Noise Contours around Brussels Airport for the Year 2016

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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 calculation according to a strictly regulated methodology (see 1.2) to reflect the evolutions of the number of movements and fleet changes, and also the actual usage of runways for take-off and landing. Weather conditions and coincidental events also affect this actual usage. 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. Since 2015, this assignment has been assumed by the WAVES research group of the Ghent University (UGent). The calculations are commissioned by the airport operator which is currently Brussels Airport Company.

1.1 Disclaimer

This assignment is performed by recognized 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 recognized 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 current Flemish environmental legislation and the legislation of the Brussels-Capital Region and is not suitable to be use 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 judgement 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 license 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 Lden 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 meters

guideline, the noise contours reports are calculated officially according to the breakdown of the day in the guideline (day: 07:00 – 19:00; evening: 7:00 PM – 23:00; night: 23:00 – 7:00 AM). 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. Based on inquiries with the Office for Statistics and Economic Information (also called National Institute for Statistics), these data for the year 2016 were revealed to be the population figures as of 1 January 2011.

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 5.6.

1.7 INM Studiy results

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

- UGENT_EBBR16_INM_studie.zip (the INM study used)
- UGENT_EBBR16_geluidscontouren.zip (the calculated contours in shape format)

[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

- UGENT_EBBR16_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 characterized 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

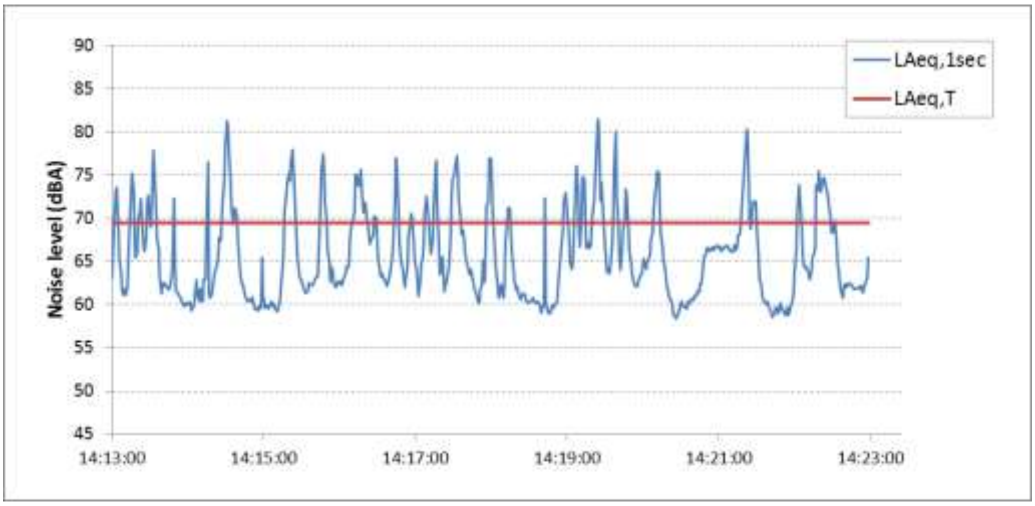
A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

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

The noise caused by overflying aircraft is not a constant noise, but has the characteristic of rising sharply to a maximum level and thereafter declining sharply again. 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 1).

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

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

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

- 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 L_{den}

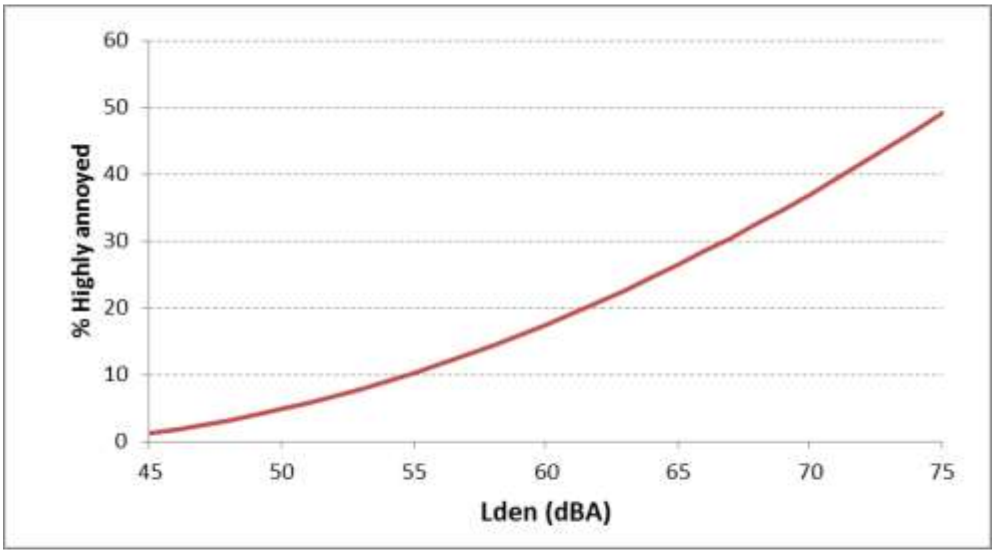
The European directive on the control and assessment of environmental noise (transposed in VLAREM 2), recommends using the Lden parameter to determine the annoyance over a longer period. The L_{den} (**L**evel **D**ay-**E**vening-**N**ight) is the A-weighted equivalent sound pressure level over 24 hours, 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 Lden 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 severely inconvenienced within the L_{den} noise contour of 55 dB(A). This equation shows the percentage of the population that is severely inconvenienced by the noise impact expressed in L_{den} (Figure 2).

% severely 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 2: Percentage of people who are potentially severely inconvenienced due to Lden 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. Personal sensitivity and difference in spectro-temporal composition of the exposure mean that at specific places and for specific persons, the inconvenience can be both higher and lower.

[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

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 the 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. Runway usage and flight paths depend on the time of day and are influenced by weather conditions: taking off and landing is with maximum headwind to increase the lift of the wings. This AIP documentation may change over time.

3.1.1 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 standardized 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 0.8 %).

3.1.2 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 results in an enormously 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.

3.1.3 Meteorological data

For the calculation of the contours for 2016, 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 2016 are:

- Average headwind (annual average across all runways, take-off and landing): 4.4 kn
- Average temperature: 11.9 °C or 53.4 °F.
- Average headwind per runway:
  - 25R: 4.7kn.
  - 25L: 4.7kn.
  - 07R: 4.2kn.
  - 07L: 4.3kn.
  - 19: 4.0kn.
  - 01: 3.9kn.

3.1.4 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 co-ordinates 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 deviations are removed from the measurements as much as possible, their contribution to the measurements recorded cannot always be avoided.

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 9 and tolerance 0.5 within a grid from 8 nmi[8] 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.

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[8] 1 nmi (nautical mile) = 1.852 km (kilometre)

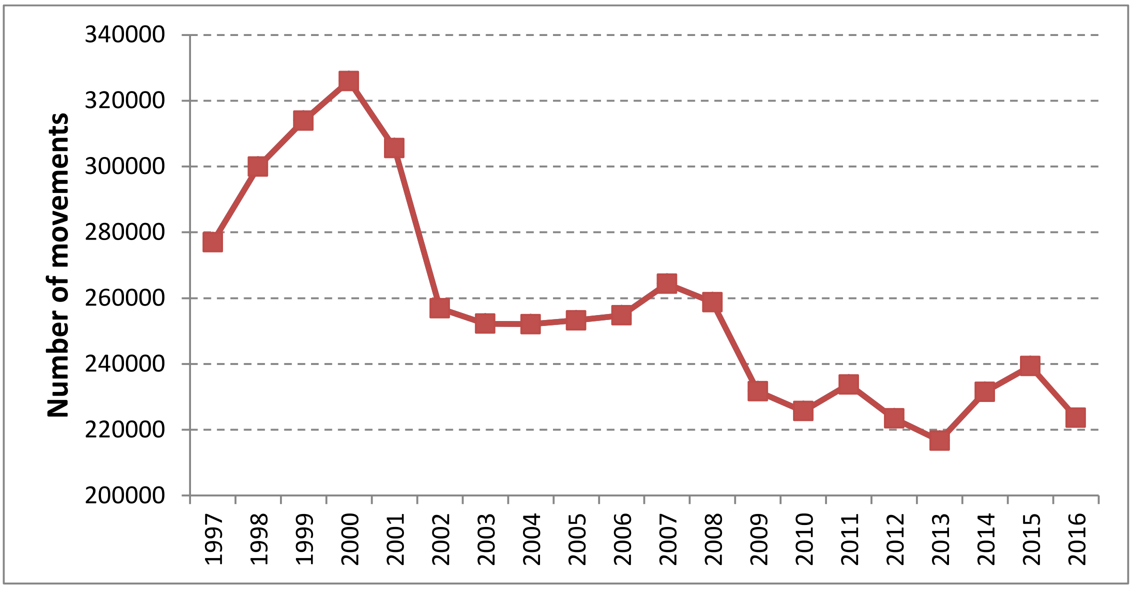
4 Results

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.

Figure 3: Evolution of flight traffic (all movements) at Brussels Airport.



The number of night-time movements (23:00-06:00) declined in 2016 by 4.7% from 16,521 in 2015 to 15,751 (including 4,941 take-offs) in 2016. This includes helicopter movements and the movements exempt from slot co-ordination such as government flights, military flights, etc.

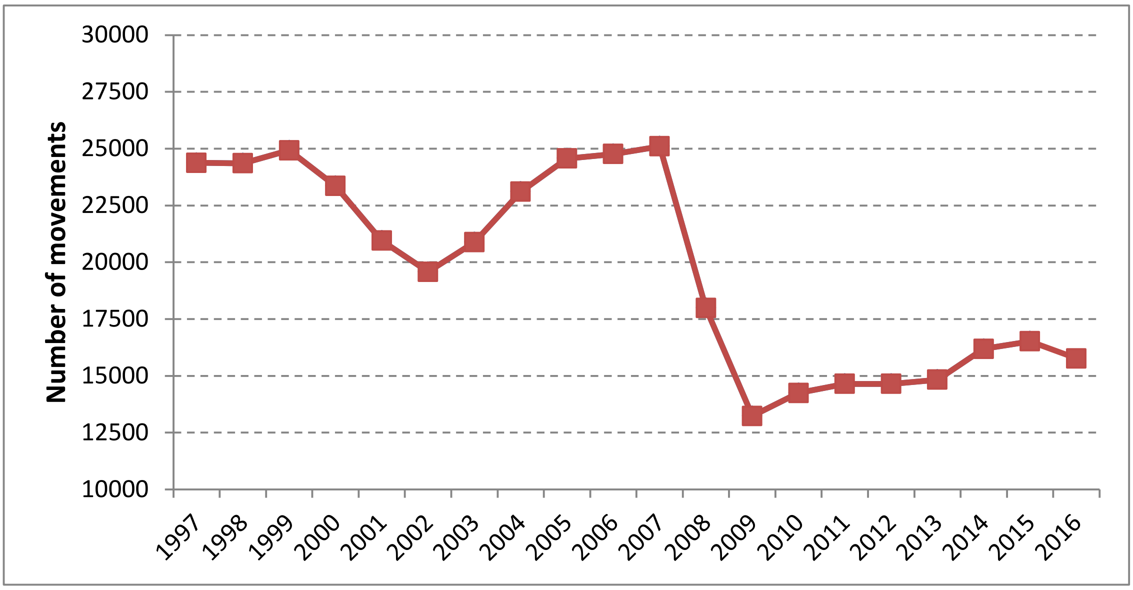
In 2016, the number of assigned night slots[9] for aircraft movements remained at 15,140, including 4,457 for departures, within the limitations imposed on the slot coordinator of Brussels Airport who since 2009 has been authorized to distribute a maximum of 16,000 night slots, of which a maximum of 5,000 may be allocated to departures (MD 21/01/2009, official amendment to the environmental

[9] night slot: permission given by the co-ordinator 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;

permit). There were 157 exempted movements with helicopters and 208 exempted movements with aircraft during the night period (23:00-06:00).

The number of movements during the operational day period (06:00 to 23:00) dropped by 6.7% from 222,828 in 2015 to 207,937 in 2016.

Figure 4: 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 2016, the data for 2015 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 2016 and the change vs.2015 (VLAREM division of the day).

	2015			2016			Relative change versus 2014		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	80,036	80,219	160,255	74,207	74,053	148,260	-7.3%	-7.7%	-7.5%
evening (19:00 - 23:00)	26,188	25,681	51,869	25,215	25,412	50,627	-3.7%	-1.0%	-2.4%
night (23:00 - 07:00)	13,456	13,769	27,225	12,426	12,375	24,801	-7.7%	-10.1%	-8.9%
00:00 - 24:00	119,680	119,669	239,349	111,848	111,840	223,688	-6.5%	-6.5%	-6.5%
06:00 - 23:00	108,140	114,688	222,828	101,038	106,899	207,937	-6.6%	-6.8%	-6.7%
23:00 - 06:00	11,540	4,981	16,521	10,810	4,941	15,751	-6.3%	-0.8%	-4.7%
06:00 - 07:00	1,916	8,788	10,704	1,616	7,434	9,050	-15.7%	-15.4%	-15.5%

The general decline of 6.5% in the number of movements on annual basis between 2015 and 2016 manifests itself largely in the day period (- 7.5%) and night period (- 8.9%). During the evening period, this decline is less pronounced (-2.4%).

The number of departures during the night for which contours have been calculated (23:00 - 07:00) has declined by 10.1%. Between 23:00 and 06:00 is this only 0.8%; between 06:00 and 07:00 15.4%. The night departures (23:00 to 06:00) are mainly performed by DHL and have suffered little impact from the attacks on the airport. The impact of the attacks on the passenger flights between 06:00 and 07:00 is significant.

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 Evolution of the movements per month for day, evening and night

The attack on the airport on 22 March 2016 not only demanded a major human loss but also had an important impact on the aircraft movements in 2016. The total number of flights has decreased and that can primarily be attributed to the strong decline of the operations after the attacks. In the overview on year basis, it was already visible that the average number of flights during the evening period declined less sharply than the annual average; 3.7% for the landings and only 1.0% for departures. This will be studied further in an evaluation based on the movements per month (see Table2). The strong increases are accented in orange, the strong decline outside the two months with partial closure of the airport in green.

The impact of the attacks was greatest in March, April. (These months are accented in grey in the table.) The decrease in the number of flights in March correspond to one week complete closure in the month of March (25%). In April, the decrease is approximately 42% during the day and slightly less during the evening and night (26% and 36%). The number of aircraft movements resumed relatively quickly the level of before the attack (June and July) but there are nevertheless clear differences for the different periods of the day.

Table2: Evolution of the number of movements in 2016 compared to 2015 according to Vlarem 2 division of day (day, evening, night) broken down per month.

	Landings			Departures		
	evolution 2015 - 2016			evolution 2015 - 2016		
	Day	Evening	Night	Day	Evening	Night
Jan	0.3%	9.1%	-14.0%	1.5%	3.2%	-8.2%
Feb	-0.9%	7.2%	-2.8%	1.5%	1.0%	-5.1%
Mar	-26.7%	-25.2%	-31.9%	-26.6%	-28.9%	-22.9%
Apr	-42.2%	-36.2%	-26.1%	-42.5%	-30.4%	-36.6%
May	-2.6%	2.9%	-10.4%	-3.2%	5.9%	-13.2%
Jun	-7.6%	-3.2%	-2.8%	-7.3%	2.3%	-11.9%
Jul	-3.5%	0.7%	-5.6%	-4.1%	6.0%	-11.0%
Aug	0.6%	1.9%	-8.2%	-2.9%	13.3%	-6.8%
Sep	-2.0%	-1.6%	-1.5%	-2.0%	4.8%	-12.0%
Oct	-3.3%	-0.5%	0.1%	-4.4%	6.5%	-6.5%
Nov	-1.6%	-2.5%	3.0%	-2.8%	-3.1%	11.6%
Dec	0.8%	3.1%	6.5%	-0.3%	4.6%	12.4%

Arrivals

During the day there is a slight decline over the whole year. For the evening, there was a strong increase before the attacks and after the attacks the number of flights very quickly reached the level of 2015 (see light blue cells) but no longer showed the strong increase in comparison with the two months before the attacks.

Departures

From May 2015, the number of departures during the evening is almost systematically higher than the number of departures in the same months in 2015 (orange in the table).

4.1.2.2 Fleet changes during the operational night

The most frequently used aircraft during the operational night period (23:00 - 06:00) in 2016 was the A320 (15.4% of the movements in 2016), following by the B752 (14.6%). The B734 increases strongly (from 5.5% to 12.2%). The A306 has a relatively smaller share than the B734 (from 8.9% to 10.7%) but increases in absolute figures (1466 to 1682). This is followed by the B738 (8.8%, increasing share) and the A319 (7.6%, declining share). This is the reverse movement in comparison with the evolution of 2014 to 2015. This is followed by the A333 and the B763 with respectively 7.0% and 6.1%.

The ratio is clearly different for departures during the operational night. The B752 is the aircraft that takes off the most frequently (22.9%), followed by the B734 (17.7%), the A306 (16.6%). The B734 and A306 both increase but the B734 has a greater share in 2016 than the A306 (increases from 274 to 873 departures). The B738 shows a decline of 82% (458 to 81 movements) and also the ATP drops by 33%.

