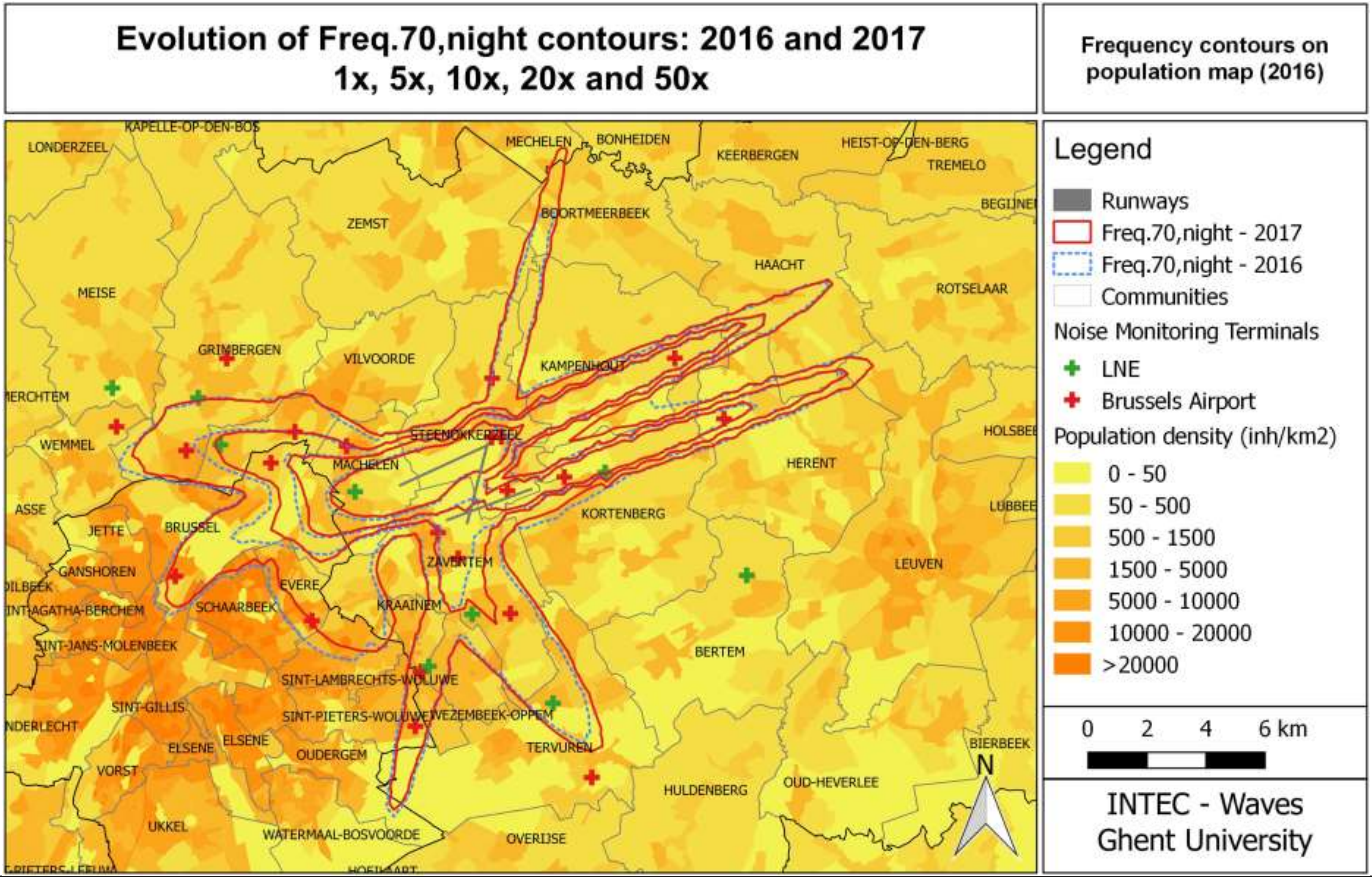
Noise contours on a population density map (2016)

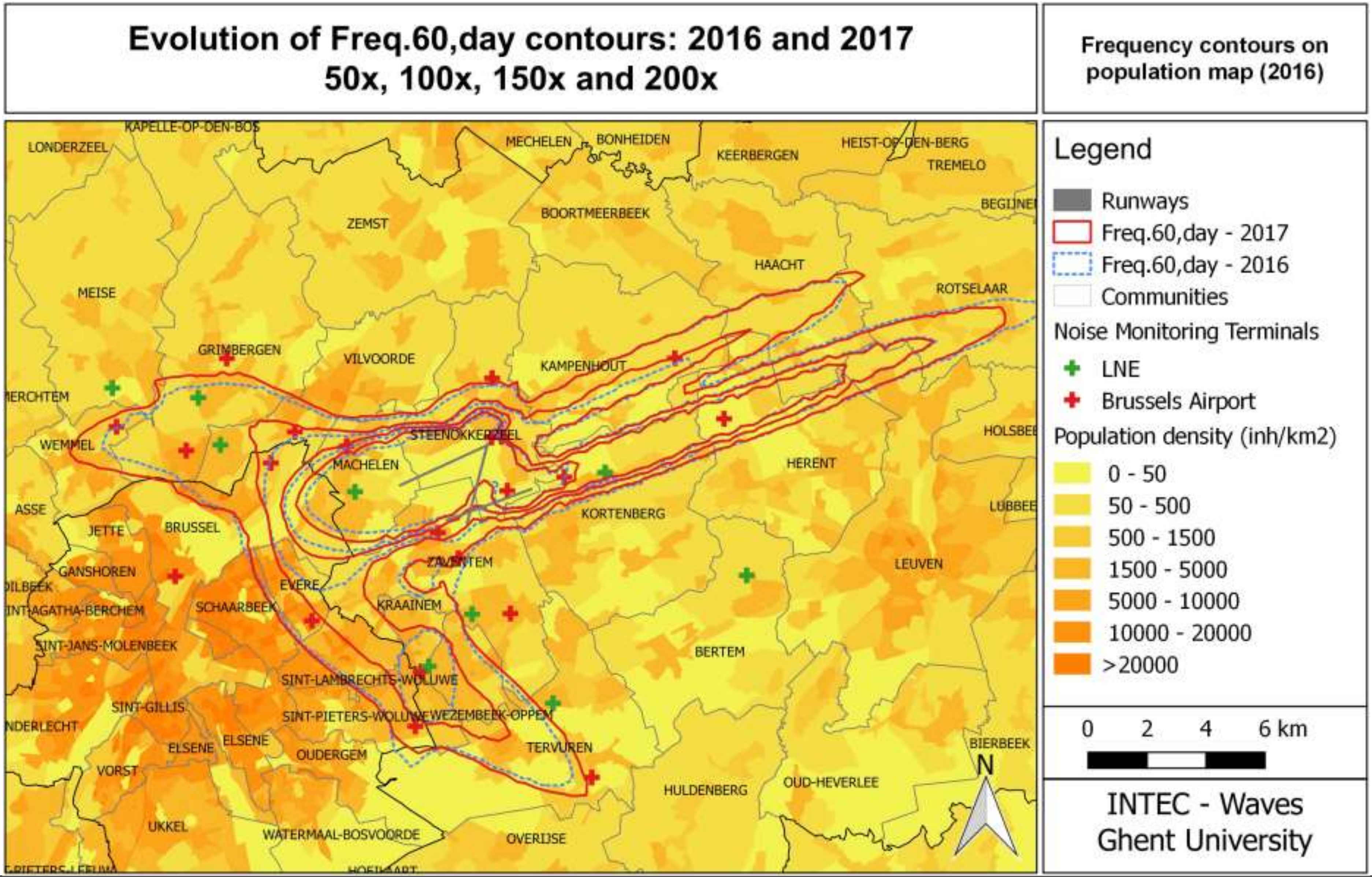


Evolution of Freq.70,day contours: 2016 and 2017
5x, 10x, 20x, 50x and 100x

Frequency contours on population map (2016)




Evolution of Freq.70,night contours: 2016 and 2017
1x, 5x, 10x, 20x and 50x
Frequency contours on population map (2016)
Legend
Runways
Freq.70,night - 2017
Freq.70,night - 2016
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
STEENOKKERZEEL
WEMMEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
EVERE
ZAVENTEM
LEUVEN
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
SINT-GILLIS
SINT-PIETERS-WOLUWE
WEZEMBEEK-OPPEM
ELSENE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE


Evolution of Freq.60,day contours: 2016 and 2017
50x, 100x, 150x and 200x
Frequency contours on population map (2016)
Legend
Runways
Freq.60,day - 2017
Freq.60,day - 2016
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0
2
4
6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
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ROTSELAAR
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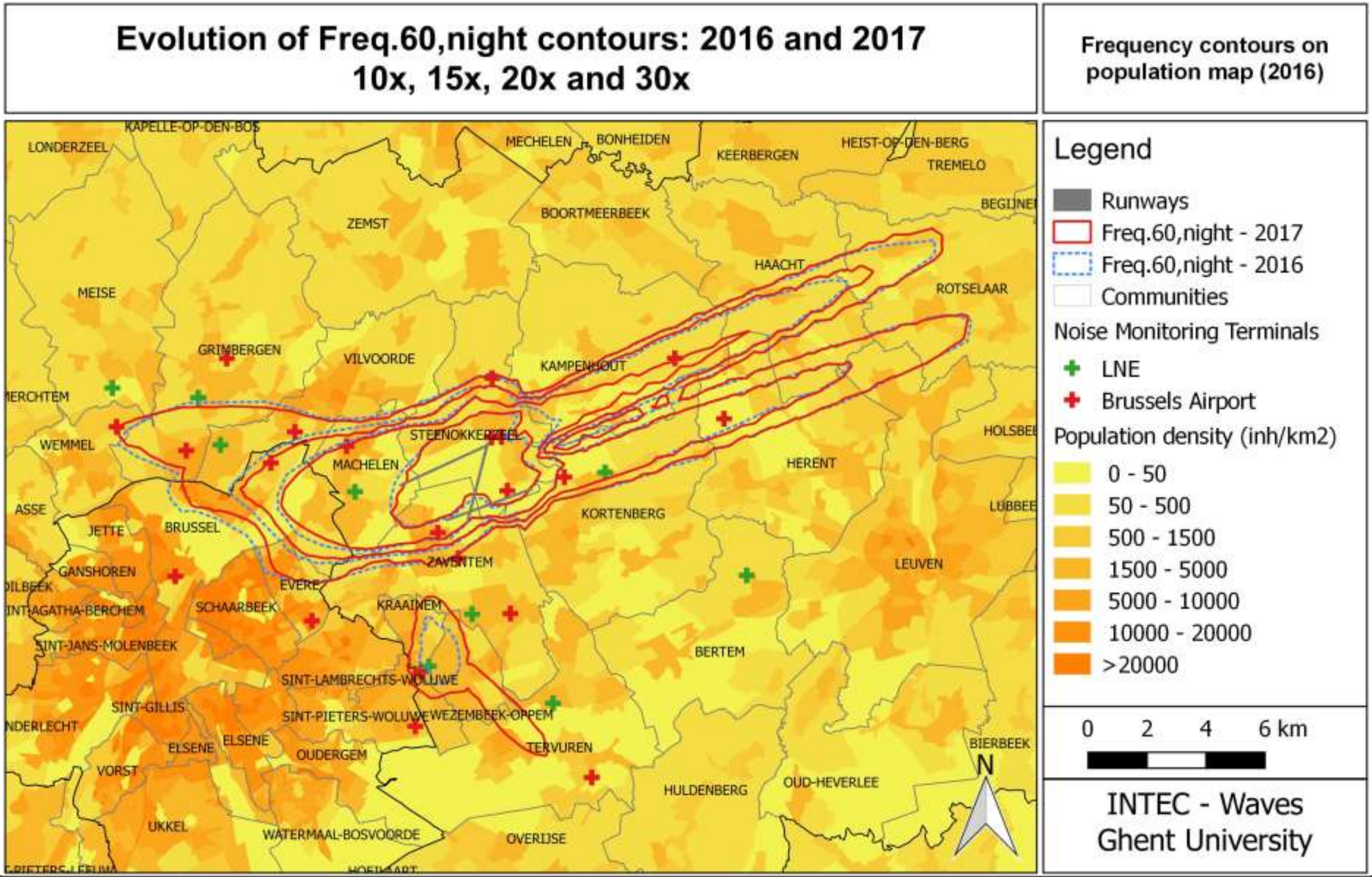
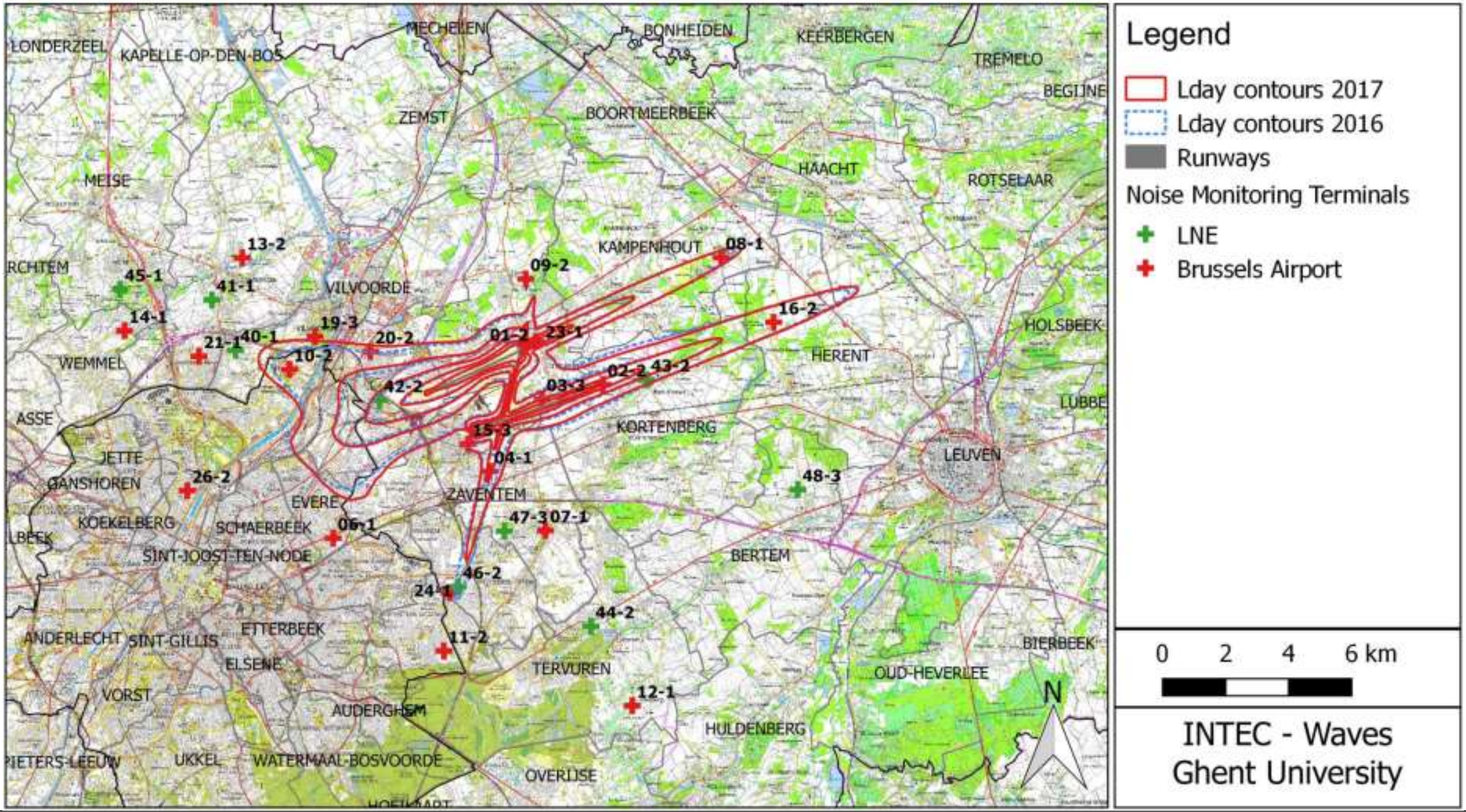
KAMPENHOUT
STEENOKKERZEEL
HOLSBEE
WEMMEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
LUBBEE
GANSHOREN
ZAVENTEM
LEUVEN
EVERE
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
SINT-GILLIS
SINT-PIETERS-WOLUWE
WEZEMBEEK-OPPEM
ELSENE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE



Evolution of Freq.60,night contours: 2016 and 2017
10x, 15x, 20x and 30x
Frequency contours on population map (2016)
Legend
Runways
Freq.60,night - 2017
Freq.60,night - 2016
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
ZAVENTEM
LEUVEN
EVERE
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
SINT-GILLIS
SINT-PIETERS-WOLUWE
WEZEMBEEK-OPPEM
ELSENE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

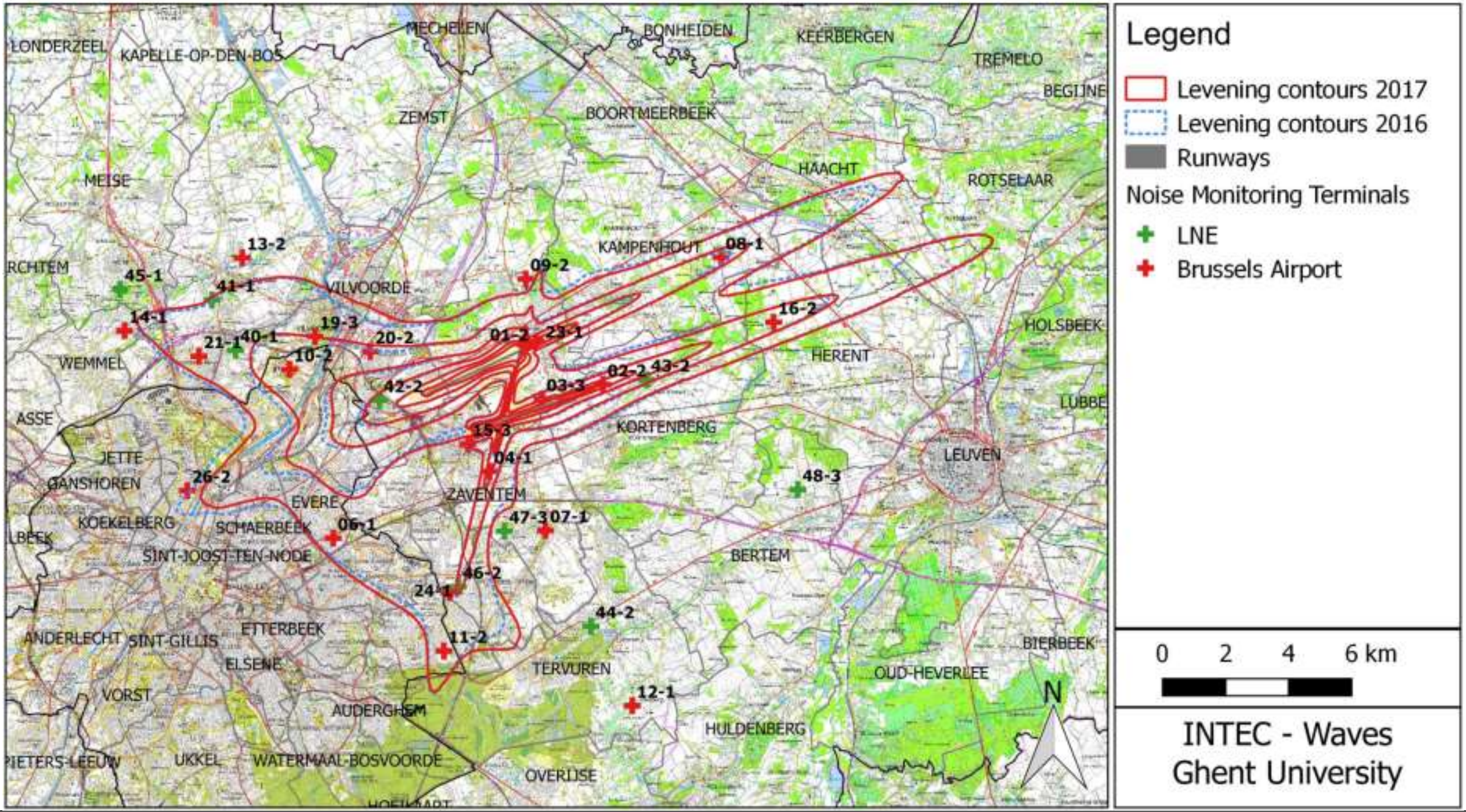
Evolution of L_{day} noise contours: 2016 and 2017
55, 60, 65, 70 and 75 dB(A) (07:00-19:00)