The number of movements in the year 2016 involving aircraft with an MTOW in excess of 136 tons (heavy aircraft) during the operational night period is 4,459, an increase of 9.9% compared to 2015 (4,056 movements). This is a continuation of the rising trend that was concluded in the previous report (3,422 movements in 2014). Departures of heavy aircraft most frequently involve the A306 (from 720 to 818), the B763 (from 480 to 493) and the B77L (from 157 to 167). The evolution of the most frequently used aircraft types during the operational night period are set out in Table3 (heavy aircraft) and Table4 (lighter aircraft).

Table3: Evolution of the number of flight movements per aircraft type during the operational night period (23:00-06:00) for the (MTOW > 136 tons) aircraft types.

	Landings				Departures			
MTOW > 136 ton	2015	2016	Evolution	Evolution (%)	2015	2016	Evolution	Evolution (%)
A333	858	1103	245	29%	3	0	-3	-100%
A306	746	864	118	16%	720	818	98	14%
B763	518	472	-46	-9%	480	493	13	3%
A332	379	339	-40	-11%	8	61	53	663%
B744	40	38	-2	-5%	14	18	4	29%
B772	3	0	-3	-100%	1	0	-1	-100%
A310	4	1	-3	-75%	4	1	-3	-75%
B788	29	59	30	103%	0	8	8	
B748	9	0	-9	-100%	9	1	-8	-89%
A343	4	0	-4	-100%	4	3	-1	-25%
DC10	1	0	-1	-100%	0	0	0	
B762	22	0	-22	-100%	23	1	-22	-96%
B77W	2	2	0	0%	0	1	1	
C17	3	2	-1	-33%	3	0	-3	-100%
B77L	9	3	-6	-67%	157	167	11	7%

Table4: 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	2015	2016	Evolution	Evolution (%)	2015	2016	Evolution	Evolution (%)
A320	2711	2037	-674	-25%	486	394	-92	-19%
B738	987	1212	225	23%	142	173	31	22%
B752	1299	1166	-133	-10%	1282	1132	-150	-12%
A319	1320	1120	-200	-15%	154	73	-81	-53%
B734	638	1044	406	64%	274	873	599	219%
B737	284	239	-45	-16%	13	10	-3	-23%
E190	285	198	-87	-31%	5	17	12	240%
RJ1H	93	169	76	82%	26	28	2	8%
EXPL	115	107	-8	-7%	56	50	-6	-11%
B733	460	83	-377	-82%	458	81	-377	-82%
B463	10	82	72	720%	1	1	0	0%
ATP	209	73	-136	-65%	316	213	-103	-33%
A321	169	42	-127	-75%	113	99	-14	-12%
C56X	25	31	6	24%	10	15	5	50%
F2TH	15	25	10	67%	12	7	-5	-42%
F100	3	22	19	633%	2	2	0	0%
C130	19	20	1	5%	2	3	1	50%
FA7X	12	17	5	42%	14	14	0	0%
E145	6	17	11	183%	8	5	-3	-38%
E135	11	15	4	36%	5	13	8	160%
GLF5	6	14	8	133%	3	3	0	0%
C25A	10	11	1	10%	6	7	1	17%
F900	17	11	-6	-35%	18	9	-9	-50%
C25B	7	10	3	43%	2	3	1	50%
LJ45	6	10	4	67%	8	10	2	25%
C510	15	10	-5	-33%	11	5	-6	-55%

4.1.2.3 Runway and route usage

<u>Preferential route usage</u>

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 2016 (see Table5).

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 density, 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 for gusts is 7 kt and the maximum crosswind is 20 kt. In the event of alternative runway usage, the maximum speeds for gusts are also 20 kt for crosswind but only 3 kt for tailwind.

Table5: Preferential runway usage since 19/09/2013 (local time) (source: AIP 10/12/2015 to 08/12/2016)

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Day</td><td>Night</td></tr>
<tr><td>06:00 to 15:59</td><td>4:00 PM to 10:59 PM</td><td>11:00 PM to 5:59 AM</td></tr>
<tr><td rowspan="2">Mon, 06:00 – Tues 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19(1)</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L(2)</td></tr>
<tr><td rowspan="2">Tues, 06:00 – Wedn 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19(1)</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L(2)</td></tr>
<tr><td rowspan="2">Wedn, 06:00 – Thurs 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19(1)</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L(2)</td></tr>
<tr><td rowspan="2">Thurs, 06:00 – Fri 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19(1)</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L(2)</td></tr>
<tr><td rowspan="2">Fri, 06:00 – Sat 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R(3)</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R</td></tr>
<tr><td rowspan="2">Sat, 06:00 – Sun 05:59</td><td>Departure</td><td>25R</td><td>25R/19(1)</td><td>25L(4)</td></tr>
<tr><td>Landing</td><td>25L/25R</td><td>25R/25L(2)</td><td>25L</td></tr>
<tr><td rowspan="2">Sun, 06:00 – Mon 05:59</td><td>Departure</td><td>25R/19(1)</td><td>25R</td><td>19(4)</td></tr>
<tr><td>Landing</td><td>25R/25L(2)</td><td>25L/25R</td><td>19</td></tr>
</table>

(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.

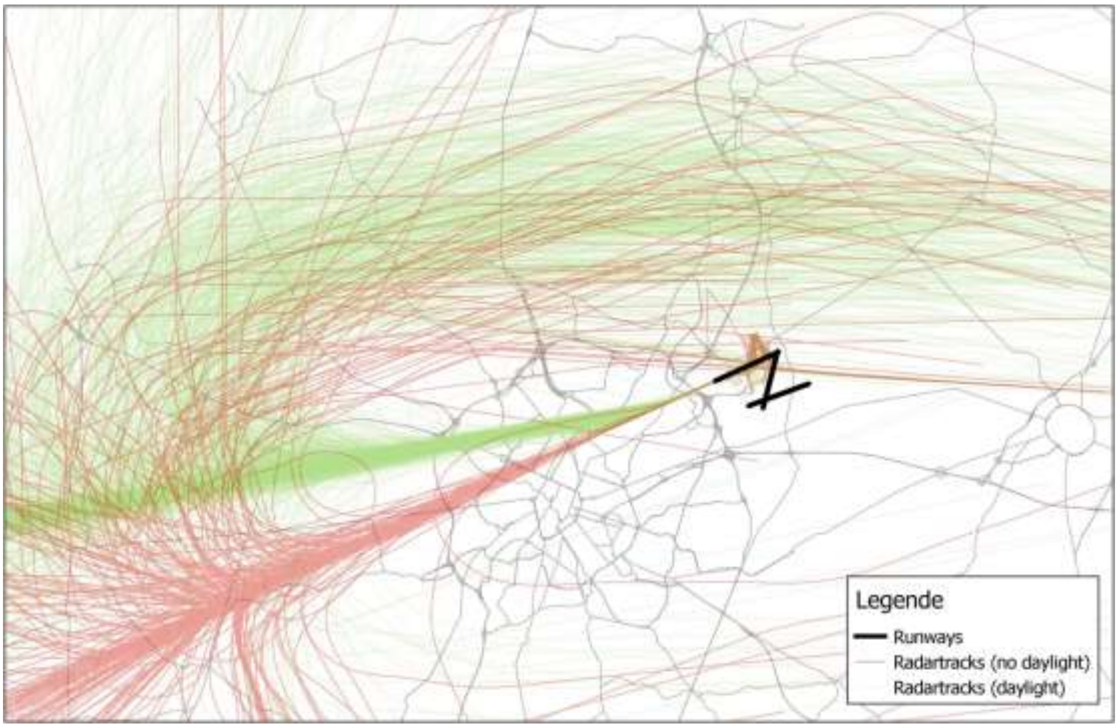
Runway usage

The major maintenance work to runway 25L-07R during the period 27 May 2015 to 19 August 2015 had a strong influence on runway usage in the year 2015. During this work, the landings that under normal circumstances would be handled on runway 25L were shifted to runway 25R, while a section of the departures from this runway 25R were in turn shifted to runway 19. This meant that the portion of departures on runway 25R dropped significantly from 82% in 2014 to 73% in 2015. For 2016, this portion rose again to 81%. The shift in the use of the landing runways that was set for the year 2015 by this work (42% on runway 25L, 40% on runway 25R in 2015 compared to 55% on runway 25L and 27% on runway 25R in the year 2014) was reversed in the year 2016 (53% on runway 25L and 29% on runway 25R).

From 26 July to 20 September 2016, the transverse runway (01/19) was renovated. Runway 19 was used as preferential runway 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. The number of departures from runway 19 was, in 2015, exceptionally high as a consequence of the renovation work to 25L (from 4,702 in 2014 to 14,444 in 2015). Since runway 25L became fully available in 2016 and additionally runway 19 was temporarily unavailable due to renovation work, the number of departures from runway 19 dropped sharply to 3,143 in 2016.

Runway 01 is used for landings in an east-westerly wind. During the period of renovation of this runway (26 July to 20 September 2016), these landings were shifted to runway 07L. The lack of an ILAS on this runway means that the aircraft normally used the VOR procedure whereby they orientate themselves on the BUB beacon that is located in the extension of runway 07R. This means that the aircraft do not fly straight on in the axis of the runway but must, at the end, make a turn to move into the extension of the runway (see green lines on figure 5). These procedures can only be used in daylight. During the renovation work, an additional procedure was published for runway 07L (PBN approach) that could be used in the periods without daylight. In this procedure, whereby use was made of satellite navigation, the aircraft farther from the airport already flew in the axis of the runway (see red lines on figure 5). In total, 252 flights made use of this procedure. Note that this operational situation (landing on runway 07L) can also arise in a strong south-easterly wind. If the cross wind is too strong, runway 01/19 is not available and landings are also made on 07L. In May 2016, such meteorological conditions forced Belgocontrol on several occasions to direct landings to runway 07L. In total, the number of landings on runway 07L rose from 2,814 in 2015 to 4,202 in 2016.

Figure 5: radar tracks of the flights that landed on 07L during the renovation of runway 01/19.



A complete overview of runways used in 2016 is included in appendix 5.1.

Changes in the SIDs

On 2/4/2015, several changes were made to the SIDs of runways 25R/25L as a result of a moratorium imposed by the Federal Government, and the situation was rolled back to that of 6/2/2014. No physical modifications to the SIDs took place in 2016. The nomenclature of the SIDs has been modified by a shift of the magnetic north. There were no significant modifications identified in the distribution of the aircraft over the various routes.

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 minimize 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. 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 99.7 % across all measuring stations. This is comparable with 2015. 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 Grimbergen (NMT13-1), but this is still 96.5 %.

The comparison between calculations and measurements based on the $LAeq_{,24h}$ shows that the discrepancy between the calculated value and the measured value for all the measuring stations, except NMT01-2 (Perk), and after exclusion of the measuring points NMT01-2, NMT 15-3 and NMT 23-1 (see previous paragraph) remains limited to 2 dB(A). The measuring station Perk lies in the extension of runway 01 and in 2016 only 69 flights departure from this runway (3,430 in 2015). The resulting margin for error is large and that is reflected in the comparison between the measurements and the calculations. At 9 measuring stations, the deviation is limited to up to 0.3 dB(A). The general discrepancy between simulations and measurements is 0.9 dB(A) (root-mean-square error, RMSE). If Perk is removed from this evaluation, the RMSE drops to 0.8 dB(A).

At the height of the measuring post in Bertem (NMT48-3), no systematic aircraft passages take place any longer. This measuring station is excluded from the statistical evaluation. The overall deviation between measurements and simulations for L_{night} is slightly higher (1.4 dB(A) RMSE, excluding measuring points NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1 and NMT48-3). For 2015, this value was 1.3 dB(A). At measuring locations Perk, Grimbergen and Meise, the predicted level is too high when compared with the measurements (more than 2.0 dB(A)). The simulations show a limited linear average difference globally across all relevant measuring locations (-0.1 dB(A), excluding measuring points NMT01-2, NMT03-3, NMT 15-3, NMT23-1 and NMT 48-3.

For the noise indicator L_{den} the RMSE is 1.4 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 paragraph) are not considered, the maximum underestimation of the measurements in Kraainem appear to be 1.6 dB(A).

At the start of 2015, the threshold values for several measuring stations of BAC were modified. This meant that more noise events were identified and also more events are correlated with the radar data. These modifications decrease significantly (by more than 1 dB(A) on $L_{Aeq,24h}$) the deviations between measurements and simulations in the measuring stations at Sterrenbeek and Duisburg. Significantly worse similarities were not identified (with the exclusion of measuring station in Perk, see previous argument).

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	57.7	62.1	-4.4
NMT02-2	KORTENBERG	67.8	67.9	-0.2
NMT03-3	HUMELGEM-Airside	63.7	64.0	-0.3
NMT04-1	NOSSEGEM	62.8	61.6	1.1
NMT06-1	EVERE	51.5	50.2	1.3
NMT07-1	STERREBEEK	46.6	46.1	0.5
NMT08-1	KAMPENHOUT	54.8	54.8	0.0
NMT09-2	PERK	44.5	46.9	-2.4
NMT10-1	NEDER-OVER-HEEMBEEK	55.0	55.2	-0.2
NMT11-2	SINT-PIETERS-WOLUWE	52.4	51.3	1.1
NMT12-1	DUISBURG	46.0	45.8	0.2
NMT13-1	GRIMBERGEN	47.0	46.4	0.7
NMT14-1	WEMMEL	47.9	47.8	0.1
NMT15-3	ZAVENTEM	45.2	55.4	-10.2
NMT16-2	VELTEM	57.0	56.2	0.8
NMT19-3	VILVOORDE	52.9	52.6	0.3
NMT20-2	MACHELEN	53.2	53.8	-0.6
NMT21-1	STROMBEEK-BEVER	52.2	50.8	1.4
NMT23-1	STEENOKKERZEEL	65.1	67.7	-2.5
NMT24-1	KRAAINEM	54.3	52.7	1.6
NMT26-2	BRUSSEL	47.9	47.8	0.2
NMT40-1*	KONINGSLO	52.8	52.2	0.6
NMT41-1*	GRIMBERGEN	47.3	48.2	-0.9
NMT42-2*	DIEGEM	63.2	64.7	-1.4
NMT43-2*	ERPS-KWERPS	55.8	56.7	-0.8
NMT44-2*	TERVUREN	44.3	45.6	-1.3
NMT45-1*	MEISE	44.8	45.7	-0.8
NMT46-2*	WEZEMBEEK-OPPEM	54.8	54.1	0.7
NMT47-3*	WEZEMBEEK-OPPEM	47.5	47.6	-0.1
NMT48-3*	BERTEM	31.0	31.0	-0.1

* 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	55.6	62.3	-6.7
NMT02-2	KORTENBERG	63.3	63.6	-0.3
NMT03-3	HUMELGEM-Airside	58.7	58.8	-0.1
NMT04-1	NOSSEGEM	60.0	58.3	1.7
NMT06-1	EVERE	44.5	43.8	0.7
NMT07-1	STERREBEEK	48.4	46.8	1.6
NMT08-1	KAMPENHOUT	52.9	52.8	0.1
NMT09-2	PERK	40.0	44.6	-4.6
NMT10-1	NEDER-OVER-HEEMBEEK	51.1	50.8	0.3
NMT11-2	SINT-PIETERS-WOLUWE	47.6	46.4	1.2
NMT12-1	DUISBURG	42.6	42.2	0.4
NMT13-1	GRIMBERGEN	38.5	40.7	-2.2
NMT14-1	WEMMEL	41.9	43.5	-1.6
NMT15-3	ZAVENTEM	47.5	51.6	-4.1
NMT16-2	VELTEM	52.5	52.0	0.5
NMT19-3	VILVOORDE	49.1	48.5	0.6
NMT20-2	MACHELEN	50.3	50.3	0.0
NMT21-1	STROMBEEK-BEVER	47.5	47.1	0.4
NMT23-1	STEENOKKERZEEL	64.0	66.1	-2.1
NMT24-1	KRAAINEM	48.9	47.3	1.6
NMT26-2	BRUSSEL	45.5	44.8	0.7
NMT40-1*	KONINGSLO	48.5	48.3	0.2
NMT41-1*	GRIMBERGEN	42.4	43.5	-1.1
NMT42-2*	DIEGEM	59.2	59.5	-0.3
NMT43-2*	ERPS-KWERPS	50.5	51.9	-1.4
NMT44-2*	TERVUREN	44.1	44.0	0.1
NMT45-1*	MEISE	38.5	40.5	-2.0
NMT46-2*	WEZEMBEEK-OPPEM	49.9	49.0	0.9
NMT47-3*	WEZEMBEEK-OPPEM	48.3	47.2	1.1
NMT48-3*	BERTEM	12.9	27.2	-14.3

* 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	62.9	68.7	-5.8
NMT02-2	KORTENBERG	71.7	72.0	-0.3
NMT03-3	HUMELGEM-Airside	67.5	67.6	-0.1
NMT04-1	NOSSEGEM	67.6	66.1	1.5
NMT06-1	EVERE	54.7	53.6	1.1
NMT07-1	STERREBEEK	54.2	53.0	1.2
NMT08-1	KAMPENHOUT	60.1	60.0	0.1
NMT09-2	PERK	47.8	52.0	-4.2
NMT10-1	NEDER-OVER-HEEMBEEK	59.2	59.5	-0.3
NMT11-2	SINT-PIETERS-WOLUWE	56.3	55.1	1.2
NMT12-1	DUISBURG	50.5	50.3	0.2
NMT13-1	GRIMBERGEN	49.5	50.2	-0.7
NMT14-1	WEMMEL	51.4	52.0	-0.6
NMT15-3	ZAVENTEM	53.1	59.6	-6.5
NMT16-2	VELTEM	61.0	60.3	0.7
NMT19-3	VILVOORDE	57.2	57.0	0.2
NMT20-2	MACHELEN	57.9	58.3	-0.4
NMT21-1	STROMBEEK-BEVER	55.9	55.2	0.7
NMT23-1	STEENOKKERZEEL	70.9	73.1	-2.2
NMT24-1	KRAAINEM	58.0	56.4	1.6
NMT26-2	BRUSSEL	53.1	52.6	0.5
NMT40-1*	KONINGSLO	56.8	56.5	0.3
NMT41-1*	GRIMBERGEN	51.2	52.3	-1.1
NMT42-2*	DIEGEM	67.4	68.5	-1.1
NMT43-2*	ERPS-KWERPS	59.4	60.5	-1.1
NMT44-2*	TERVUREN	50.5	51.1	-0.6
NMT45-1*	MEISE	48.2	49.6	-1.4
NMT46-2*	WEZEMBEEK-OPPEM	58.7	57.9	0.8
NMT47-3*	WEZEMBEEK-OPPEM	54.4	53.7	0.7
NMT48-3*	BERTEM	31.6	35.3	-3.7

* 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 5.4.

The surface and the number of residents is calculated for each noise contour. On the basis of L_{den} contours, the number of potentially severely inconvenienced is calculated according to the methods described in chapter2.2. The results are available per municipality in appendix 5.3. The contours of 2015 and 2016 are compared in appendix 5.4 . Appendix 5.5 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 and 2016 is shown in Figure 7.

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 (north-eastern wind), then the combination of departures from 07R/07L and landings on 1 is generally applied.

A shift of all contours is visible to the east of Brussels Airport. Through the normal availability of runway 25L in 2016, the noise contour is again in the situation for 2015.

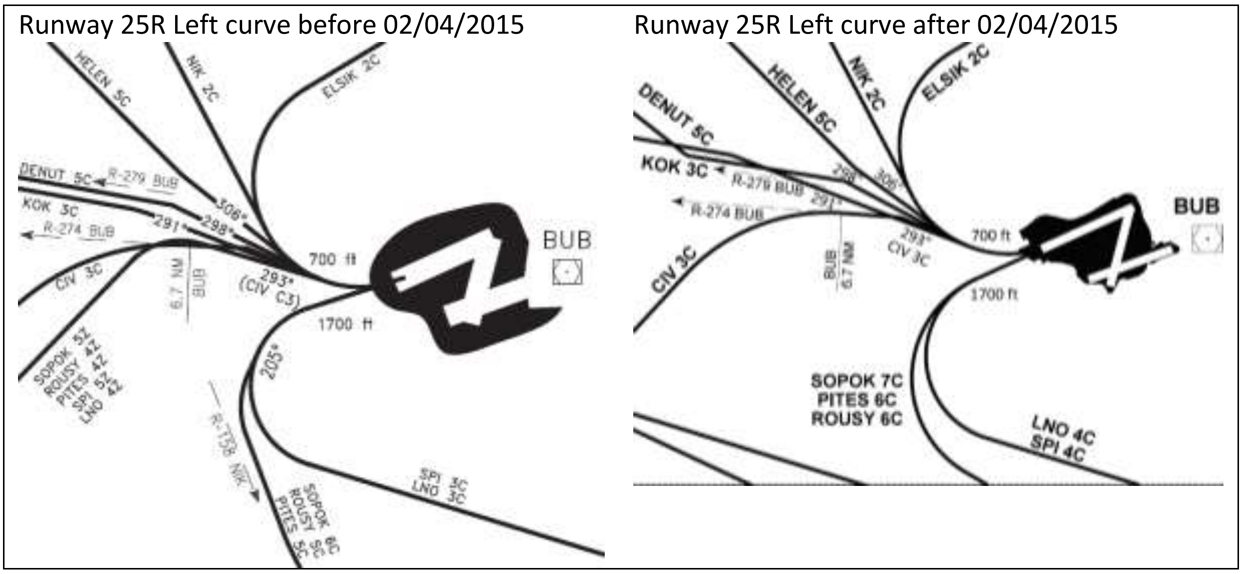
To the west of Brussels Airport, modifications are hardly visible in the contours that are consistent with levels about 60 dB(A). The shape of the contour 55 dB(A) contour changes slightly about the Brussels-Capital Region.

The number of flights that take off from runway 25R and continue straight ahead has dropped significantly compared to 2014 as a result of the moratorium imposed on 2 April 2015. The moratorium of 2 April 2015 also imposed other take-off procedures for departures from runway 25R with a turn to the left (see

Figure 6). The standard procedure (SID) now has a shorter curve for these departures. This situation is now general throughout the whole year of 2016.

The share of the departures from runway 25R rises from 73.4% to 81.1%. Because of this, despite the decrease in the number of departures on an annual basis, the number of departures from runway 25R increased slightly (from 58,908 in 2015 to 60,030 in 2016). On the routes straight ahead there is a slight decline (from 6.7% to 6.3%). The relative share of the flights that make a curve to the right or left increases. The 55 dB contour remains, with the left curve, identical to that in 2015.

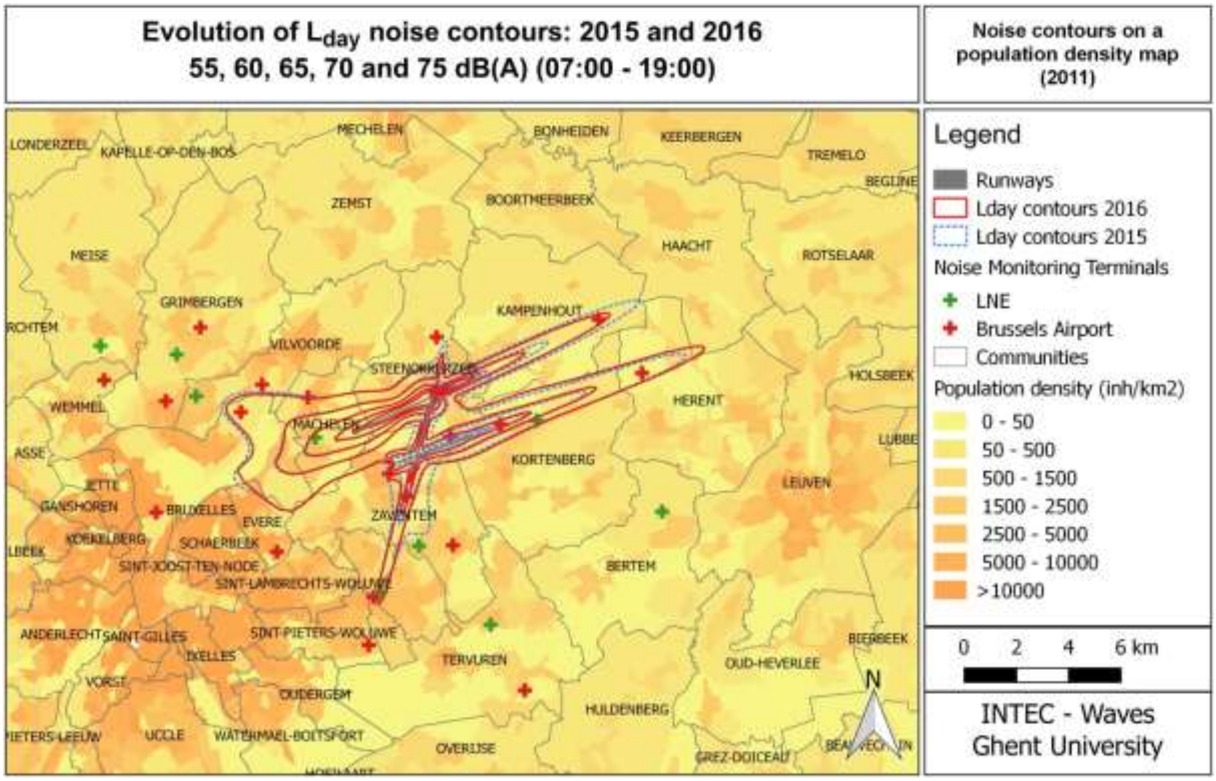
Figure 6: Changes in departure routes for the left curve from runway 25R from 02/04/2015 (source: AIP).



The most remarkable change to the south of Brussels Airport is the strong decrease in the 55 dB(A) contour in an easterly direction. This is a direct consequence of the decrease in the departures from runway 19 (1,243 departures in 2016 compared to 9,180 in 2015). This is lower than the number of departures in 2014 (1,990), the consequence of the renovation of runway 01/19. The contours at this location are however still defined to a great extent by the landings on runway 01 but also those movements have declined slightly in 2016 (from 9,899 in 2015 to 9,348 in 2016).

To the north of Brussels Airport, a similar shrinkage if visible. There are virtually no departures from runway 01 (54 in 2016 instead of 2.177 in 2015) and the number of landings on runway 19 has declined slightly (from 1,497 in 2015 to 1,219 in 2016).

Figure 7: L_{day} noise contours around Brussels Airport in 2015 (dotted blue) and 2016 (solid red).



The total surface area inside the L_{day} contour of 55 dB(A) declined in 2016 by about 8.0% compared to 2015 (from 5,135 to 4,723 ha). The number of residents inside the L_{den} contour of the 55 dB(A) noise contour dropped by 11.4% (from 35,056 to 31,057).

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 2015 and 2016 is shown in Figure 8. An additional contour is reported and this creates a visually enlarged effect. The 50 dB(A) contour has become equally significant for the calculation of the L_{den} as the L_{day} contour of 55dB(A) due to the 5 dB(A) correction.

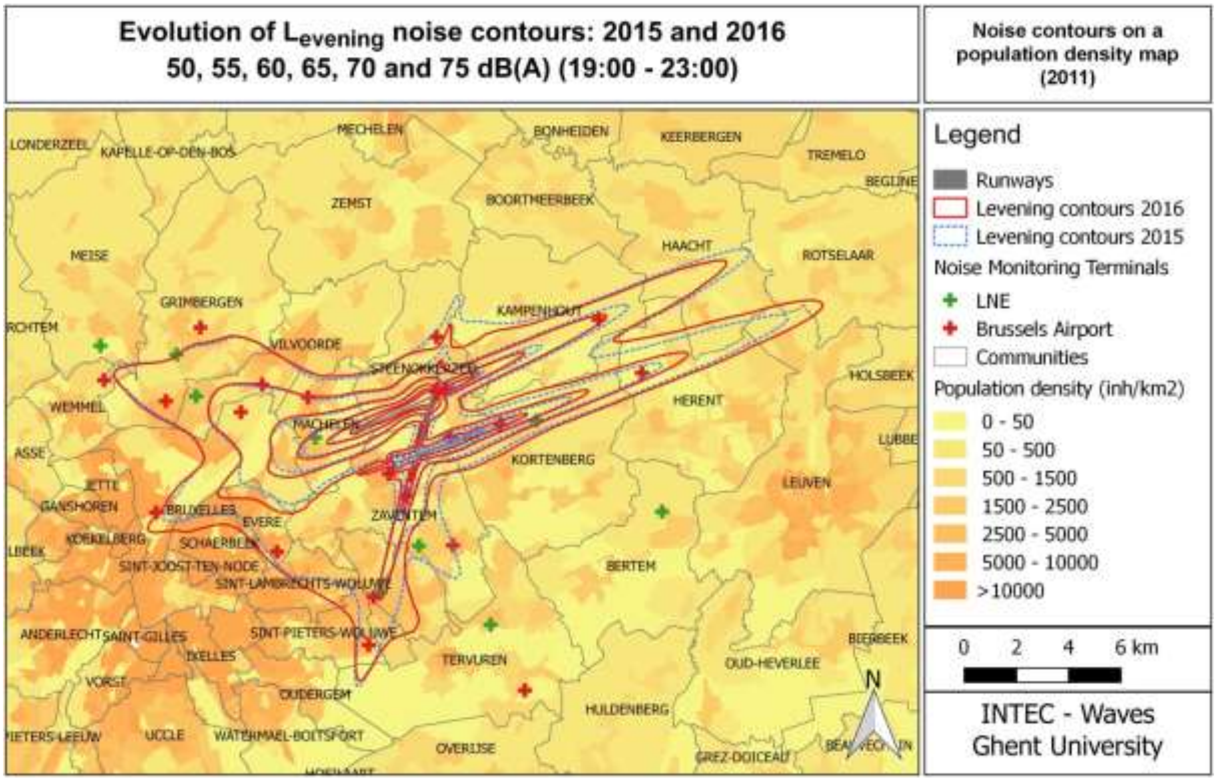
The evaluation period for the $L_{evening}$ contours falls entirely within the operational daytime period (06:00 to 23:00) as specified at Brussels Airport. The average traffic congestion during the evening period on Brussels Airport is highly comparable to the day period. The average number of flights per hour in 2016 is 34.6 during the day period compared to 33.8 during the evening period. During the evening period, the airport had an average in 2016 of 17.4 departures per hour, slightly fewer than the 17.6 in 2015. There were 17.2 arrivals per hour in 2016, 3.7% fewer than the 17.9 per hour in 2015. Runway usage is similar to the daytime period.

The location of the contours $L_{evening}$ > 55 dB(A) has changed more compared to 2015 than the location of the contours L_{day} > 55 dB(A), but major changes can be seen largely on the 50 dB(A) contour. Through the shift of a portion of the departures from runway 19 to runway 25R, the contours for departures with a turn to the left from 25R have also become larger. There is also an enlargement of the noise contour in the area extending from runway 25R. That is not a consequence of an absolute increase in the number of flights (minimal decline from 1238 to 1126 flights), but is caused by a change in the noise emissions of the aircraft on this route. This route is used by the Boeing 747. In 2016 this is a very slight increase in the number of flights with this type of aircraft on this route, but the share of the more modern 800 version of this aircraft is smaller in 2016 than in 2015. There are no significant changes for the noise contours to the north west.

To the east of Brussels Airport, a reduction of the landing contour on runway 25R can be seen. This is the effect of the normal availability of runway 25L.

To the south of Brussels Airport, the bulge of the 55 dB(A) contour to the east disappears through the large number of departures from runway 19 (from 2,420 in 2015 to 492 in 2016). The number of landings on runway 01 dropped from 3,808 to 3,294. This strongly depends on the percentage of alternative runway usage, but is also influenced by the renovation of runway 01/19.

Figure 8: $L_{evening}$ noise contours around Brussels Airport in 2015 (dotted blue) and 2016 (solid red).



The total surface area inside the $L_{evening}$ contour of 50 dB(A) rose in 2016 by about 2.6% compared to 2015 (from 13,147 to 13,488 ha). The number of residents inside the $L_{evening}$ contour of 50 dB(A) dropped by 21.5% (from 202,444 to 245,949). The expansion of the $L_{evening}$ contour occurs in the more densely populated zones, the shrinkage of the contours in less densely population zones.

4.3.3 L_{night} contours

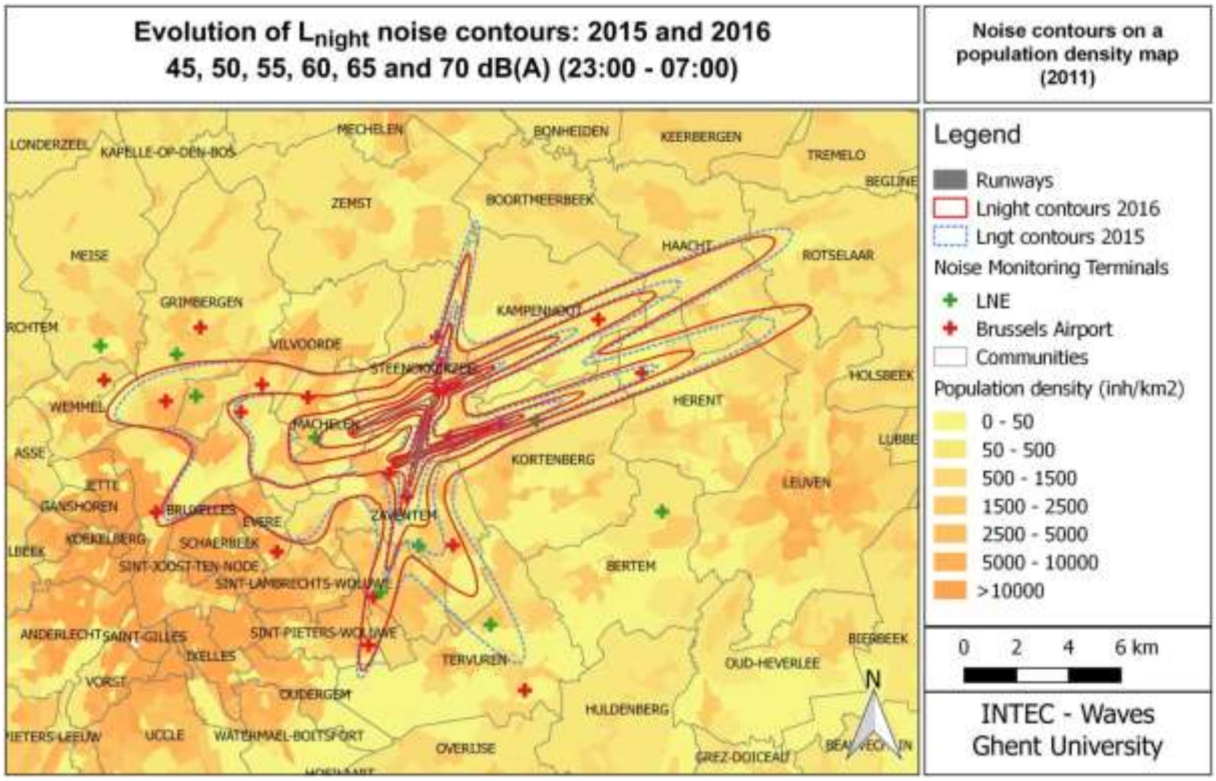
The L_{night} contours represent the A-weighted equivalent sound pressure level for the period 23:00 to 07:00 and are reported from 45 dB(A) to 70 dB(A) in steps of 5 dB(A). The evolution of the contours from 2015 to 2016 is shown in Figure 9. Since an additional contour is reported, this creates a visually 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 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 noise contours to the east of Brussels Airport reflect the changes resulting from the use of arrivals on 25L and 25R which can also be seen during the day and the evening.