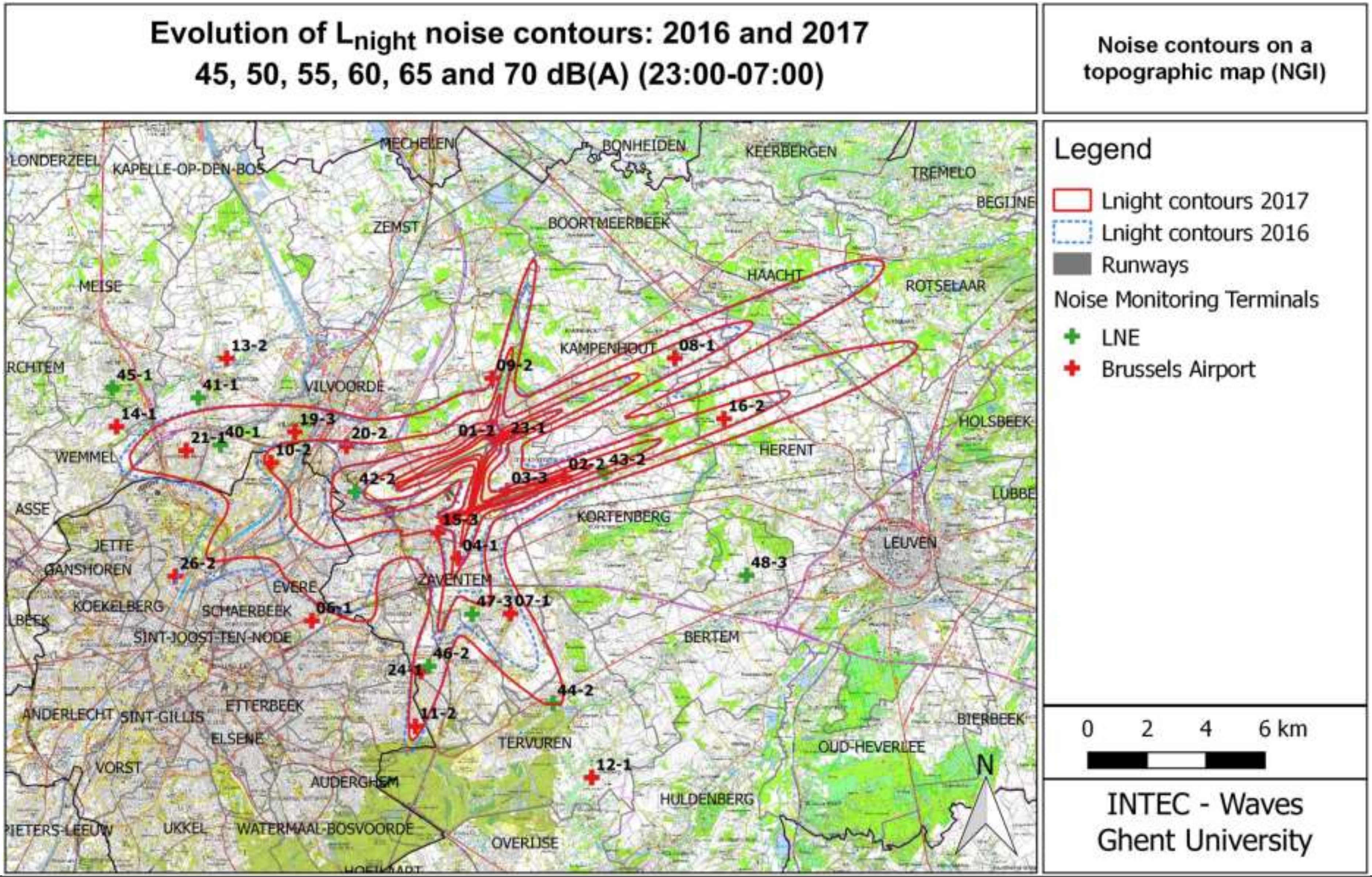
Noise contours on a topographic map (NGI)



Evolution of $L_{evening}$ noise contours: 2016 and 2017
50, 55, 60, 65, 70 and 75 dB(A) (19:00-23:00)

Noise contours on a topographic map (NGI)





Evolution of L_{night} noise contours: 2016 and 2017
45, 50, 55, 60, 65 and 70 dB(A) (23:00-07:00)
Noise contours on a topographic map (NGI)
Legend
Lnight contours 2017
Lnight contours 2016
Runways
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
KAMPENHOUT
VILVOORDE
HOLSBEEK
WEMMEL
HERENT
LUBBE
ASSE
KORTENBERG
LEUVEN
JETTE
GANSHOREN
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
ANDERLECHT
SINT-GILLIS
ETTERBEEK
BIERBEEK
ELSENE
TERVUREN
OUD-HEVERLEE
VORST
AUDERGHEM
HULDENBERG
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
13-2
45-1
41-1
14-1
21-1
40-1
19-3
20-2
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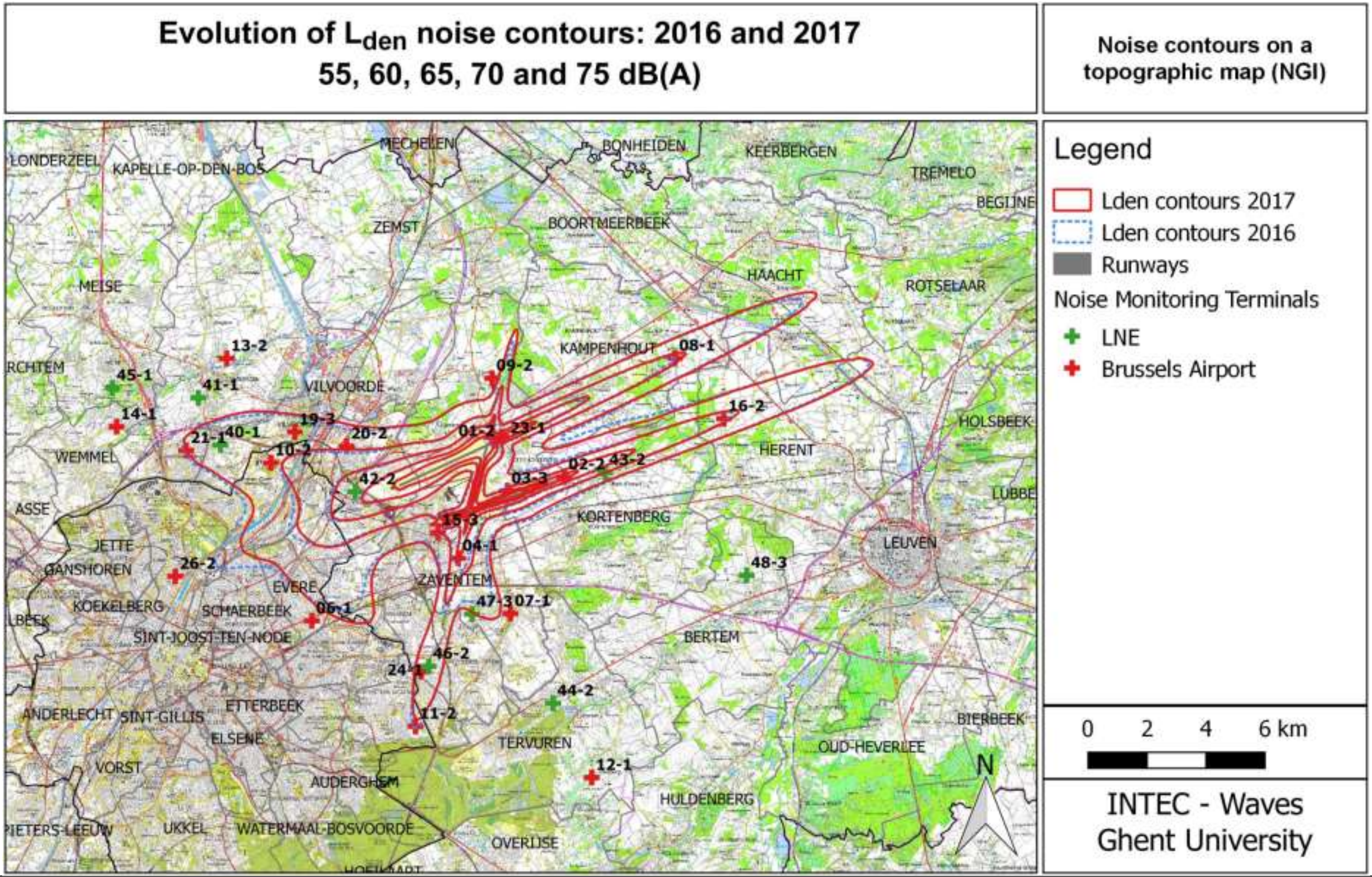
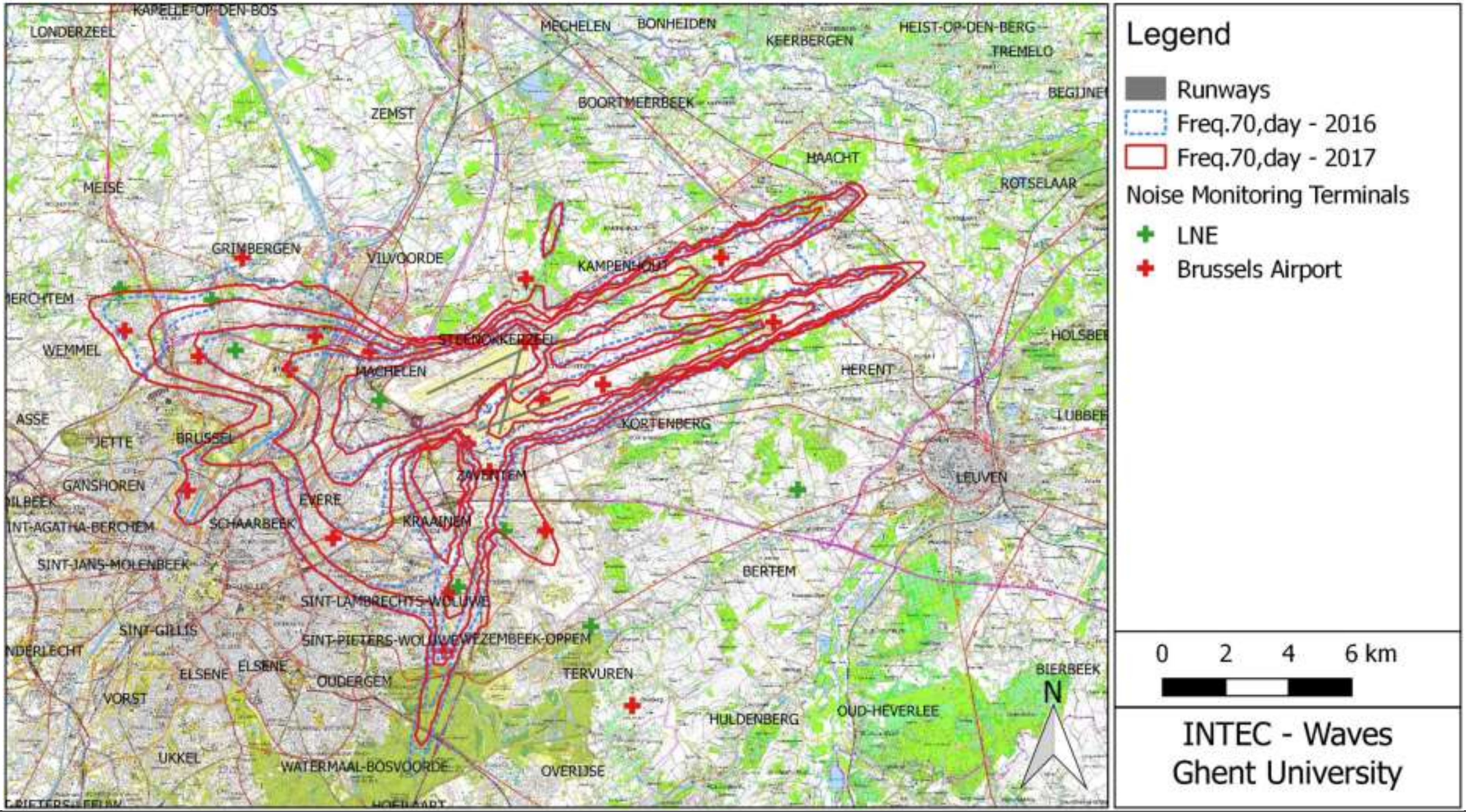
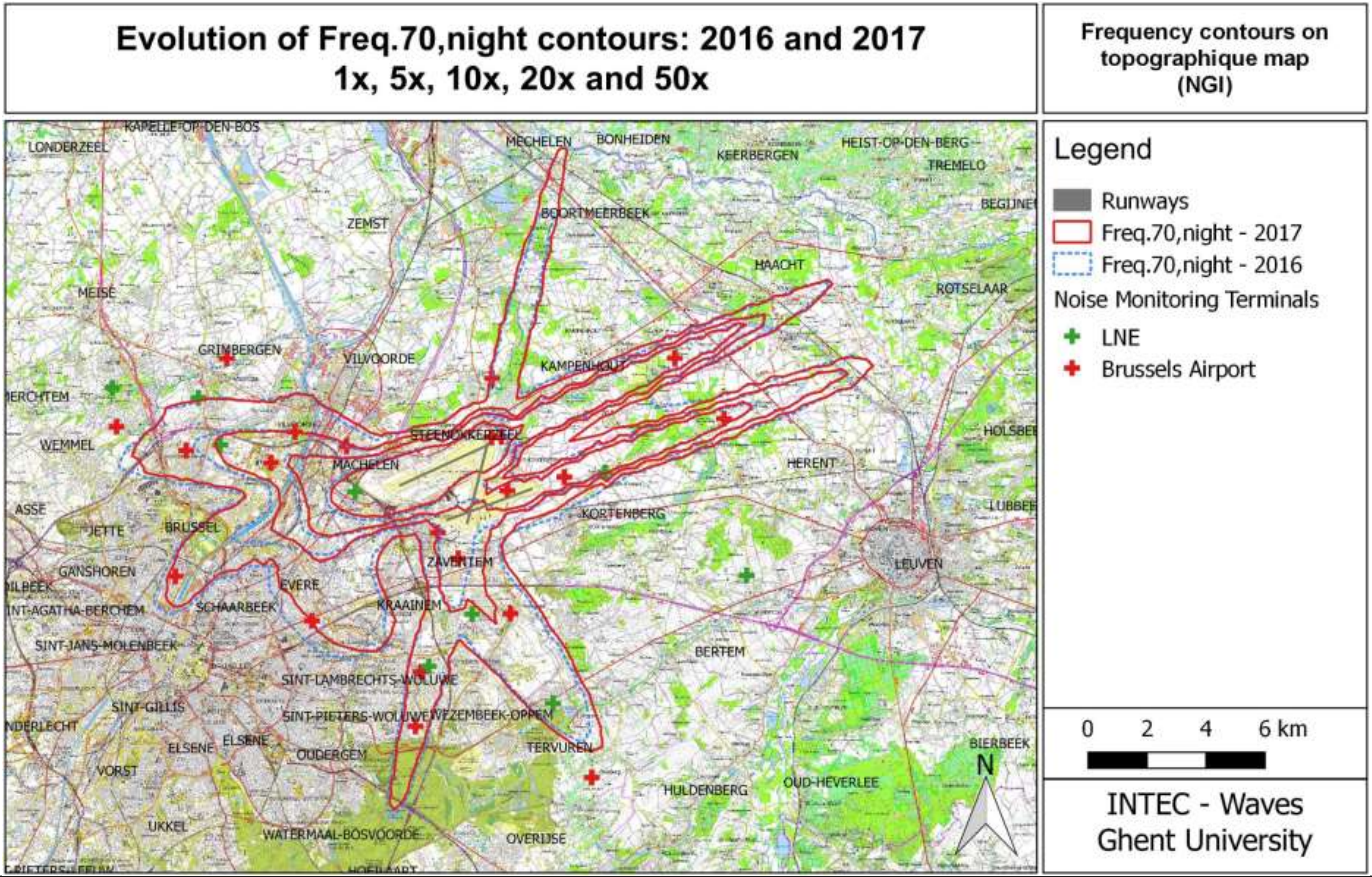
09-2
08-1
16-2
01-2
23-1
02-2
43-2
03-3
42-2
15-3
04-1
48-3
26-2
06-1
47-3
07-1
46-2
24-1
44-2
11-2
12-1