To the south of Brussels Airport, the surface area of all contours decline through the lower use of runway 19 for take-off (from 2,845 departures in 2015 to 1,408 departures in 2016). The number of landings on runway 01 also dropped from 1,399 to 1,126. These departing flights shift to runway 25R and cause an expansion of the contours in all directions (left turn, straight ahead and right turn).

Figure 9: L_{night} noise contours around Brussels Airport in 2015 (dotted blue) and 2016 (solid red).



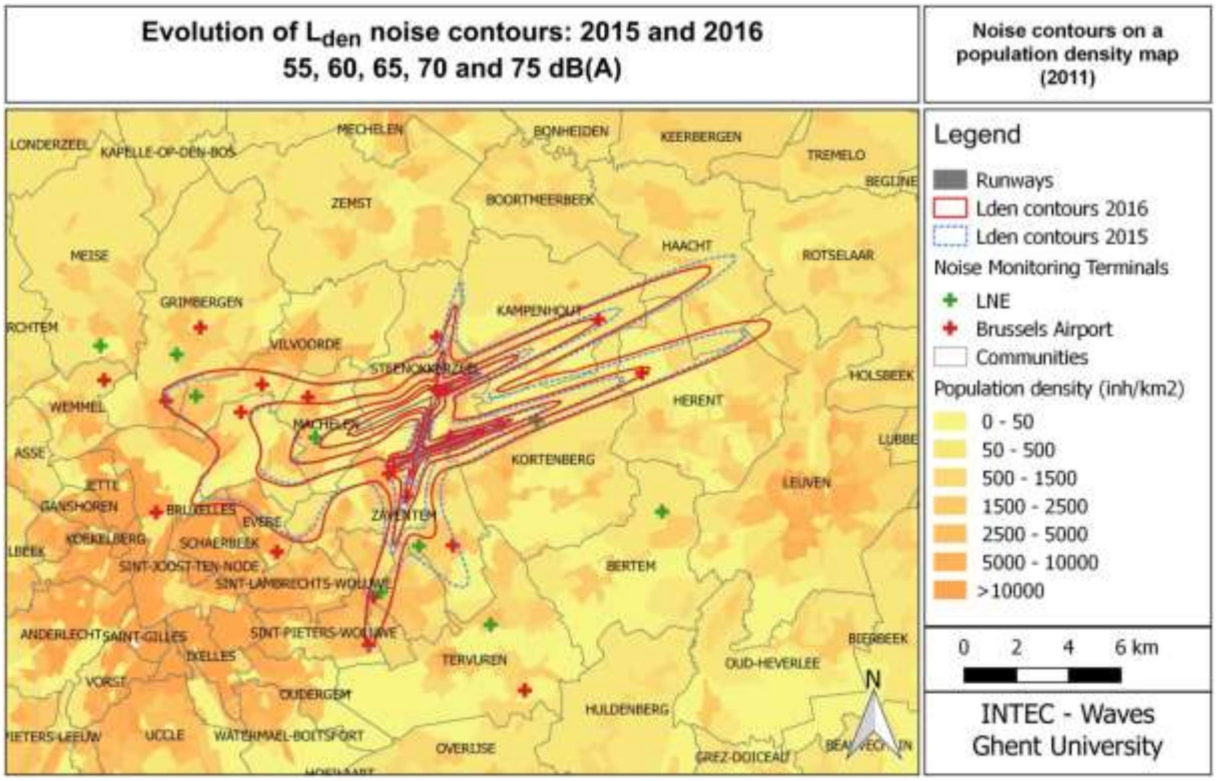
The busy departure hour from 06:00 and 07:00 contributes the most to the L_{night} contours. In 2016, 60.1% of the departures during the night hours took place between 06:00 and 07:00, slightly fewer than the 63.8% in 2015.

The total surface area inside the L_{night} contour of 45 dB(A) declined in 2016 by about 5.0% compared to 2015 (from 13,413 to 12,748 ha). The number of residents inside the L_{night} contour of 45 dB(A) only dropped by 0.2% (from 161,524 to 161,216).

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 10 you can see the evolution of the L_{den} contours for 2015 and 2016. The L_{den} contours are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A).

Figure 10: L_{den} noise contours around Brussels Airport in 2015 (dotted blue) and 2016 (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. The contour is comparable with 2015 with the exception of the southerly direction where the decline in the departures with a bend to left from runway 19 causes a clear shrinking of the contour. As far as the landing zones to the north-east are concerned, there is the shift of the contour from runway 25R to runway 25L since runway 25L became normally available again in 2016.

The total surface area inside the L_{den} contour of 55 dB(A) declined in 2016 by about 2.8% compared to 2015 (from 9,236 to 8,974 ha). The number of residents inside the L_{den} contour of 55 dB(A) rose by 3.8% (from 96,075 to 99,680).

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 to the routes (see Figure 11).

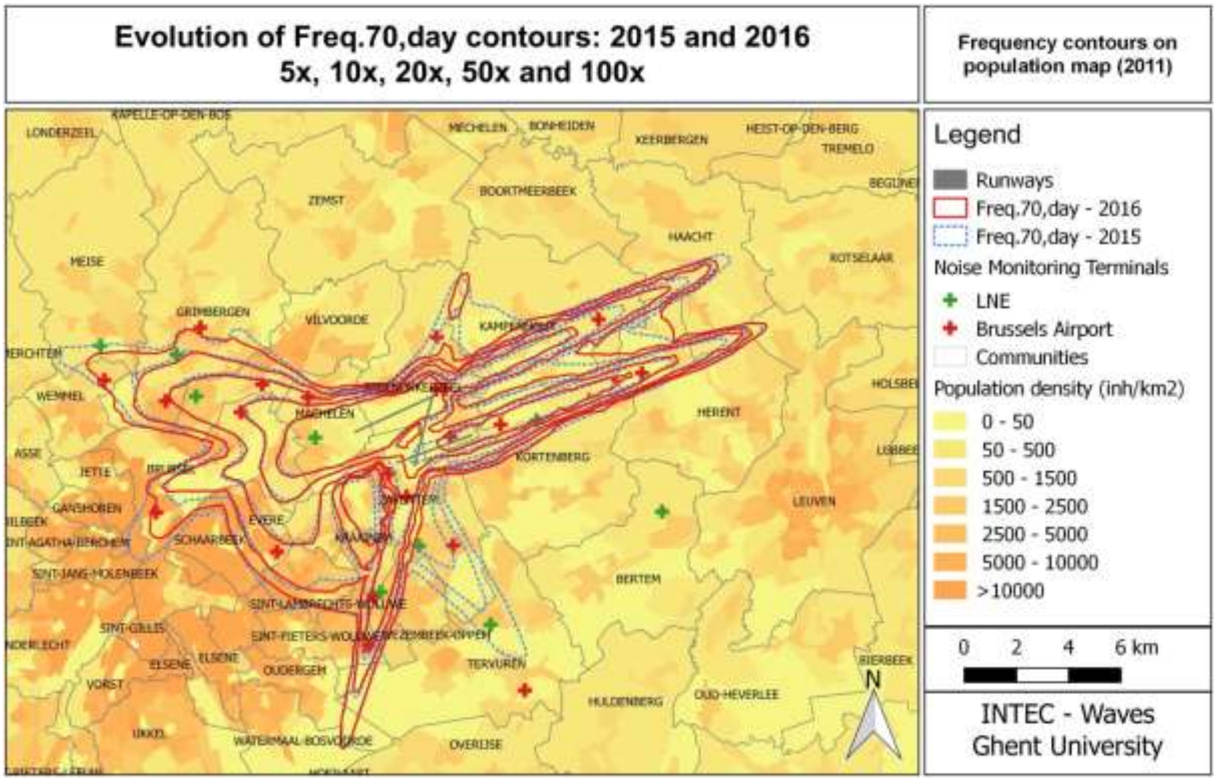
The changed shape to the south is caused by a strong reduction in the number of departures from runway 19. This change is compensated to a slight degree by the contribution of flights that take the shorter turn to left from runway 25R. The contours to the west - in particular the 5x and 10x contour - shrink slightly.

To the east, the shift from runway 25R to 25L is clearly but the differences are less pronounced in the number of events than in the L_{day} or $L_{evening}$ noise contours.

To the north of runway 01/19, a zone arises where departures from runway 07L and 07R cross with the landings on runway 19, and this results in the 5x contour being exceeded.

The total surface area inside the contour of 5x above 70 dB(A) declined in 2016 by about 26.3% compared to 2015 (from 18,314 to 13,491 ha). This means the total surface area is now below the situation in 2014 (15,372 ha). The number of residents inside the Freq.70,day contour of 5 events dropped sharply by 27.2% (from 334,264 to 243,235).

Figure 11: Freq.70,day frequency contours around Brussels Airport for 2015 and 2016.

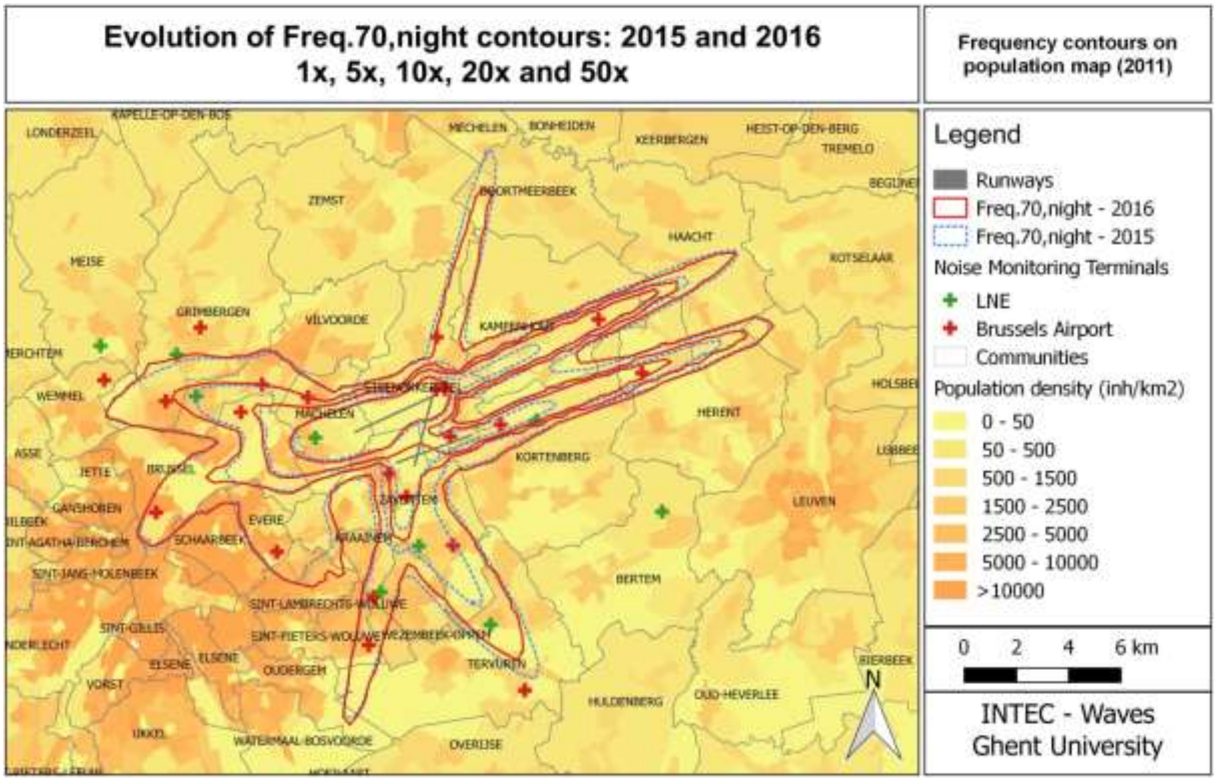


4.3.6 Freq.70,night contours (night 23:00-07:00)

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 usage and the changes that are discussed for L_{night}.

The total surface area inside the 1x above the 70 dB(A) contour during the night declined in 2016 by 1.4% compared to 2015 (from 13,885 to 13,690 ha). The number of residents inside this contour rose by 5.5% (from 210,939 to 222,622).

Figure 12: Freq.70,night frequency contours around Brussels Airport for 2015 and 2016.

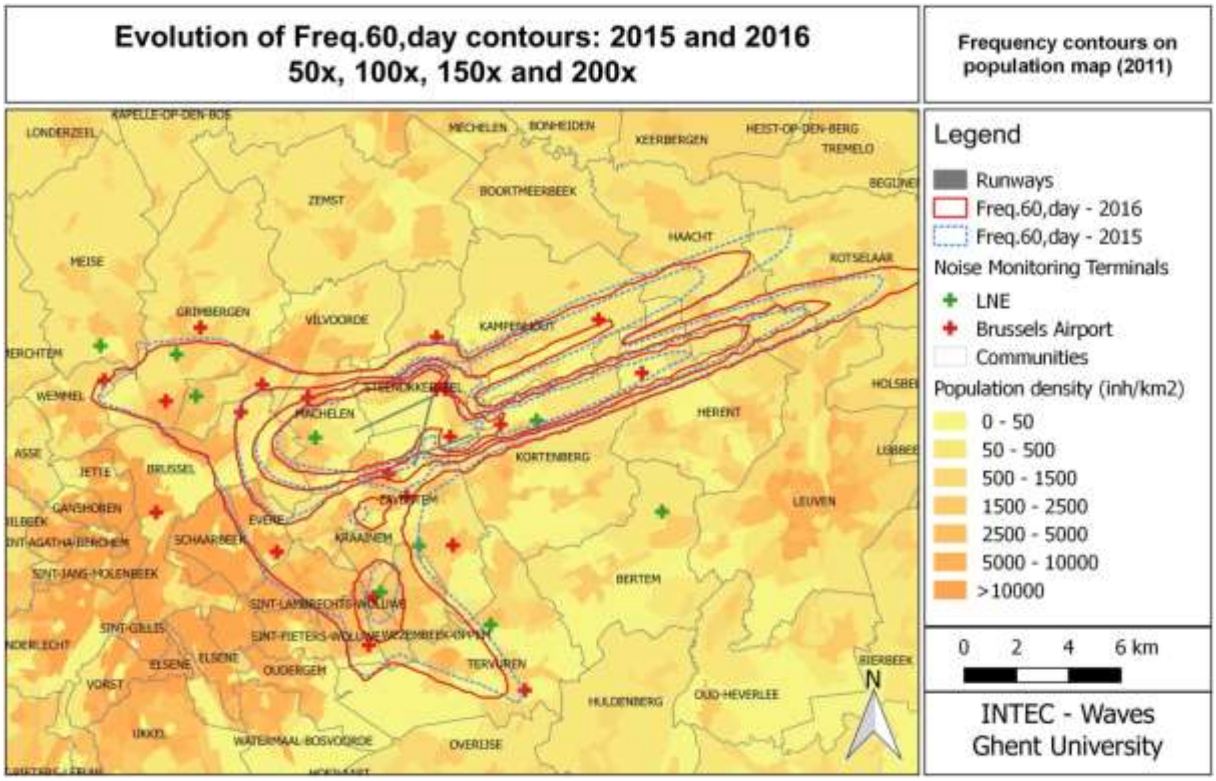


4.3.7 Freq.60,day contours (day 07:00-23:00)

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 above Brussels because there are no 50 flights per 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 50x contour shifts to the south of the airport because that contour is now more strongly determined by the departures from 25R with a turn to the left.

The total surface area inside the Freq.60,day contour of 50x above 60 dB(A) decreased in 2016 by about 2.7% compared to 2015 (from 16,203 to 15,760 ha). The number of residents inside the Freq.60,day contour of 50 times above the 60 dB(A) dropped by 2.0% (from 243,774 to 238,939).

Figure 13: Freq.60,day frequency contours around Brussels Airport for 2015 and 2016.

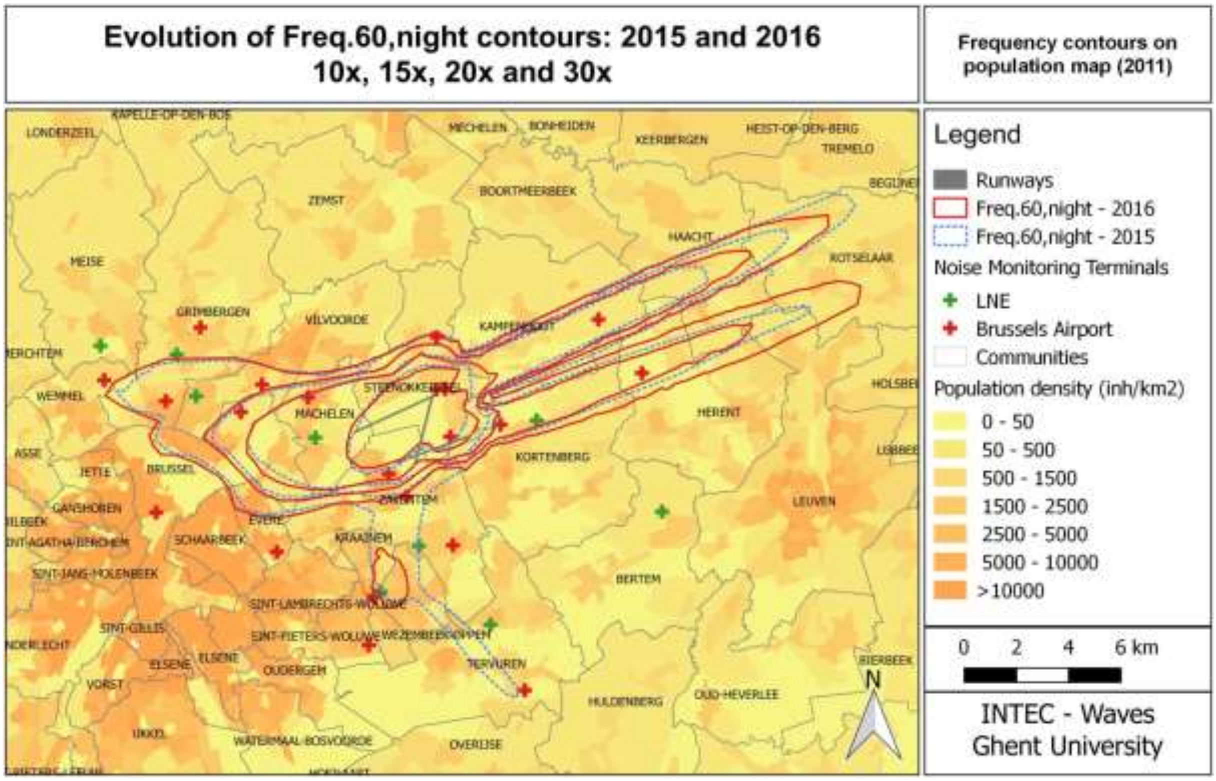


4.3.8 Freq.60,night - contours (night 23:00-07:00)

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 departures from runway 19 have been greatly reduced and this has resulted in an outermost contour to the south of the airport shrinking strongly. Only a small additional zone with 10x above 60 dB(A) is visible as a result of the combination of flights from runway 25R that use the short left curve and the landings on runway 01.

The total surface area inside the Freq.60,night frequency contour with 10x above 60 dB(A) rose in 2016 by about 0.7% compared to 2015 (from 11,964 to 12,052 ha). The number of residents inside the Freq.60,night contour of 10x above 60 dB(A) increased by 0.4% (from 131,736 to 132,238).

Figure 14: Freq.60,night frequency contours around Brussels Airport for 2015 and 2016.



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 severely inconvenienced per municipality.

For 2016, the total number of people who are potentially severely inconvenienced living inside the 55 dB(A) contour amounted to 14,226. This is an increase of 1.9% compared to 2015.

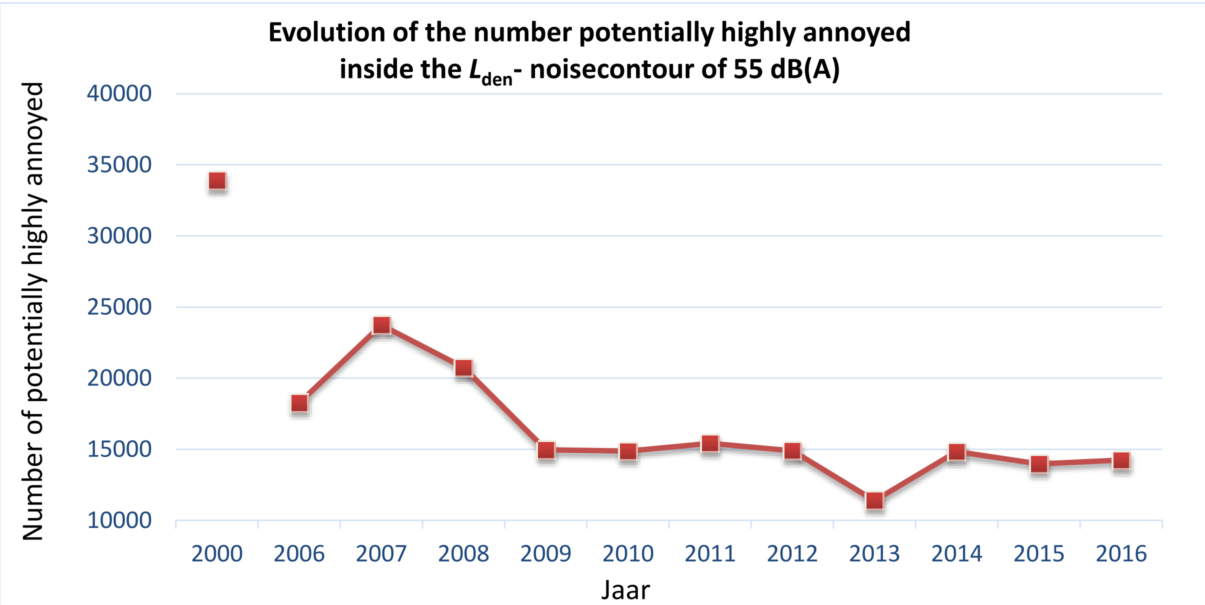
This increase is in contrast with the decrease of the number of movements between 2015 and 2016 by 6.5% (Section 4.1.1). Two elements explain the increase. The first element is the shift of a portion of the departures from runway 19 to 25R. In 2015 there were, due to the renovation work to runway 25L, just a few more departures on runway 19 compared to the normal situation without renovation work. Second, in 2016, the reverse situation occurred due to the renovation work on runway 19. This caused a clear reduction of the potential severe inconvenience in Zaventem in 2016 compared to 2015. These departures, however, were shifted to runway 25R. The contours shrink in a less densely populated area and grow slightly in a more densely populated area. This leads to an increased in the potential severe inconvenience in a number of municipalities in the departure zone of runway 25R (Evere, Schaarbeek and Grimbergen).

An overview is given by merged municipality in Table9.

Table9: Evolution of the number of people who are potentially severely inconvenienced inside the L_{den} 55 dB(A) noise contour.

Year	2000	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
INM versie	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b
Population data		1jan'03	1jan'06	1jan'07	1jan'07	1jan'08	1jan'08	1jan'10	1jan'10	1jan'10	1jan'11	1jan'11
Brussel	2,441	1,254	1,691	1,447	1,131	1,115	1,061	1,080	928	1,780	1,739	1,789
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
Grimbergen	3,111	479	1,305	638	202	132	193	120	0	175	428	517
Haacht	96	103	119	58	36	31	37	37	24	50	115	70
Herent	186	88	140	162	119	115	123	134	107	152	111	161
Huldenberg	112	0	0	0	0	0	0	0	0	0	0	0
Kampenhout	529	747	727	582	453	483	461	399	430	469	648	566
Kortenberg	664	548	621	604	512	526	497	422	603	443	366	438
Kraainem	1,453	934	1,373	1,277	673	669	667	500	589	111	368	379
Leuven	70		9	22	2	1	3	5	0	11	0	0
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
Meise	506	0	0	0	0	0	0	0	0	0	0	0
Overijse	70	0	0	0	0	0	0	0	0	0	0	0
Rotselaar	9	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
Sint-L.-Woluwe	1,515	382	1,218	994	489	290	196	150	0	0	0	1
Sint-P.-Woluwe	642	411	798	607	396	477	270	82	390	0	79	102
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
Tervuren	1,550	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
Wemmel	142	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
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
ZEMST	0	0	0	0	0	0	0	0	0	0	0	0
Eindtotaal	**33,889**	**18,257**	**23,732**	**20,737**	**14,950**	**14,861**	**15,409**	**14,886**	**11,399**	**14,825**	**13,965**	**14,226**

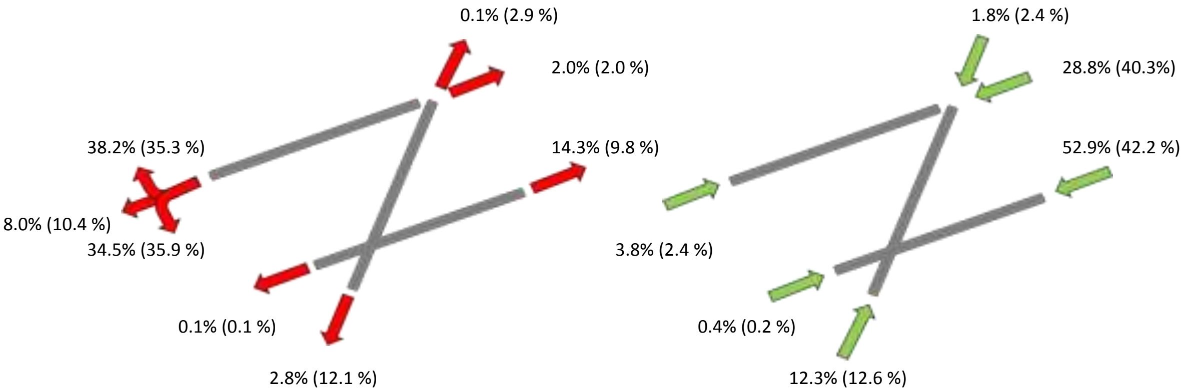
Figure 15: Evolution of the number of people who are potentially severely inconvenienced inside the L_{den} 55 dB(A) noise contour.



5 Appendices

5.1 Runway and route usage

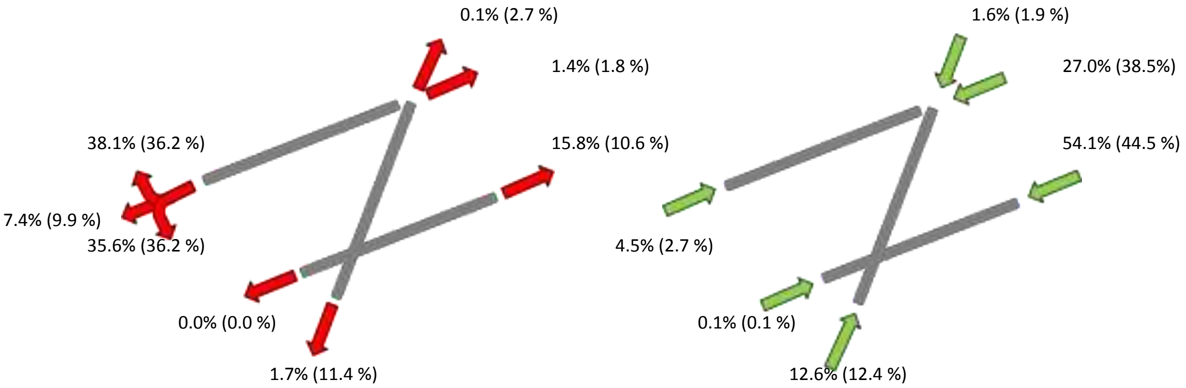
Table 10: Overview of the number of departures and arrivals annually per runway including changes vs. the previous year (all flights, day, evening and night). The figures between brackets are the data for 2015.



All flights (day, evening, night)				
Departures				
	Number		Percentage	
Runway	**2015**	**2016**	**2015**	**2016**
01	3,430	69	2.9%	0.1%
07L	2,439	2,244	2.0%	2.0%
07R	11,724	16,039	9.8%	14.3%
19	14,447	3,139	12.1%	2.8%
25L	103	149	0.1%	0.1%
25R	87,529	90,180	73.1%	80.6%

All flights (day, evening, night)				
Landings				
	Number		Percentage	
Runway	**2015**	**2016**	**2015**	**2016**
01	15,113	13,768	12.6%	12.3%
07L	2,814	4,202	2.4%	3.8%
07R	220	419	0.2%	0.4%
19	2,897	2,052	2.4%	1.8%
25L	50,454	59,190	42.2%	52.9%
25R	48,201	32,208	40.3%	28.8%

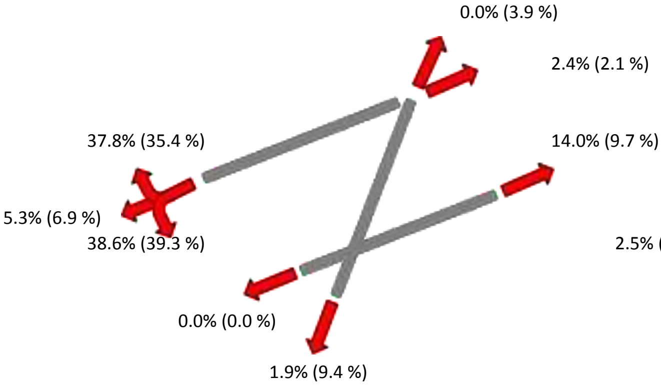
Table 11: Overview of the number of departures and arrivals annually per runway including changes vs. the previous year: day. The figures between brackets are the data for 2015.

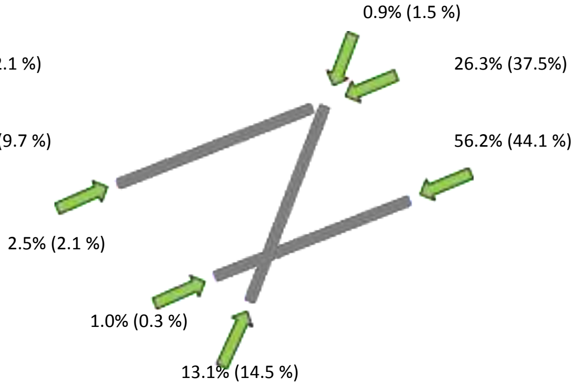


Flights day				
Departures				
	Number		Percentage	
Runway	**2015**	**2016**	**2015**	**2016**
01	2,177	54	2.7%	0.1%
07L	1,440	1,033	1.8%	1.4%
07R	8,491	11,667	10.6%	15.8%
19	9,180	1,239	11.4%	1.7%
25L	23	24	0.0%	0.0%
25R	58,908	60,019	73.4%	81.1%

Flights day				
Landings				
	Number		Percentage	
Runway	**2015**	**2016**	**2015**	**2016**
01	9,899	9,349	12.4%	12.6%
07L	2,168	3,370	2.7%	4.5%
07R	42	87	0.1%	0.1%
19	1,497	1,217	1.9%	1.6%
25L	35,598	40,172	44.5%	54.1%
25R	30,832	19,996	38.5%	27.0%

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 2015.

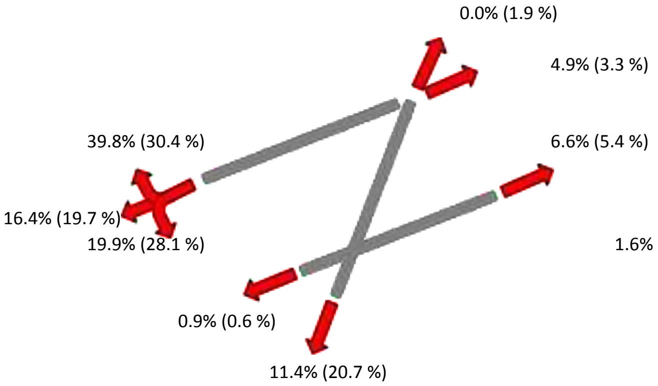


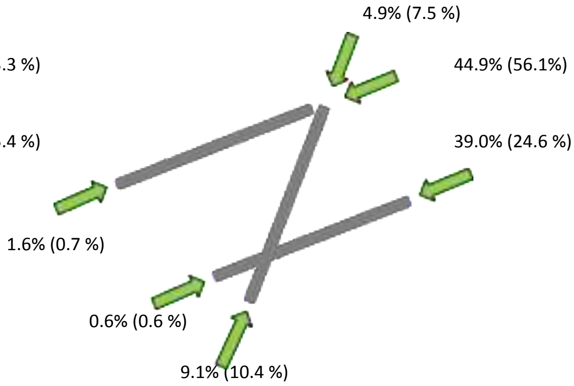


Flights evening				
Departures				
	Number		Percentage	
Runway	2015	2016	2015	2016
01	996	10	3.9%	0.0%
07L	548	610	2.1%	2.4%
07R	2,490	3,550	9.7%	14.0%
19	2,420	492	9.4%	1.9%
25L	4	8	0.0%	0.0%
25R	19,223	20,736	74.9%	81.6%

Flights evening				
Landings				
	Number		Percentage	
Runway	2015	2016	2015	2016
01	3,808	3,293	14.5%	13.1%
07L	549	636	2.1%	2.5%
07R	91	263	0.3%	1.0%
19	384	227	1.5%	0.9%
25L	11,540	14,168	44.1%	56.2%
25R	9,816	6,622	37.5%	26.3%

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 2015.