Evolution of L_{den} noise contours: 2016 and 2017
55, 60, 65, 70 and 75 dB(A)
Noise contours on a topographic map (NGI)
Legend
Lden contours 2017
Lden contours 2016
Runways
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
KAMPENHOUT
VILVOORDE
HOLSBEEK
WEMMEL
HERENT
ASSE
JETTE
GANSHOREN
KORTENBERG
LEUVEN
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
ANDERLECHT
SINT-GILLIS
ETTERBEEK
ELSENE
TERVUREN
BIERBEEK
OUD-HEVERLEE
VORST
AUDERGHEM
HULDENBERG
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
13-2
45-1
41-1
14-1
21-1
40-1
19-3
10-3
20-2
09-2
08-1
01-2
23-1
16-2
02-2
43-2
03-3
42-2
15-3
04-1
26-2
48-3
47-3
07-1
06-1
46-2
24-1
44-2
11-2
12-1

Evolution of Freq.70,day contours: 2016 and 2017
5x, 10x, 20x, 50x and 100x

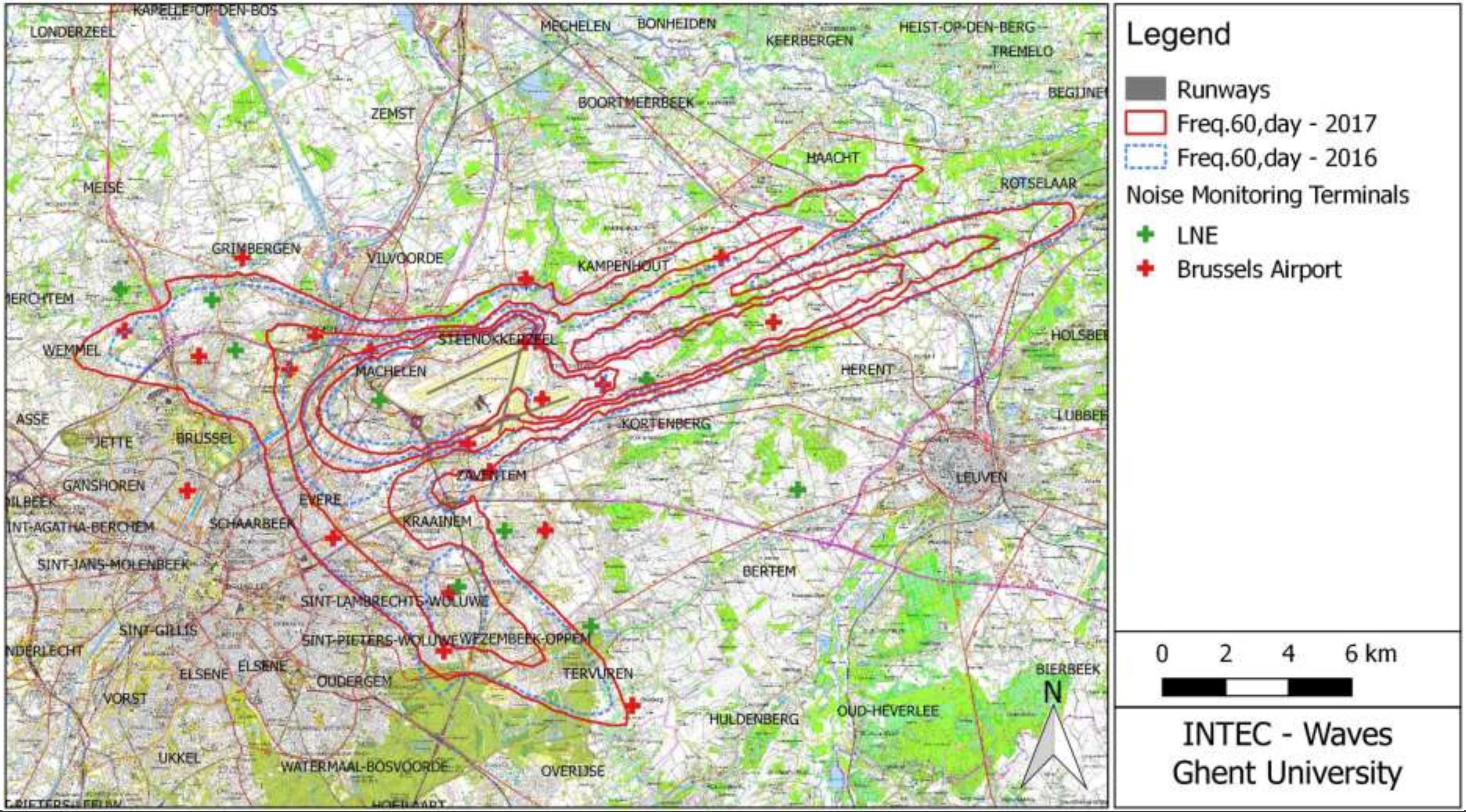
Frequency contours on topographique map (NGI)