Flights night				
Departures				
	Number		Percentage	
Runway	2015	2016	2015	2016
01	257	5	1.9%	0.0%
07L	451	601	3.3%	4.9%
07R	743	822	5.4%	6.6%
19	2,847	1,408	20.7%	11.4%
25L	76	117	0.6%	0.9%
25R	9,398	9,425	68.2%	76.1%

Flights night				
Landings				
	Number		Percentage	
Runway	2015	2016	2015	2016
01	1,406	1,126	10.4%	9.1%
07L	97	196	0.7%	1.6%
07R	87	69	0.6%	0.6%
19	1,016	608	7.5%	4.9%
25L	3,316	4,850	24.6%	39.0%
25R	7,553	5,590	56.1%	44.9%

5.2 Location of the measuring stations

Figure 16: Location of the measuring stations.

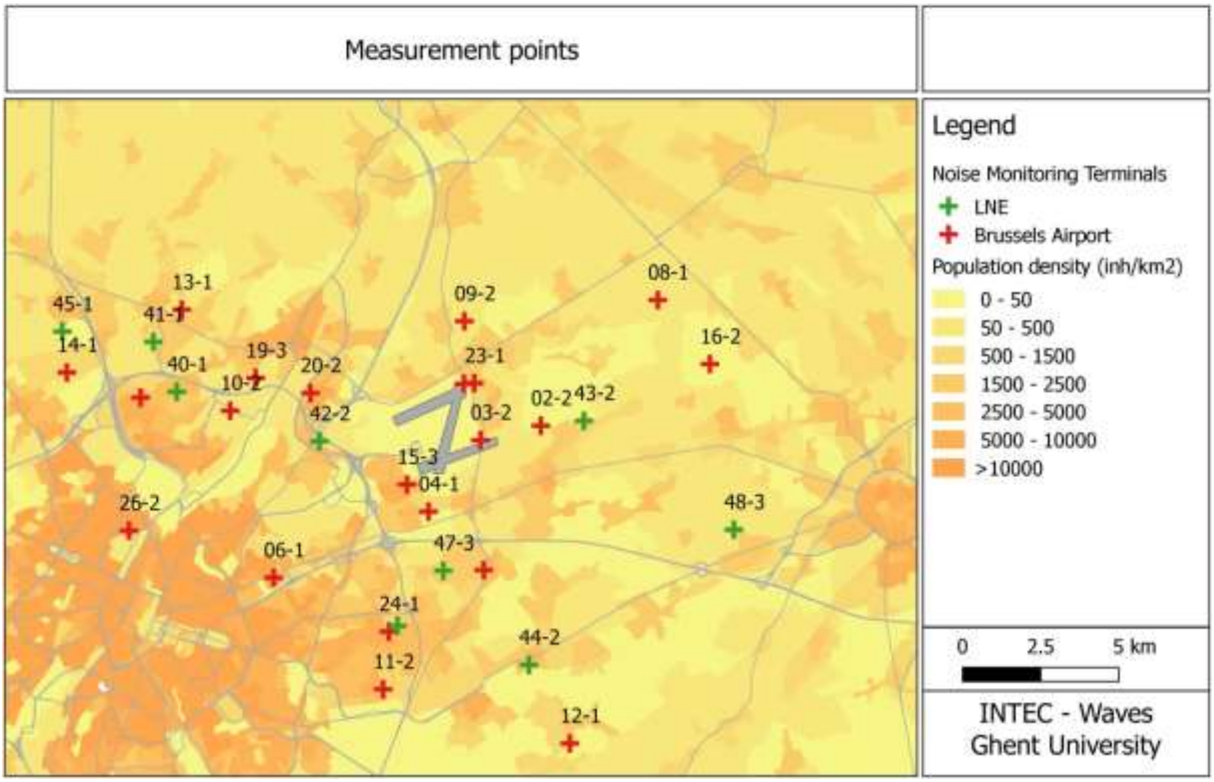


Table 14: Overview of the measuring points.

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

5.3 Results of contour calculations – 2016

5.3.1 Surface area per contour zone and per municipality

Table 15: Surface area per L_{day} contour zone and municipality – 2016.

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	635	115	0	-	-	750
Evere	47	-	-	-	-	47
Haacht	14	-	-	-	-	14
Herent	217	-	-	-	-	217
Kampenhout	344	56	-	-	-	400
Kortenberg	408	193	42	-	-	643
Kraainem	44	-	-	-	-	44
Machelen	319	279	191	53	9	851
Steenokkerzeel	441	313	235	70	72	1,131
Vilvoorde	39	-	-	-	-	39
Wezembeek-O.	29	-	-	-	-	29
Zaventem	351	130	78	-	-	559
Totaal	**2,886**	**1,087**	**545**	**123**	**82**	**4,723**

Table 16: Surface area per $L_{evening}$ contour zone and municipality – 2016.

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	515	690	203	6	-	-	1,413
Evere	360	137	-	-	-	-	497
Grimbergen	819	-	-	-	-	-	819
Haacht	514	-	-	-	-	-	514
Herent	755	169	-	-	-	-	924
Kampenhout	1,109	345	60	-	-	-	1,514
Kortenberg	434	390	164	34	-	-	1,022
Kraainem	445	41	-	-	-	-	486
Machelen	216	331	268	198	63	15	1,093
Meise	8	-	-	-	-	-	8
Rotselaar	54	-	-	-	-	-	54
Schaarbeek	212	14	-	-	-	-	226
Sint-Lambrechts-Woluwe	391	-	-	-	-	-	391
Sint-P.-Woluwe	254	-	-	-	-	-	254
Steenokkerzeel	410	469	318	228	71	76	1,572
Tervuren	22	-	-	-	-	-	22
Vilvoorde	497	193	-	-	-	-	689
Wemmel	28	-	-	-	-	-	28
Wezembeek-O.	257	24	-	-	-	-	281
Zaventem	1,103	385	124	70	-	-	1,682
Total	**8,402**	**3,188**	**1,137**	**536**	**135**	**91**	**13,488**

Table 17: Surface area per L_{night} contour zone and municipality – 2016.

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	881	567	45	-	-	-	1,494
Evere	306	0	-	-	-	-	306
Grimbergen	683	-	-	-	-	-	683
Haacht	764	19	-	-	-	-	783
Herent	751	184	-	-	-	-	935
Kampenhout	979	466	128	12	-	-	1,585
Kortenberg	443	333	134	27	1	-	938
Kraainem	189	19	-	-	-	-	208
Machelen	272	349	307	141	33	10	1,111
Rotselaar	90	-	-	-	-	-	90
Schaarbeek	72	-	-	-	-	-	72
Sint-Lambrechts-Woluwe	4	-	-	-	-	-	4
Sint-P.-Woluwe	104	-	-	-	-	-	104
Steenokkerzeel	494	474	309	207	134	88	1,708
Tervuren	3	-	-	-	-	-	3
Vilvoorde	606	43	-	-	-	-	649
Wezembeek-O.	154	5	-	-	-	-	158
Zaventem	1,169	469	189	54	19	11	1,912
Zemst	5	-	-	-	-	-	5
Total	**7,969**	**2,930**	**1,111**	**441**	**188**	**109**	**12,748**

Table 18: Surface area per L_{den} contour zone and municipality – 2016.

Area (ha)	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	708	390	28	-	-	1,126
Evere	272	-	-	-	-	272
Grimbergen	147	-	-	-	-	147
Haacht	353	-	-	-	-	353
Herent	499	46	-	-	-	544
Kampenhout	838	253	44	-	-	1,135
Kortenberg	379	313	89	15	-	795
Kraainem	166	-	-	-	-	166
Machelen	291	321	264	117	30	1,023
Schaarbeek	52	-	-	-	-	52
Sint-Lambrechts-Woluwe	2	-	-	-	-	2
Sint-P.-Woluwe	34	-	-	-	-	34
Steenokkerzeel	477	420	270	163	159	1,490
Vilvoorde	501	15	-	-	-	516
Wezembeek-O.	98	-	-	-	-	98
Zaventem	738	328	101	31	24	1,222
Total	**5,554**	**2,085**	**797**	**326**	**213**	**8,974**

Table 19: Surface area per Freq.70,day contour zone and municipality – 2016.

Area (ha)	Freq.70,day contour zone (07:00-23:00)					
Municipality	5-10	10-20	20-50	50-100	>100	Total
Brussel	410	305	377	374	123	1,589
Evere	12	267	232	-	-	512
Grimbergen	511	494	65	-	-	1,070
Haacht	110	158	133	-	-	401
Herent	325	137	192	133	8	794
Kampenhout	244	478	548	243	2	1,516
Kortenberg	166	147	233	212	348	1,107
Kraainem	129	162	142	-	-	432
Machelen	51	73	141	183	555	1,003
Meise	57	-	-	-	-	57
Oudergem	58	-	-	-	-	58
Schaarbeek	202	11	-	-	-	213
Sint-Lambrechts-Woluwe	180	358	6	-	-	544
Sint-P.-Woluwe	118	106	30	-	-	253
Steenokkerzeel	141	123	248	365	549	1,426
Tervuren	95	33	-	-	-	128
Vilvoorde	103	150	383	19	-	655
WATERMAAL-BOSVOORDE	10	-	-	-	-	10
Wemmel	141	-	-	-	-	141
Wezembeek-O.	60	50	83	-	-	193
Zaventem	208	354	559	186	81	1,388
Total	**3,331**	**3,407**	**3,372**	**1,715**	**1,666**	**13,491**

Table 20: Surface area per Freq.70,night contour zone and municipality – 2016.

Area (ha)	Freq.70,night contour zone (23:00-07:00)				
Municipality	1-5	5-10	10-20	>20	Total
Boortmeerbeek	77	-	-	-	77
Brussel	789	532	280	26	1,627
Evere	468	28	-	-	497
Grimbergen	756	22	-	-	778
Haacht	281	150	19	-	450
Herent	313	211	92	-	615
Kampenhout	811	238	524	-	1,573
Kortenberg	351	160	419	-	929
Kraainem	257	-	-	-	257
Machelen	188	133	229	453	1,003
Oudergem	23	-	-	-	23
Schaarbeek	98	-	-	-	98
Sint-Jans-Molenbeek	12	-	-	-	12
Sint-Lambrechts-Woluwe	268	-	-	-	268
Sint-P.-Woluwe	183	-	-	-	183
Steenokkerzeel	516	210	449	444	1,618
Tervuren	493	-	-	-	493
Vilvoorde	347	317	11	-	675
Wezembeek-O.	255	-	-	-	255
Zaventem	1,552	439	127	75	2,194
Zemst	66	-	-	-	66
Total	**8,104**	**2,439**	**2,149**	**998**	**13,690**

Table 21: Surface area per Freq.60,day contour zone and municipality – 2016.

Area (ha)	Freq.60,day contour zone (day 07:00-23:00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	392	399	252	131	1,175
Evere	386	126	-	-	512
Grimbergen	978	-	-	-	978
Haacht	673	71	141	-	886
Herent	501	393	366	-	1,260
Kampenhout	1,126	290	24	-	1,439
Kortenberg	299	169	619	35	1,122
Kraainem	351	232	-	-	583
Machelen	115	128	193	673	1,108
Meise	3	-	-	-	3
Rotselaar	619	48	-	-	666
Schaarbeek	66	-	-	-	66
Sint-Lambrechts-Woluwe	509	1	-	-	511
Sint-P.-Woluwe	284	93	-	-	377
Steenokkerzeel	275	258	223	831	1,587
Tervuren	718	-	-	-	718
Vilvoorde	581	58	-	-	639
Wemmel	70	-	-	-	70
Wezembeek-O.	444	145	-	-	589
Zaventem	865	260	99	246	1,470
Total	**9,256**	**2,670**	**1,918**	**1,916**	**15,760**

Table 22: Surface area per Freq.60,night contour zone and municipality – 2016.

Area (ha)	Freq.60,night contour zone (23:00-07:00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	372	495	426	-	1,293
Evere	200	19	-	-	219
Grimbergen	702	-	-	-	702
Haacht	492	556	-	-	1,048
Herent	771	383	-	-	1,154
Kampenhout	393	1,026	37	-	1,457
Kortenberg	299	629	32	-	960
Kraainem	81	-	-	-	81
Machelen	70	120	832	107	1,128
Meise	0	-	-	-	0
Rotselaar	686	0	-	-	686
Steenokkerzeel	125	191	505	862	1,683
Vilvoorde	583	61	4	-	648
Wemmel	8	-	-	-	8
Wezembeek-O.	132	-	-	-	132
Zaventem	230	155	216	254	854
Total	**5,142**	**3,635**	**2,053**	**1,222**	**12,052**

5.3.2 Number of residents per contour zone and per municipality

Table 23: Number of residents per L_{day} contour zone and municipality – 2016.

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	2,783	2,203	0	-	-	4,986
Evere	1,849	-	-	-	-	1,849
Haacht	27	-	-	-	-	27
Herent	536	-	-	-	-	536
Kampenhout	1,106	244	-	-	-	1,351
Kortenberg	1,458	356	17	-	-	1,831
Kraainem	165	-	-	-	-	165
Machelen	4,188	3,601	1,845	13	-	9,647
Steenokkerzeel	3,934	1,328	213	16	-	5,491
Vilvoorde	109	-	-	-	-	109
Wezembeek-O.	564	-	-	-	-	564
Zaventem	3,835	647	19	-	-	4,501
Total	**20,554**	**8,380**	**2,094**	**28**	**-**	**31,057**

Table 24: Number of residents per $L_{evening}$ contour zone and municipality – 2016.

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	19,356	2,494	3,588	29	-	-	25,467
Evere	29,023	7,538	-	-	-	-	36,561
Grimbergen	16,663	-	-	-	-	-	16,663
Haacht	1,232	-	-	-	-	-	1,232
Herent	1,744	346	-	-	-	-	2,090
Kampenhout	4,008	1,358	267	-	-	-	5,633
Kortenberg	2,705	1,270	257	14	-	-	4,246
Kraainem	12,602	139	-	-	-	-	12,741
Machelen	3,180	4,312	3,065	2,522	34	-	13,112
Meise	109	-	-	-	-	-	109
Rotselaar	123	-	-	-	-	-	123
Schaarbeek	42,865	1,113	-	-	-	-	43,978
Sint-Lambrechts-Woluwe	19,600	-	-	-	-	-	19,600
Sint-P.-Woluwe	10,978	-	-	-	-	-	10,978
Steenokkerzeel	3,027	4,266	1,450	229	18	-	8,991
Tervuren	1	-	-	-	-	-	1
Vilvoorde	13,705	1,962	-	-	-	-	15,666
Wemmel	237	-	-	-	-	-	237
Wezembeek-O.	6,350	440	-	-	-	-	6,790
Zaventem	16,812	4,405	512	2	-	-	21,731
Total	**204,319**	**29,643**	**9,140**	**2,796**	**52**	**-**	**245,949**

Table 25: Number of residents per L_{night} contour zone and municipality – 2016.

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	25,509	4,336	383	-	-	-	30,228
Evere	18,631	-	-	-	-	-	18,631
Grimbergen	15,746	-	-	-	-	-	15,746
Haacht	2,455	19	-	-	-	-	2,474
Herent	1,758	431	-	-	-	-	2,189
Kampenhout	3,485	1,558	420	96	-	-	5,558
Kortenberg	2,190	1,057	177	11	1	-	3,435
Kraainem	4,397	43	-	-	-	-	4,440
Machelen	3,278	5,042	4,704	325	1	-	13,350
Rotselaar	148	-	-	-	-	-	148
Schaarbeek	13,085	-	-	-	-	-	13,085
Sint-Lambrechts-Woluwe	23	-	-	-	-	-	23
Sint-P.-Woluwe	3,544	-	-	-	-	-	3,544
Steenokkerzeel	2,790	4,521	1,675	278	130	-	9,394
Tervuren	0	-	-	-	-	-	0
Vilvoorde	13,355	118	-	-	-	-	13,474
Wezembeek-O.	2,944	67	-	-	-	-	3,011
Zaventem	15,594	6,285	596	5	-	-	22,480
Zemst	6	-	-	-	-	-	6
Total	**128,939**	**23,476**	**7,954**	**715**	**131**	**-**	**161,216**

Table 26: Number of residents per L_{den} contour zone and municipality – 2016.

Number of Inhabitants	L_{den} contour zone in dB(A)					
Municipality	55-60	60-65	65-70	70-75	>75	Total
Brussel	7,276	4,151	245	-	-	11,671
Evere	15,840	-	-	-	-	15,840
Grimbergen	5,037	-	-	-	-	5,037
Haacht	615	-	-	-	-	615
Herent	1,245	17	-	-	-	1,263
Kampenhout	2,605	914	202	-	-	3,721
Kortenberg	2,002	810	68	6	-	2,886
Kraainem	3,313	-	-	-	-	3,313
Machelen	3,800	4,290	3,838	267	-	12,195
Schaarbeek	9,068	-	-	-	-	9,068
Sint-Lambrechts-Woluwe	14	-	-	-	-	14
Sint-P.-Woluwe	992	-	-	-	-	992
Steenokkerzeel	3,803	3,433	794	178	23	8,231
Vilvoorde	9,679	37	-	-	-	9,716
Wezembeek-O.	2,102	-	-	-	-	2,102
Zaventem	9,838	3,042	137	0	-	13,016
Total	**77,229**	**16,694**	**5,284**	**450**	**23**	**99,680**

Table 27: Number of residents per Freq.70,day contour zone and municipality – 2016.