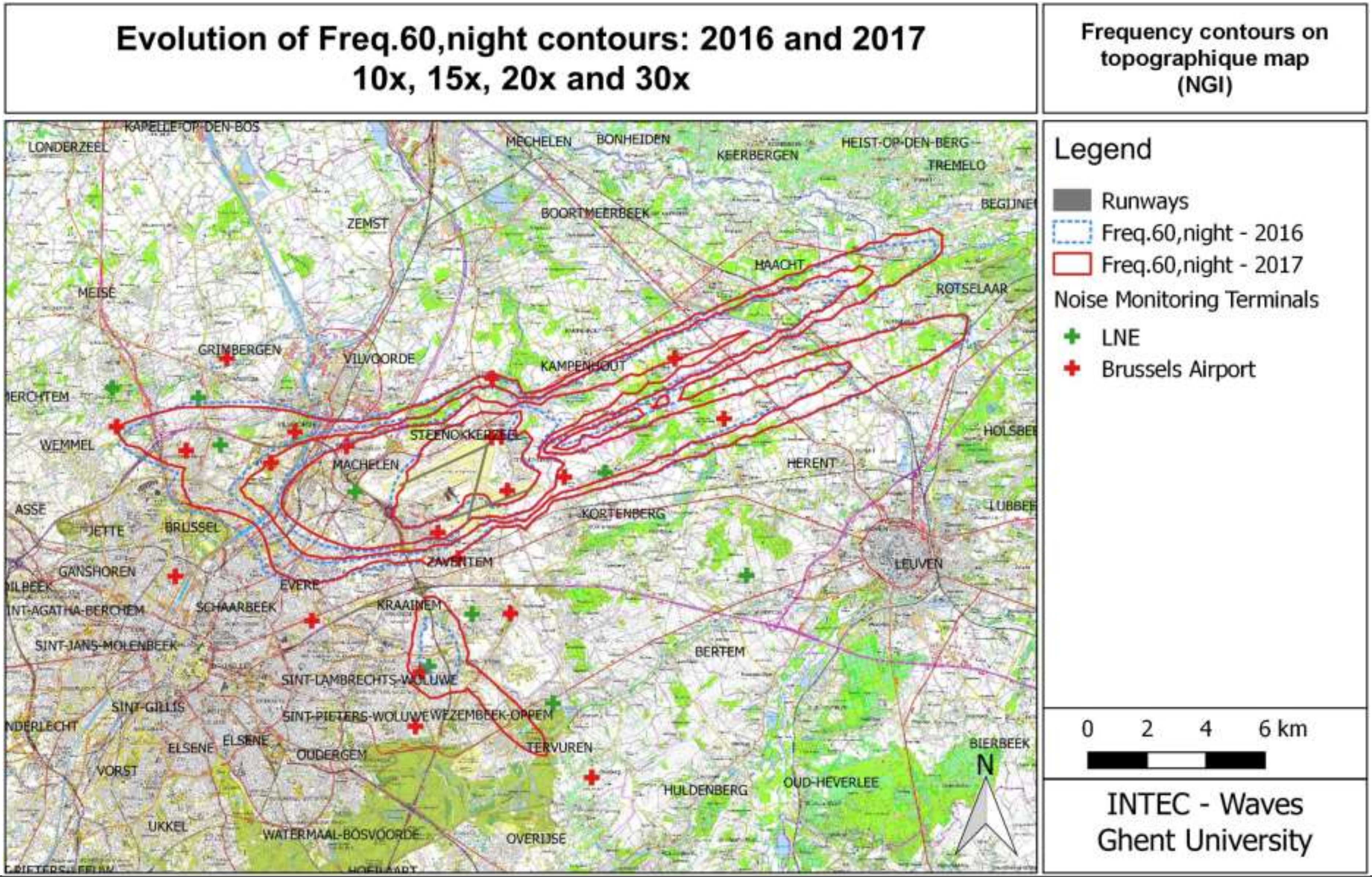



Evolution of Freq.70,night contours: 2016 and 2017
1x, 5x, 10x, 20x and 50x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.70,night - 2017
Freq.70,night - 2016
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
ZAVENTEM
LEUVEN
EVERE
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
SINT-GILLIS
SINT-PIETERS-WOLUWE
WEZEMBEEK-OPPEM
ELSENE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

Evolution of Freq.60,day contours: 2016 and 2017
50x, 100x, 150x and 200x

Frequency contours on topographique map (NGI)




Evolution of Freq.60,night contours: 2016 and 2017
10x, 15x, 20x and 30x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.60,night - 2016
Freq.60,night - 2017
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
ZAVENTEM
LEUVEN
EVERE
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
SINT-GILLIS
SINT-PIETERS-WOLUWE
WEZEMBEEK-OPPEM
ELSENE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

5.6 Evolution of the surface area and the number of residents

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

Table 32: Evolution of the surface area inside the L_{day} contours (2000, 2006-2017).

Area (ha)	L_{day} contour zone in dB(A) (day 07.00-19.00)*					
Year	55-60	60-65	65-70	70-75	>75	Totaal
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**

* Calculated with INM 7.0b

Figure 17: Evolution of the surface area inside the L_{day} contours (2000, 2006-2017).

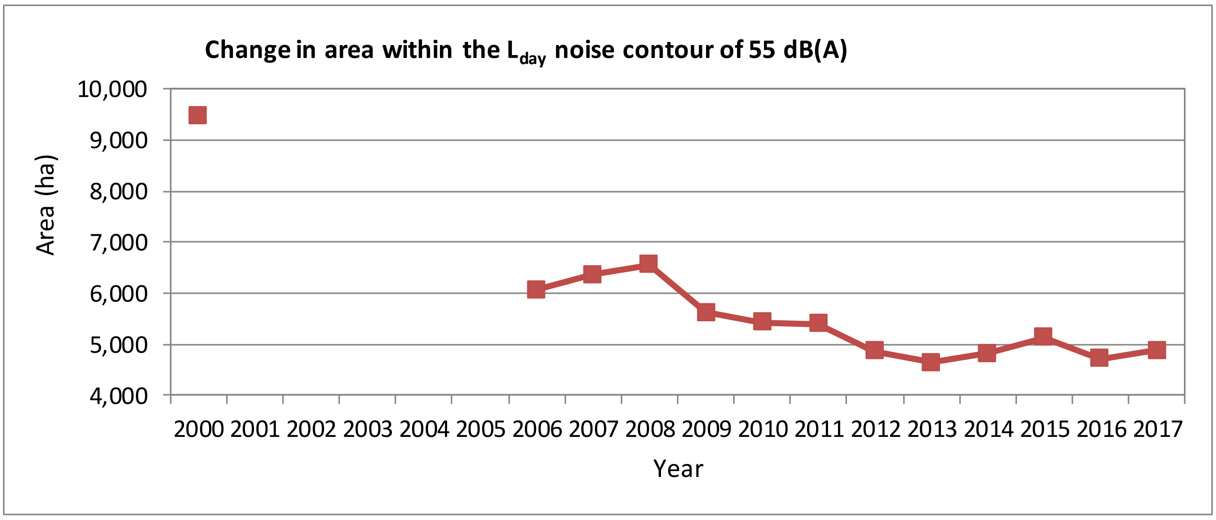


Table 33: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2017).

Area (ha)	$L_{evening}$ contour zone in dB(A) (evening 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**

* Calculated with INM 7.0b

Figure 18: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2017).

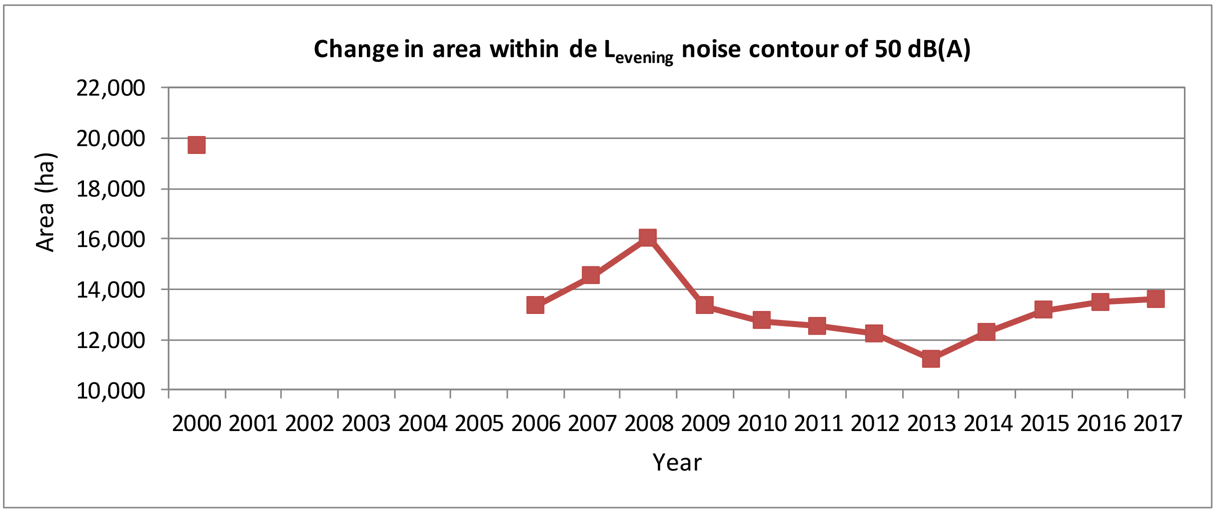


Table 34: Evolution of the surface area inside the L_{night} contours (2000, 2006-2017).

Area (ha)	L_{night} contour zone 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**

* Calculated with INM 7.0b

Figure 19: Evolution of the surface area inside the L_{night} contours (2000, 2006-2017).

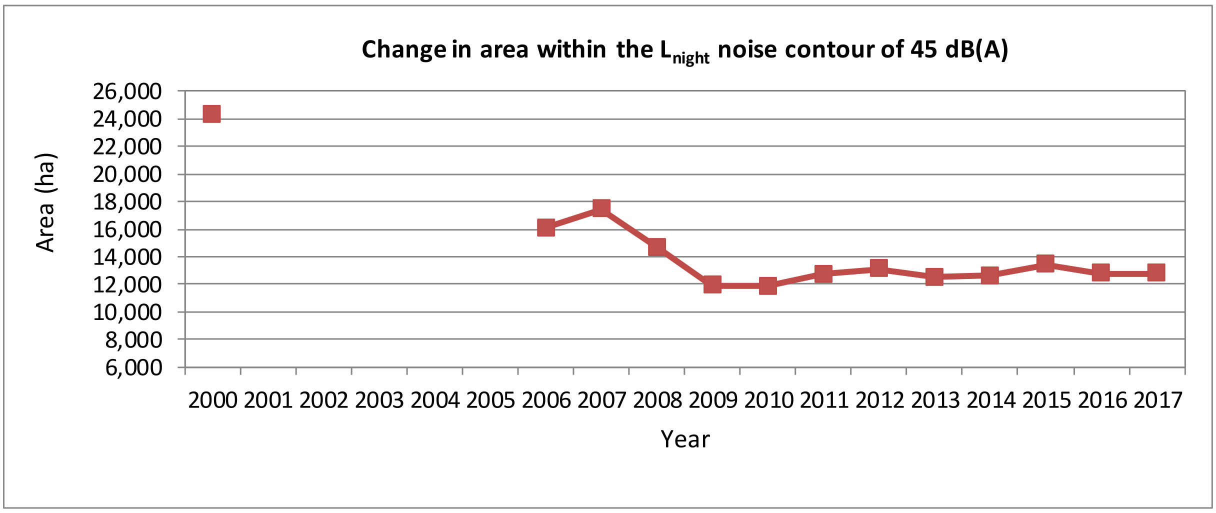


Table 35: Evolution of the surface area inside the L_{den} contours (2000, 2006-2017).

Area (ha)	L_{den} contour zone in dB(A) (d. 07-19, ev. 19-23, n. 23-07)*					
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**

* Calculated with INM 7.0b

Figure 20: Evolution of the surface area inside the L_{den} contours (2000, 2006-2017).

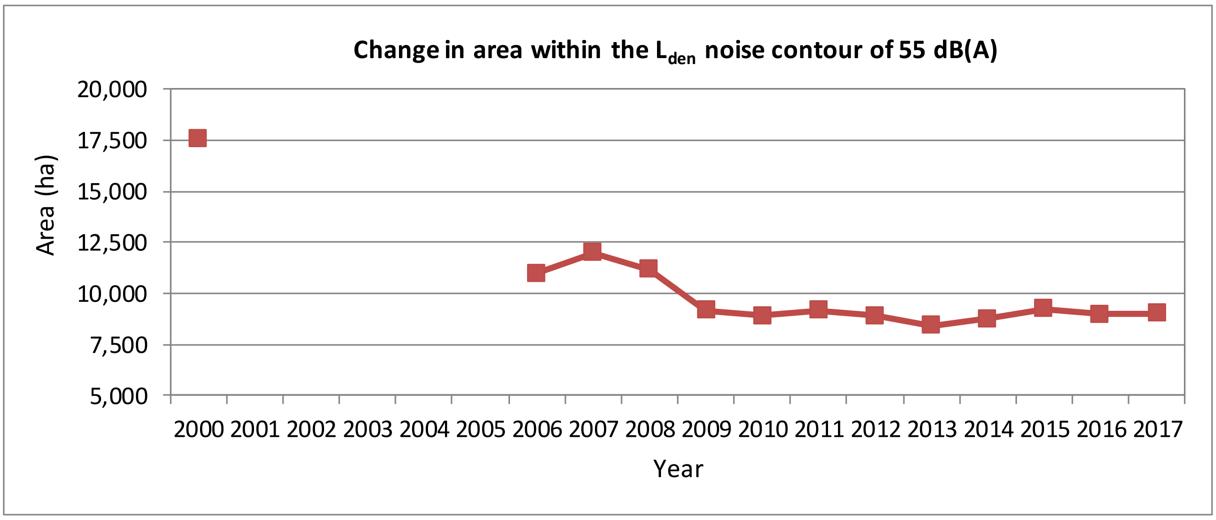


Table 36: Evolution of the surface area inside the Freq.70, day contours (2000, 2006-2017).

Area (ha)	Freq.70,day contour zone (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**

* Calculated with INM 7.0b

Figure 21: Evolution of the surface area inside the Freq.70, day contours (2000, 2006-2017).

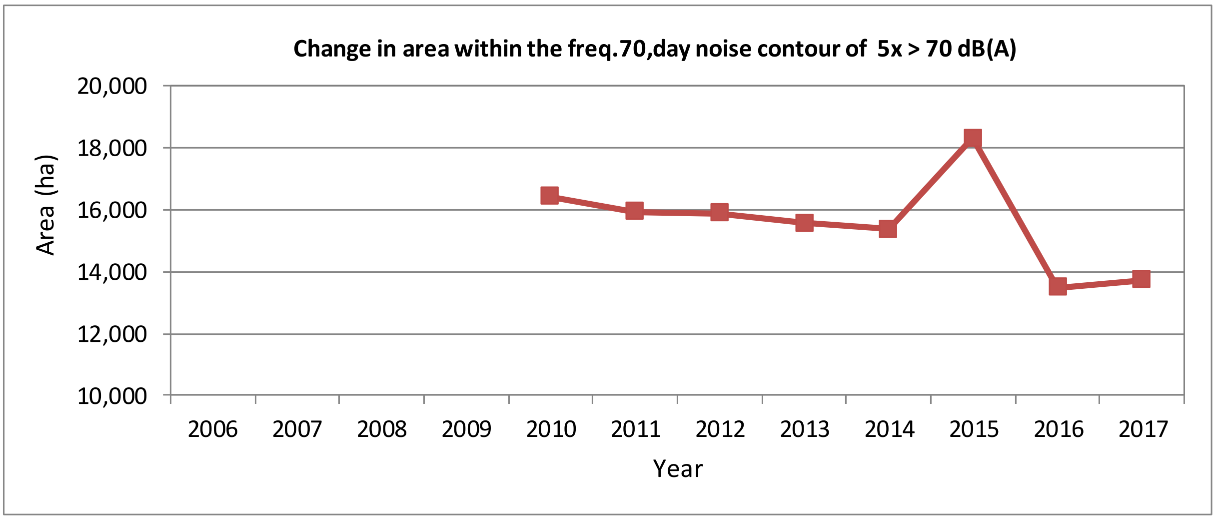


Table 37: Evolution of the surface area inside the Freq.70, night contours (2000, 2006-2017).

Area (ha)	Freq.70,night contour zone (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**

* Calculated with INM 7.0b

Figure 22: Evolution of the surface area inside the Freq.70, night contours (2000, 2006-2017).

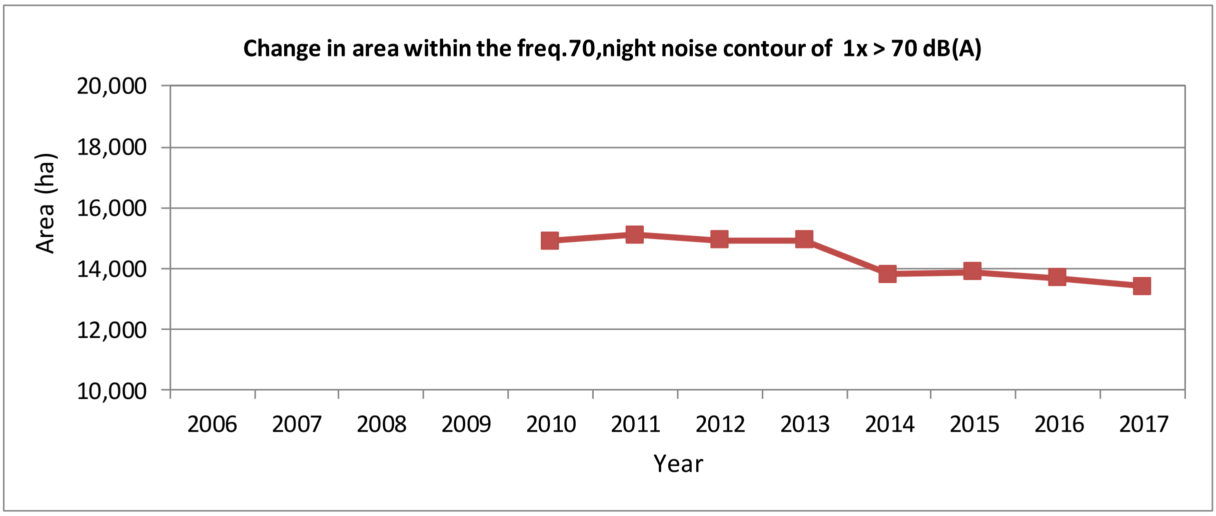


Table 38: Evolution of the surface area inside the Freq.60, day contours (2000, 2006-2017).

Area (ha)	Freq.60,day contour zone (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**

* Calculated with INM 7.0b

Figure 23: Evolution of the surface area inside the Freq.60, day contours (2000, 2006-2017).

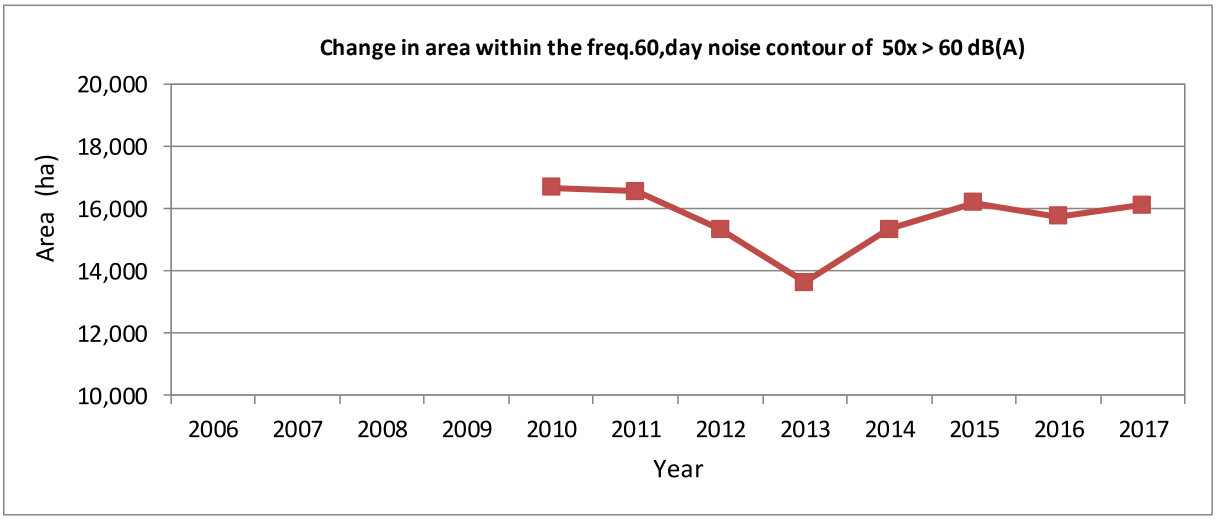
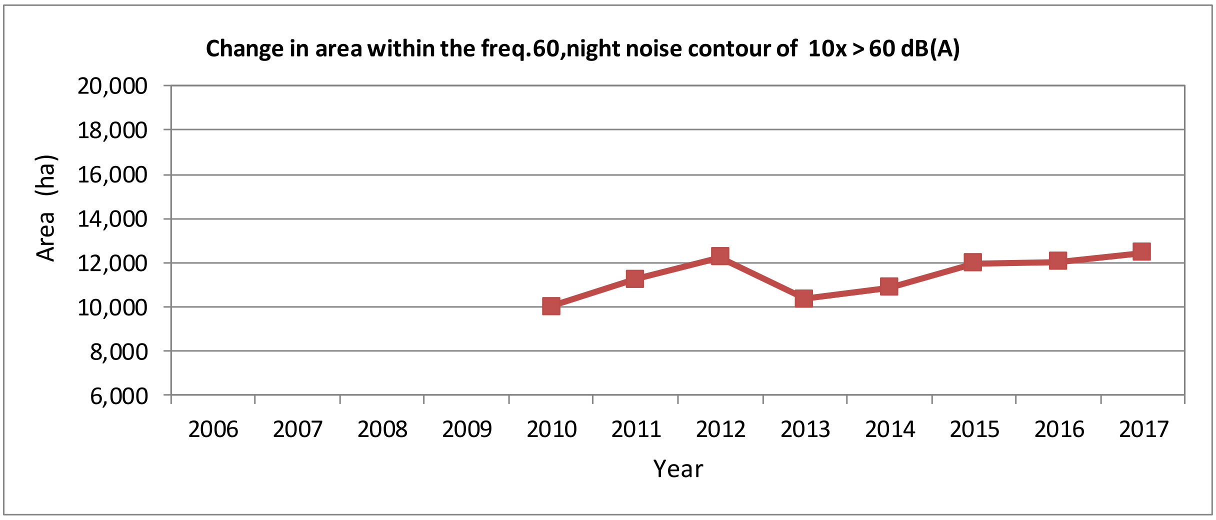


Table 39: Evolution of the surface area inside the Freq.60, night contours (2000, 2006-2017).

Area (ha)	Freq.60,night contour zone in dB(A)*				
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**

* Calculated with INM 7.0b

Figure 24: Evolution of the surface area inside the Freq.60, night contours (2000, 2006-2017).



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

Table 40: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2017).

Number of inhabitants		L_{day} contour zone 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**	01jan16	21,950	9,003	3,108	0	0	**34,062**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 25: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2017).

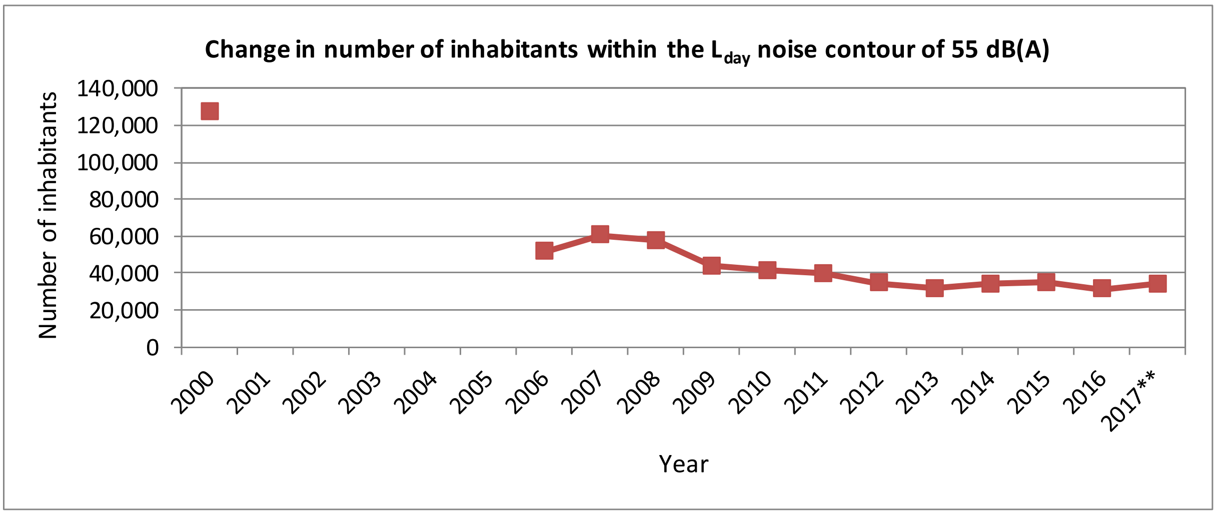


Table 41: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2017).

Number of inhabitants		$L_{evening}$ contour zone 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**	01jan16	206,220	26,880	9,055	3,173	5	0	**245,334**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 26: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2017).

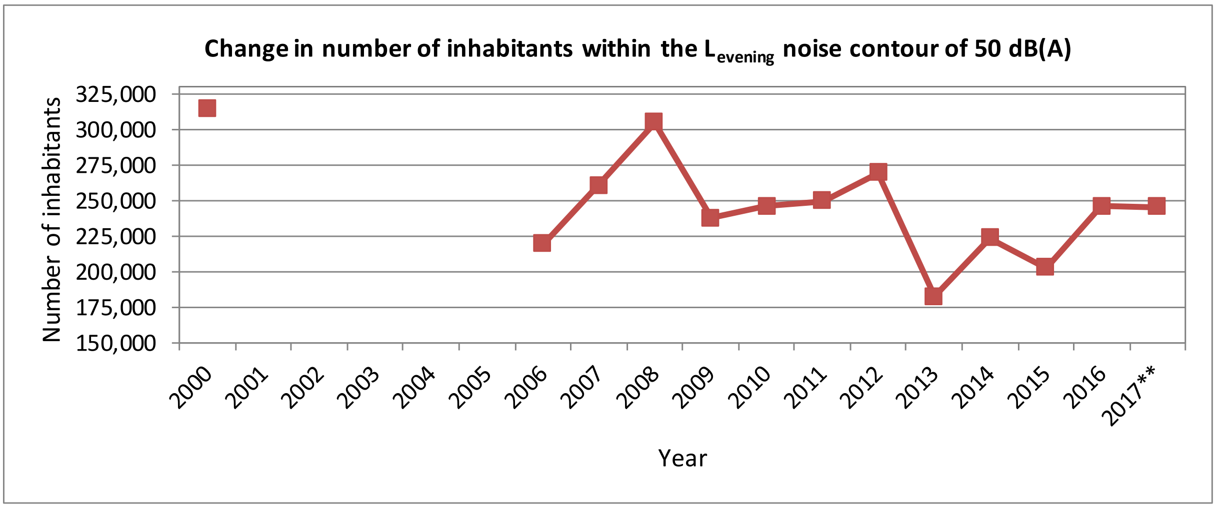


Table 42: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2017).

Number of inhabitants		L_{night} contour zone 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**	01jan16	106,964	27,127	7,484	469	66	0	**142,110**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 27: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2017).

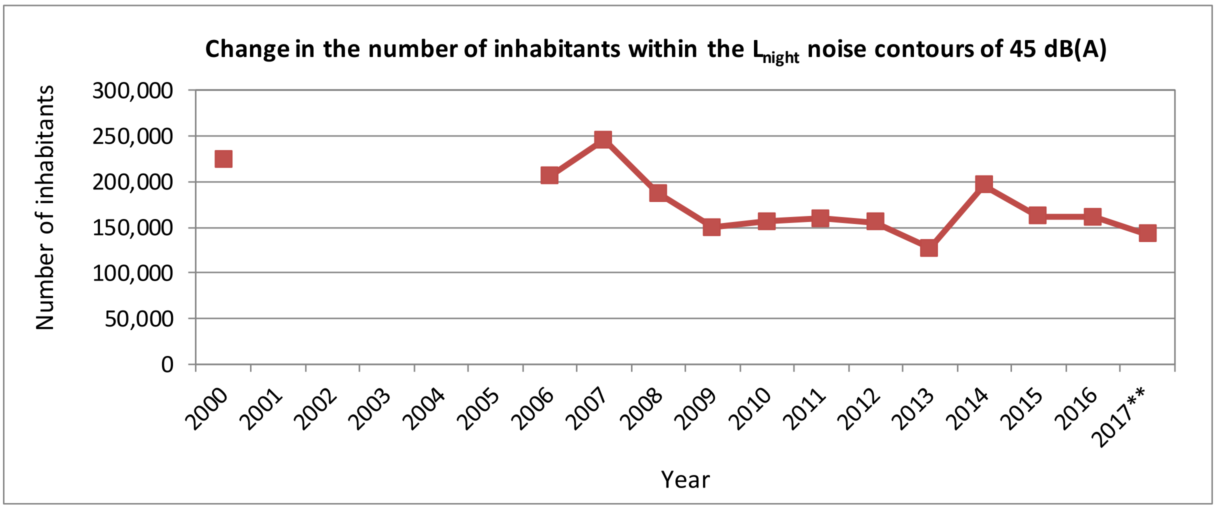


Table 43: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2017).

Number of inhabitants		L_{den} contour zone in dB(A) (d. 07-19, ev. 19-23, n. 23-07)*					
Year	**Population data**	**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**	01jan16	70,139	17,645	5,264	257	0	**93,305**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 28: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2017).

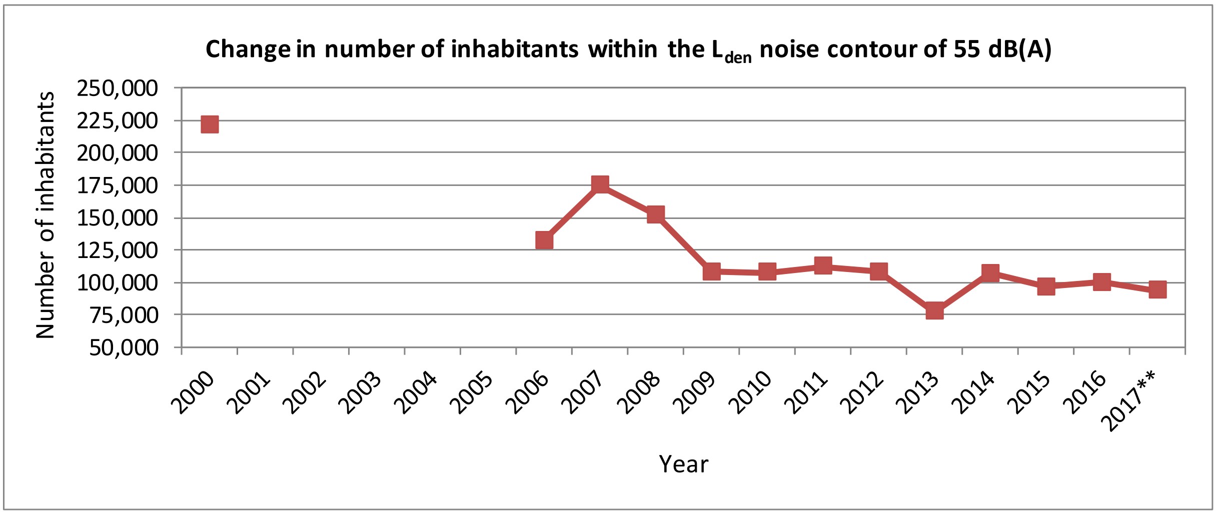


Table 44: Evolution of the number of residents inside the Freq.70, day contours (2000, 2006-2017).

Number of inhabitants		Freq.70,day contour zone (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**	01jan16	111,019	92,035	40,125	10,365	12,694	**266,238**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 29: Evolution of the number of residents inside the Freq.70, day contours (2000, 2006-2017).

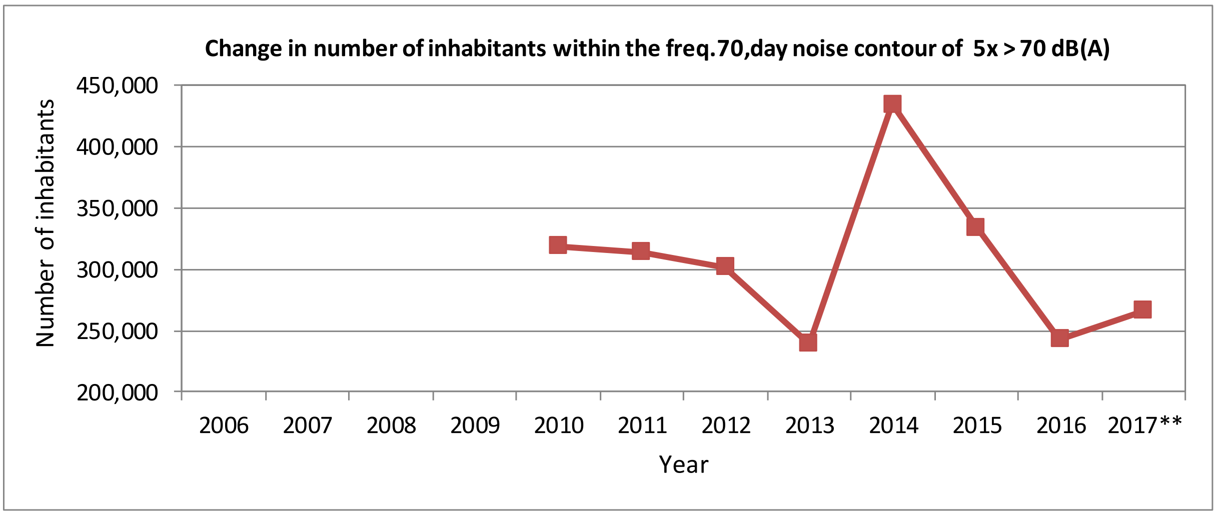


Table 45: Evolution of the number of residents inside the Freq.70, night contours (2000, 2006-2017).

Number of inhabitants		Freq.70,night contour zone (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**	01jan16	155,257	19,411	14,408	5,854	0	**194,930**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 30: Evolution of the number of residents inside the Freq.70, night contours (2000, 2006-2017).

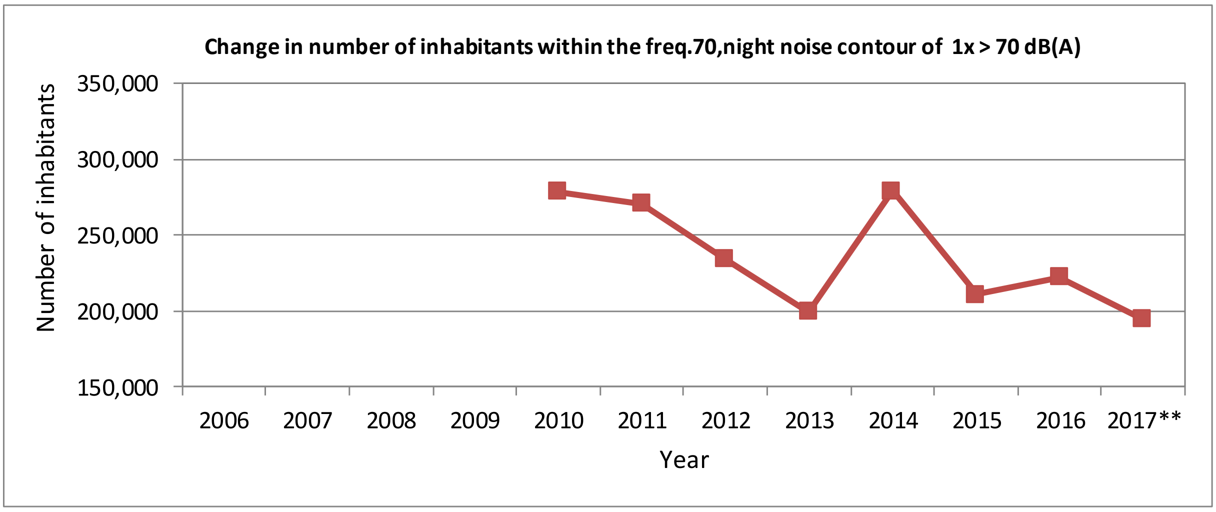


Table 46: Evolution of the number of residents inside the Freq.60, day contours (2000, 2006-2017).

Number of inhabitants		Freq.60,day contour zone (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**	01jan16	174,069	62,701	9,661	22,736	**269,167**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 31: Evolution of the number of residents inside the Freq.60, day contours (2000, 2006-2017).

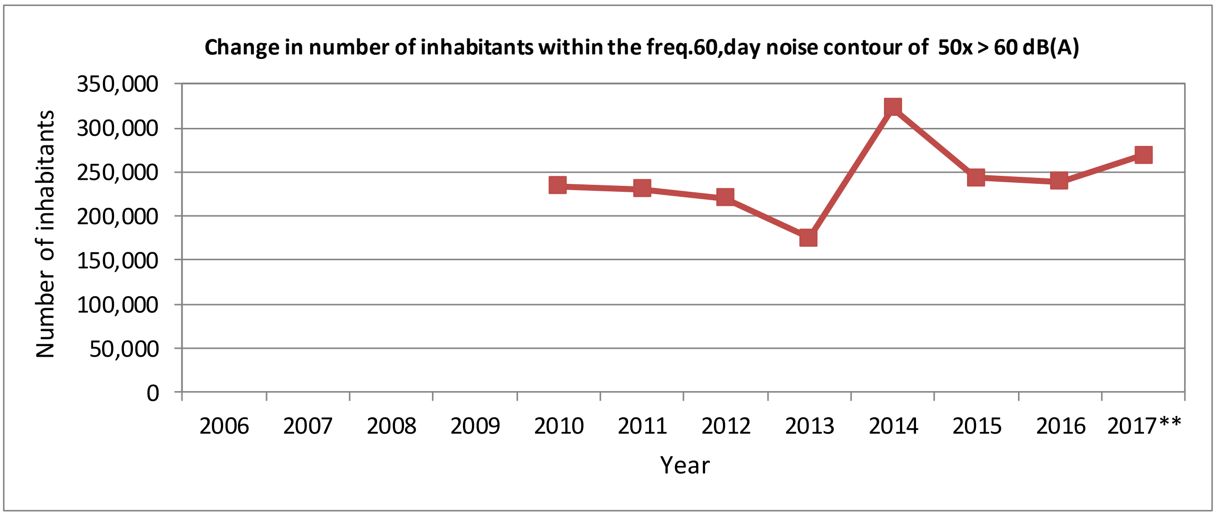
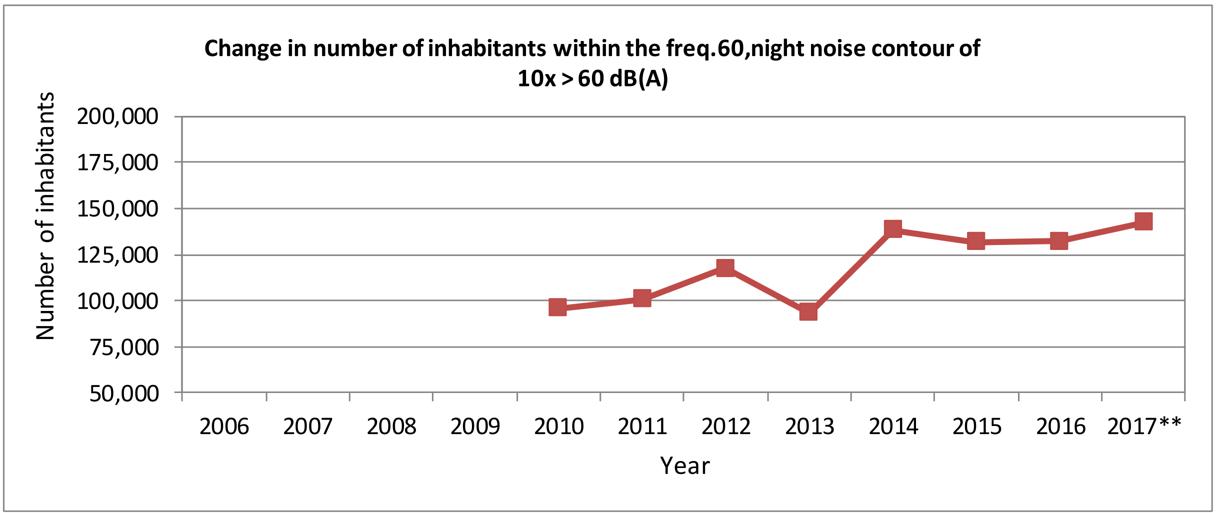


Table 47: Evolution of the number of residents inside the Freq.60, night contours (2000, 2006-2017).

Number of inhabitants		Freq.60,night contour zone 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**	01jan16	93,532	15,687	23,488	9,538	**142,245**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 32: Evolution of the number of residents inside the Freq.60, night contours (2000, 2006-2017).



5.7 Documentation provided files

Radar data for the year 2017 (source: BAC-ANOMS)

2017-01_ops.csv … 2017-12_ops.csv	10/01/2018	580721 kB … 514689 kB

Flight data for the year 2017 (source: BAC-CDB)

cdb_2017_01_12_missing_field.txt	10/01/2018	63811 kB

Weather data for the year 2017 (source: BAC-ANOMS)

2017_meteo.xlsx	23/01/2018	1717 kB

Noise events for the year 2017 (source: BAC-ANOMS)

2017-01_events.xlsx	23/01/2017 10:38	7517 KB
2017-02_events.xlsx	23/01/2017 10:38	7634 KB
2017-03_events.xlsx	23/01/2017 10:38	9151 KB
2017-04_events.xlsx	23/01/2017 10:38	8626 KB
2017-05_events.xlsx	23/01/2017 10:38	9432 KB
2017-06_events.xlsx	23/01/2017 10:38	9061 KB
2017-07_events.xlsx	23/01/2017 10:38	9109 KB
2017-08_events.xlsx	23/01/2017 10:38	9204 KB
2017-09_events.xlsx	23/01/2017 10:38	10296 KB
2017-10_events.xlsx	23/01/2017 10:38	9851 KB
2017-11_events.xlsx	23/01/2017 10:38	9303 KB
2017-12_events.xlsx	23/01/2017 10:38	9013 KB

1 h reports noise measuring network for the year 2017 (source: BAC-ANOMS / LNE)

uur-rapporten_2017-01&02&03.xlsx	23/01/2018 10:38	4498 KB
uur-rapporten_2017-04&05&06.xlsx	23/01/2018 10:38	4634 KB
uur-rapporten_2017-07&08&09.xlsx	23/01/2018 10:38	4696 KB
uur-rapporten_2017-10&11&12.xlsx	23/01/2018 10:38	4659 KB
status_LNE_2017.xls	22/02/2018 09:15	1929 KB

24 h reports noise measuring network for the year 2017 (source: BAC-ANOMS)