Number of Inhabitants	Freq.70,day contour zone (07:00-23:00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	25,246	4,632	950	2,200	2,227	35,255
Evere	1,337	23,940	12,096	-	-	37,374
Grimbergen	6,438	12,206	2,004	-	-	20,648
Haacht	467	265	215	-	-	947
Herent	850	247	604	175	3	1,878
Kampenhout	1,180	1,643	1,632	882	1	5,338
Kortenberg	984	1,136	1,404	898	819	5,240
Kraainem	3,881	5,089	2,829	-	-	11,799
Machelen	638	1,412	1,613	2,687	5,542	11,893
Meise	544	-	-	-	-	544
Oudergem	8	-	-	-	-	8
Schaarbeek	25,505	604	-	-	-	26,109
Sint-Lambrechts-Woluwe	11,633	19,265	33	-	-	30,931
Sint-P.-Woluwe	5,739	4,296	898	-	-	10,933
Steenokkerzeel	938	1,197	2,283	2,179	1,162	7,758
Tervuren	4	1	-	-	-	5
Vilvoorde	3,565	3,588	7,294	49	-	14,496
WATERMAAL-BOSVOORDE	0	-	-	-	-	0
Wemmel	1,145	-	-	-	-	1,145
Wezembeek-O.	1,443	1,169	1,779	-	-	4,390
Zaventem	3,539	6,124	4,653	1,439	787	16,542
Total	**95,084**	**86,813**	**40,288**	**10,509**	**10,541**	**243,235**

Table 28: Number of residents per Freq.70,night contour zone and municipality – 2016.

Aantal Inwoners	Freq.70,nacht - contourzone in dB(A) (23:00-07:00)				
Gemeente	**1-5**	**5-10**	**10-20**	**>20**	**Totaal**
Boortmeerbeek	359	-	-	-	359
Brussel	33,791	1,211	3,850	131	38,982
Evere	34,823	663	-	-	35,486
Grimbergen	16,236	977	-	-	17,212
Haacht	866	238	19	-	1,122
Herent	651	715	53	-	1,420
Kampenhout	2,823	961	1,771	-	5,554
Kortenberg	2,353	874	973	-	4,199
Kraainem	6,106	-	-	-	6,106
Machelen	2,646	1,828	3,260	4,227	11,961
Oudergem	3	-	-	-	3
Schaarbeek	17,180	-	-	-	17,180
Sint-Jans-Molenbeek	2,519	-	-	-	2,519
Sint-Lambrechts-Woluwe	15,641	-	-	-	15,641
Sint-P.-Woluwe	6,531	-	-	-	6,531
Steenokkerzeel	3,626	1,614	2,510	1,204	8,955
Tervuren	3,535	-	-	-	3,535
Vilvoorde	9,271	6,130	28	-	15,429
Wezembeek-O.	5,061	-	-	-	5,061
Zaventem	19,670	3,405	1,615	589	25,280
Zemst	87	-	-	-	87
Totaal	**183,776**	**18,616**	**14,079**	**6,151**	**222,622**

Table 29: Number of residents per Freq.60,day contour zone and municipality – 2016.

Number of Inhabitants	**Freq.60,day contour zone (07:00-23:00)**				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	17,807	1,000	1,580	2,675	23,062
Evere	30,887	6,486	-	-	37,374
Grimbergen	17,824	-	-	-	17,824
Haacht	2,403	176	263	-	2,842
Herent	1,591	884	935	-	3,411
Kampenhout	4,243	562	10	-	4,815
Kortenberg	1,367	699	2,452	19	4,537
Kraainem	7,028	6,504	-	-	13,532
Machelen	1,547	1,611	2,485	7,704	13,347
Meise	45	-	-	-	45
Rotselaar	4,155	71	-	-	4,226
Schaarbeek	7,945	-	-	-	7,945
Sint-Lambrechts-Woluwe	26,377	23	-	-	26,401
Sint-P.-Woluwe	10,895	4,940	-	-	15,835
Steenokkerzeel	1,993	1,857	1,479	3,782	9,111
Tervuren	8,512	-	-	-	8,512
Vilvoorde	13,301	149	-	-	13,451
Wemmel	415	-	-	-	415
Wezembeek-O.	8,472	3,745	-	-	12,217
Zaventem	13,032	2,420	1,270	3,315	20,037
Total	**179,841**	**31,127**	**10,476**	**17,495**	**238,939**

Table 30: Number of residents per Freq.60,night contour zone and municipality – 2016.

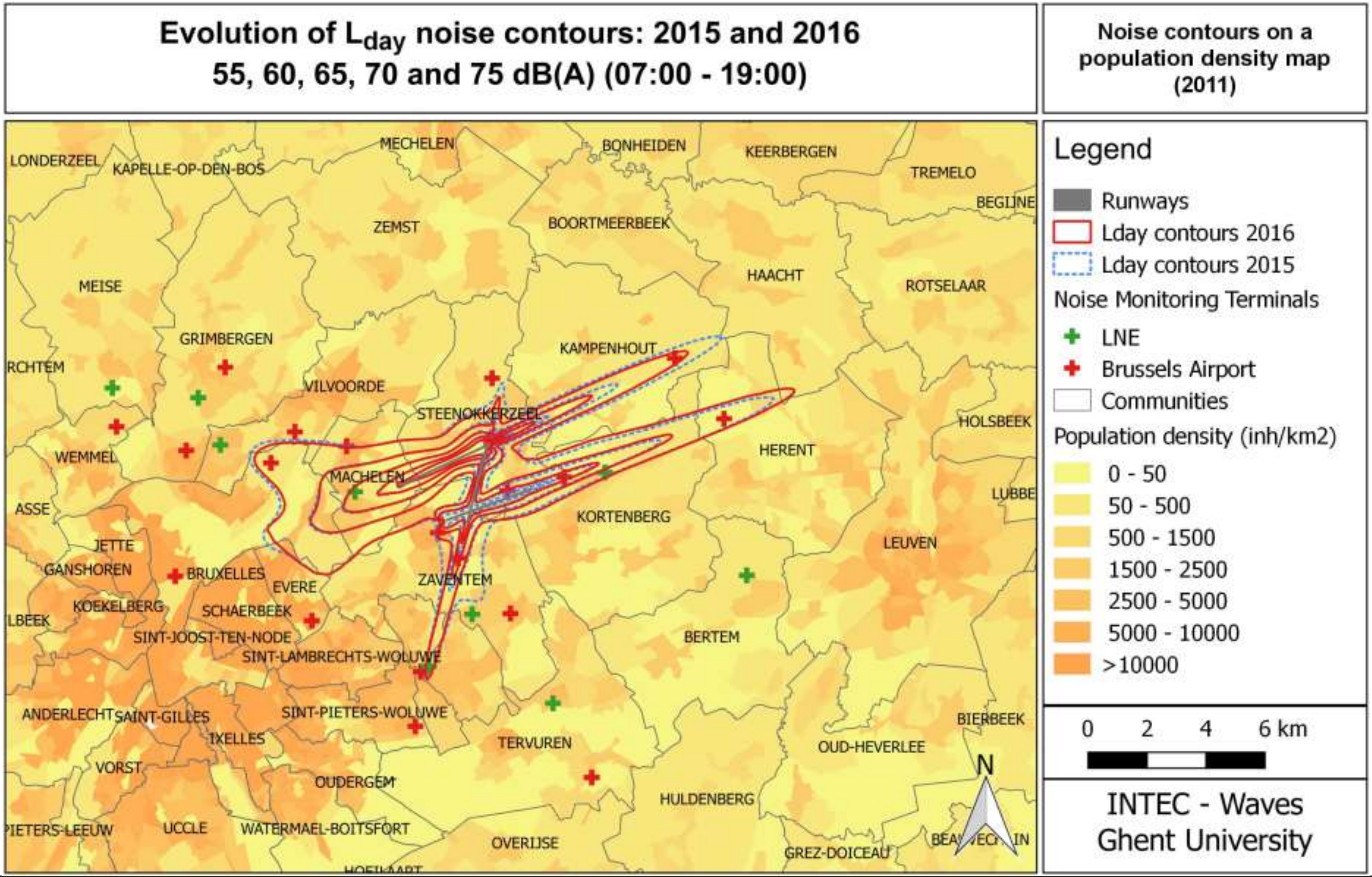
Number of Inhabitants	**Freq.60,night contour zone (23:00-07:00)**				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	20,725	6,491	4,234	-	31,450
Evere	15,148	1,004	-	-	16,153
Grimbergen	15,089	-	-	-	15,089
Haacht	2,050	1,505	-	-	3,555
Herent	2,261	876	-	-	3,137
Kampenhout	1,442	3,509	255	-	5,206
Kortenberg	1,539	2,149	15	-	3,703
Kraainem	699	-	-	-	699
Machelen	694	1,513	11,153	102	13,463
Meise	0	-	-	-	0
Rotselaar	2,891	0	-	-	2,891
Steenokkerzeel	956	1,139	2,367	5,360	9,823
Vilvoorde	12,220	172	9	-	12,401
Wemmel	58	-	-	-	58
Wezembeek-O.	3,301	-	-	-	3,301
Zaventem	2,160	1,997	3,835	3,316	11,308
Total	**81,235**	**20,356**	**21,869**	**8,779**	**132,238**

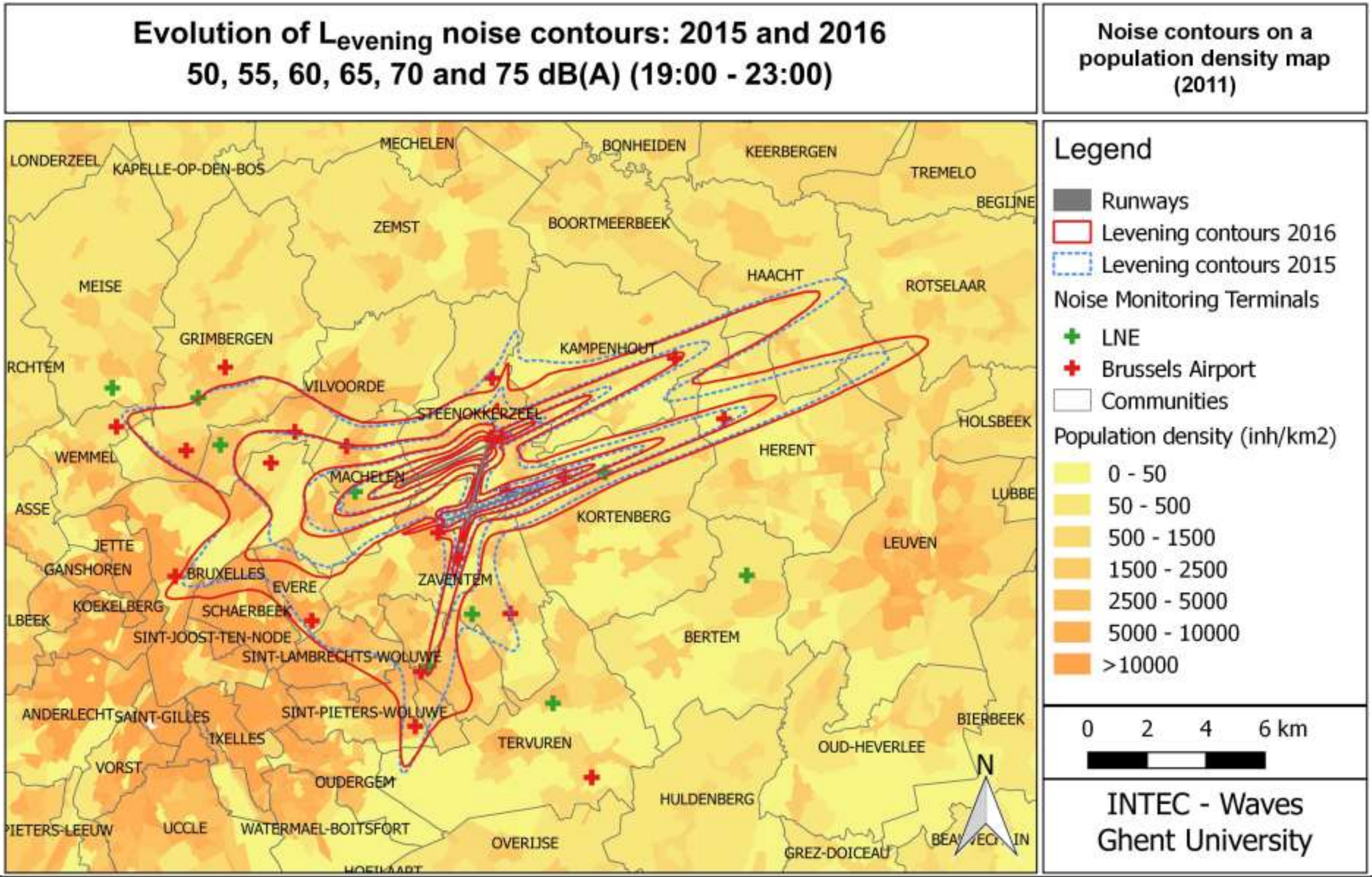
5.4 Noise contour maps: evolution 2015-2016

This appendix includes noise maps in A4 format.

- L_{day} noise contours for 2015 and 2016, background population map – 2011
- $L_{evening}$ noise contours for 2015 and 2016, background population map – 2011
- L_{night} noise contours for 2015 and 2016, background population map – 2011
- L_{den} noise contours for 2015 and 2016, background population map – 2011
- Freq.70,day noise contours for 2015 and 2016, background population map – 2011
- Freq.70,night noise contours for 2015 and 2016, background population map – 2011
- Freq.60,day noise contours for 2015 and 2016, background population map – 2011
- Freq.60,night noise contours for 2015 and 2016, background population map – 2011

- L_{day} noise contours for 2015 and 2016, background NGI topographical map
- $L_{evening}$ noise contours for 2015 and 2016, background NGI topographical map
- L_{night} noise contours for 2015 and 2016, background NGI topographical map
- L_{den} noise contours for 2015 and 2016, background NGI topographical map
- Freq.70,day noise contours for 2015 and 2016, background NGI topographical map
- Freq.70,night noise contours for 2015 and 2016, background NGI topographical map
- Freq.60,day noise contours for 2015 and 2016, background NGI topographical map
- Freq.60,night noise contours for 2015 and 2016, background NGI topographical map


Evolution of L_{day} noise contours: 2015 and 2016
55, 60, 65, 70 and 75 dB(A) (07:00 - 19:00)
Noise contours on a population density map (2011)
Legend
Runways
Lday contours 2016
Lday contours 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
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
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
IETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU


Evolution of $L_{evening}$ noise contours: 2015 and 2016
50, 55, 60, 65, 70 and 75 dB(A) (19:00 - 23:00)
Noise contours on a population density map (2011)
Legend
Runways
Levening contours 2016
Levening contours 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
INTEC - Waves
Ghent University
N
LONDERZEEL
KAPELLE-OP-DEN-BOS
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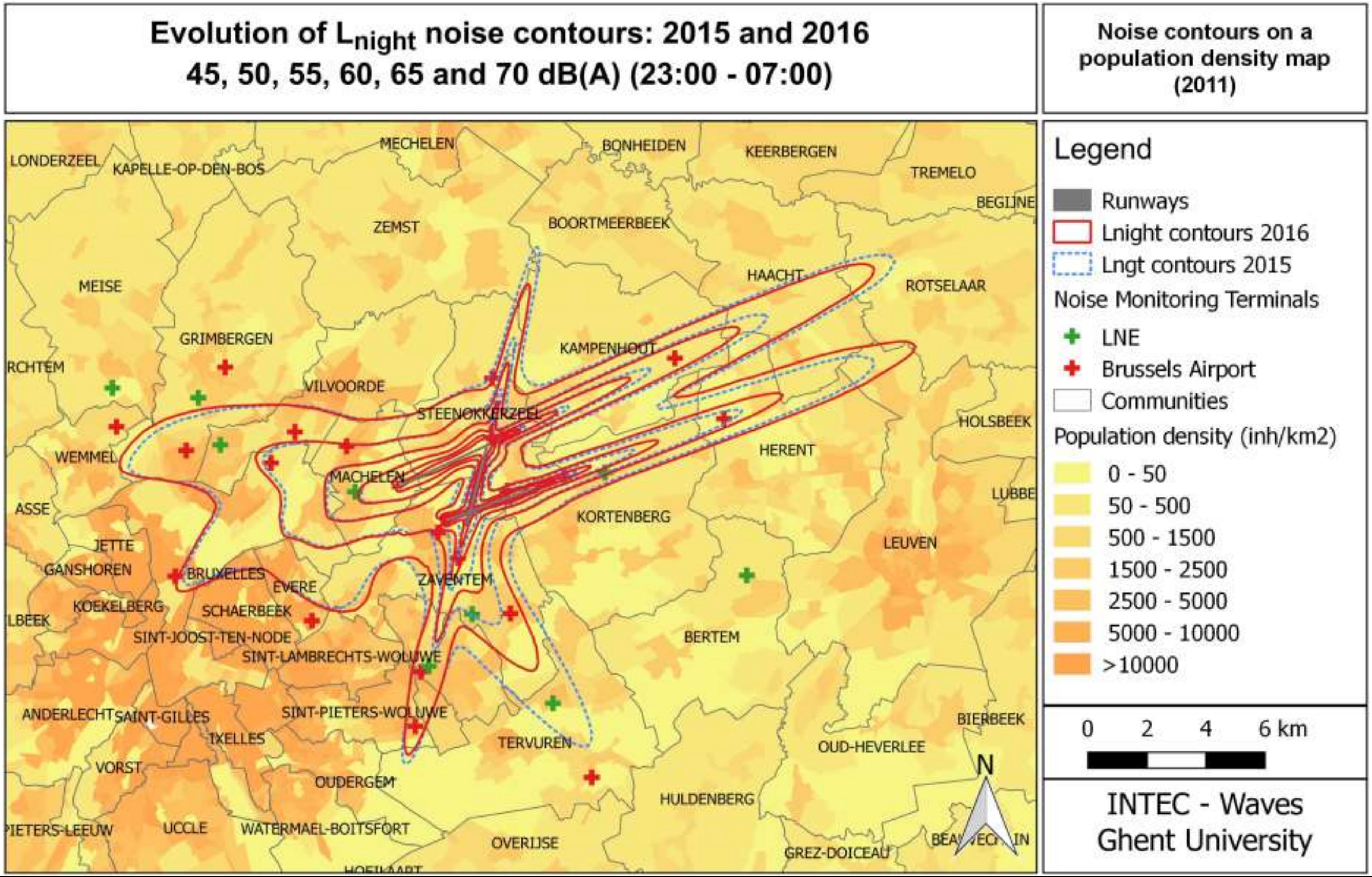
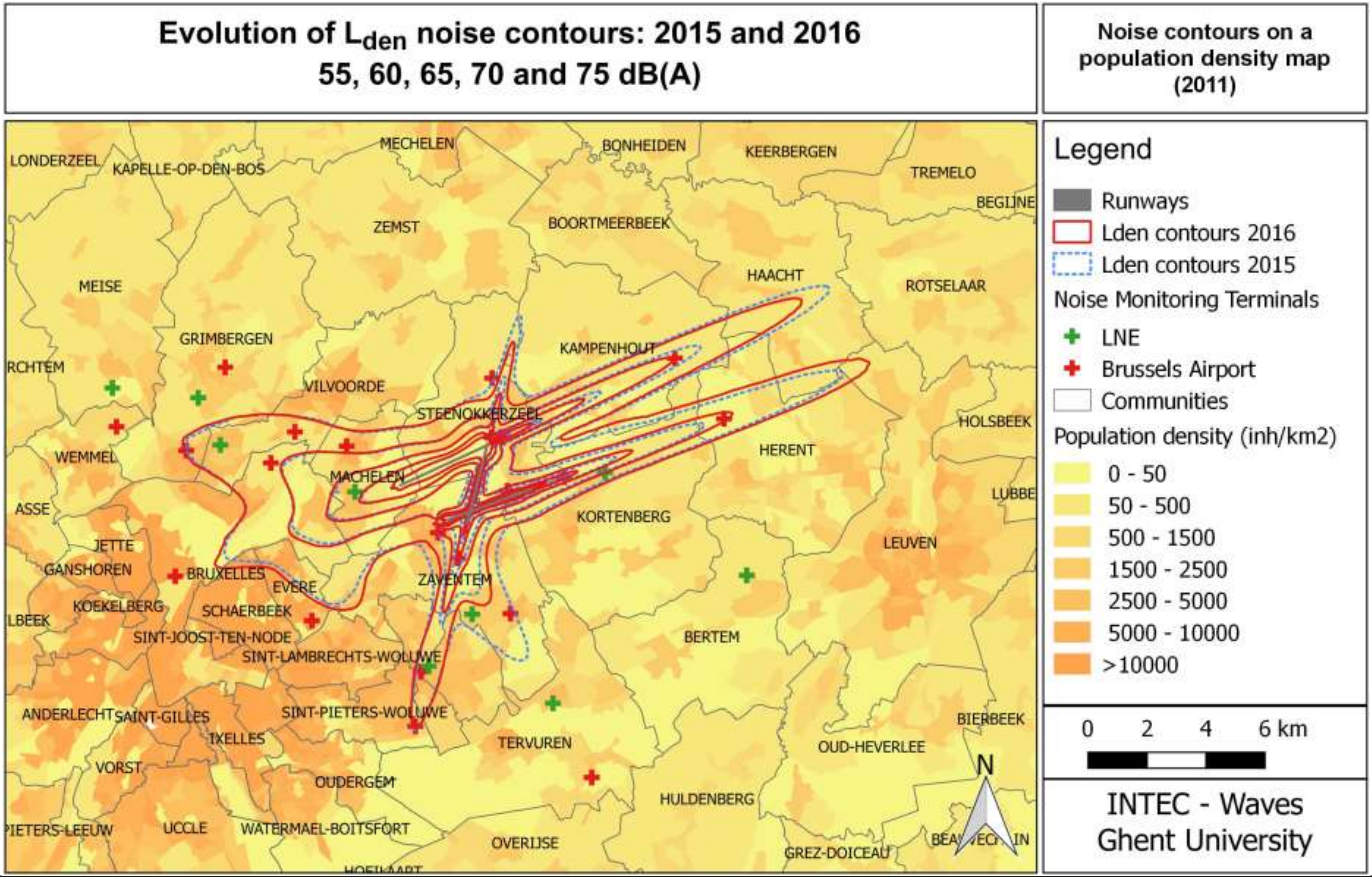
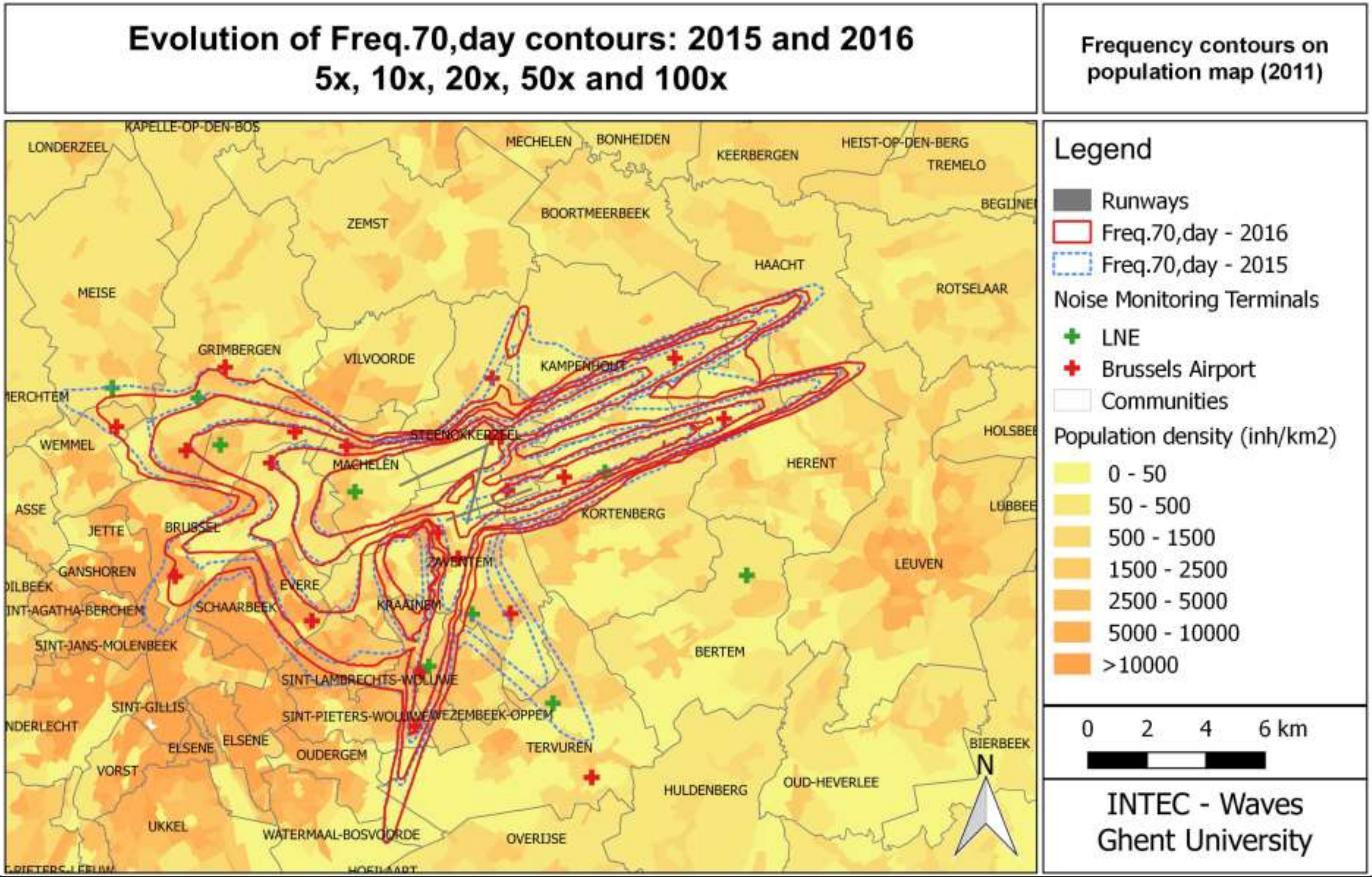
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
LEUVEN
JETTE
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
IETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU

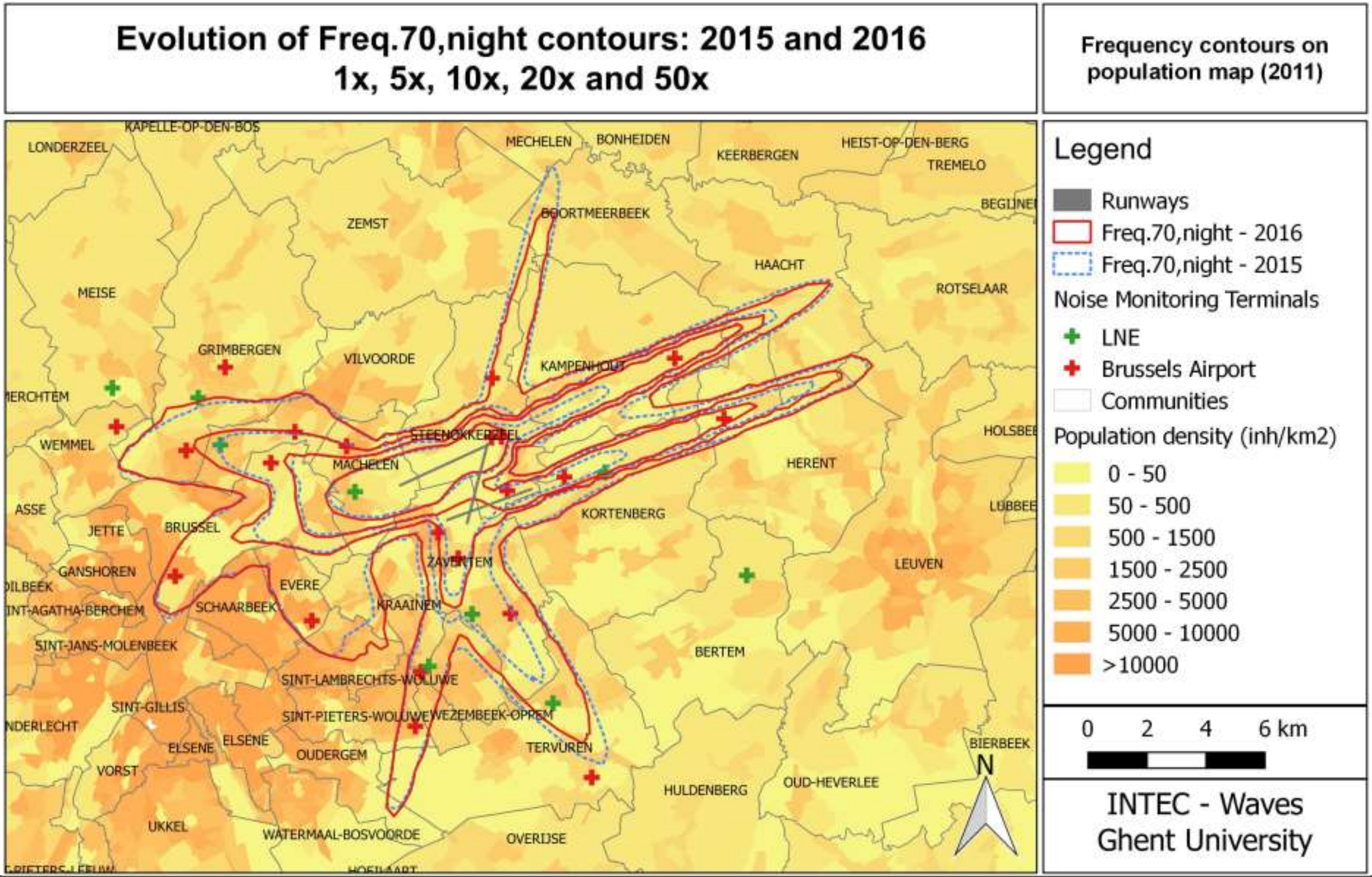

Evolution of Lnight noise contours: 2015 and 2016
45, 50, 55, 60, 65 and 70 dB(A) (23:00 - 07:00)
Noise contours on a population density map (2011)
Legend
Runways
Lnight contours 2016
Lngt contours 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
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
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
ZAVENTEM
EVERE
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
IETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU



Evolution of L_den noise contours: 2015 and 2016
55, 60, 65, 70 and 75 dB(A)
Noise contours on a population density map (2011)
Legend
Runways
Lden contours 2016
Lden contours 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
IETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU

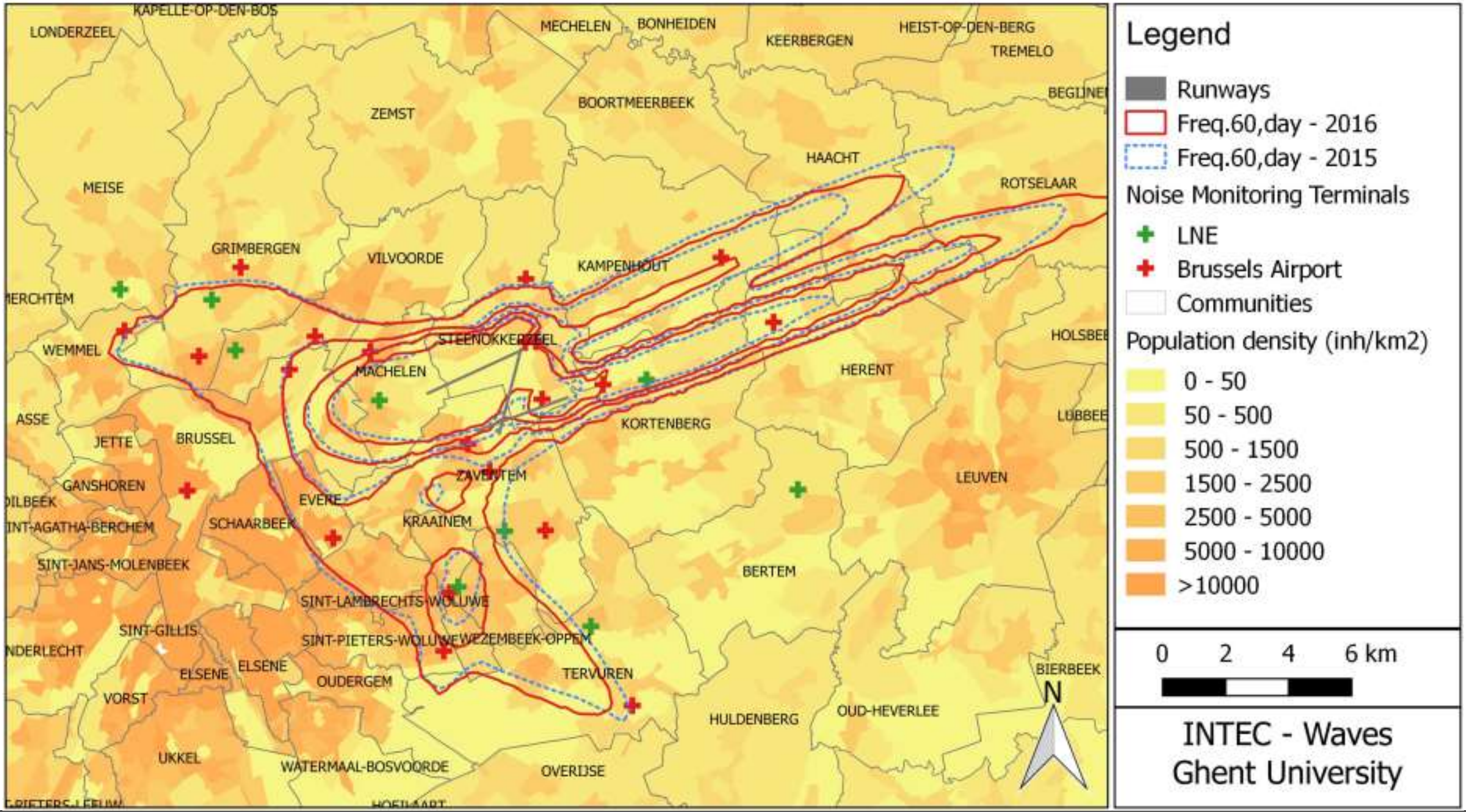


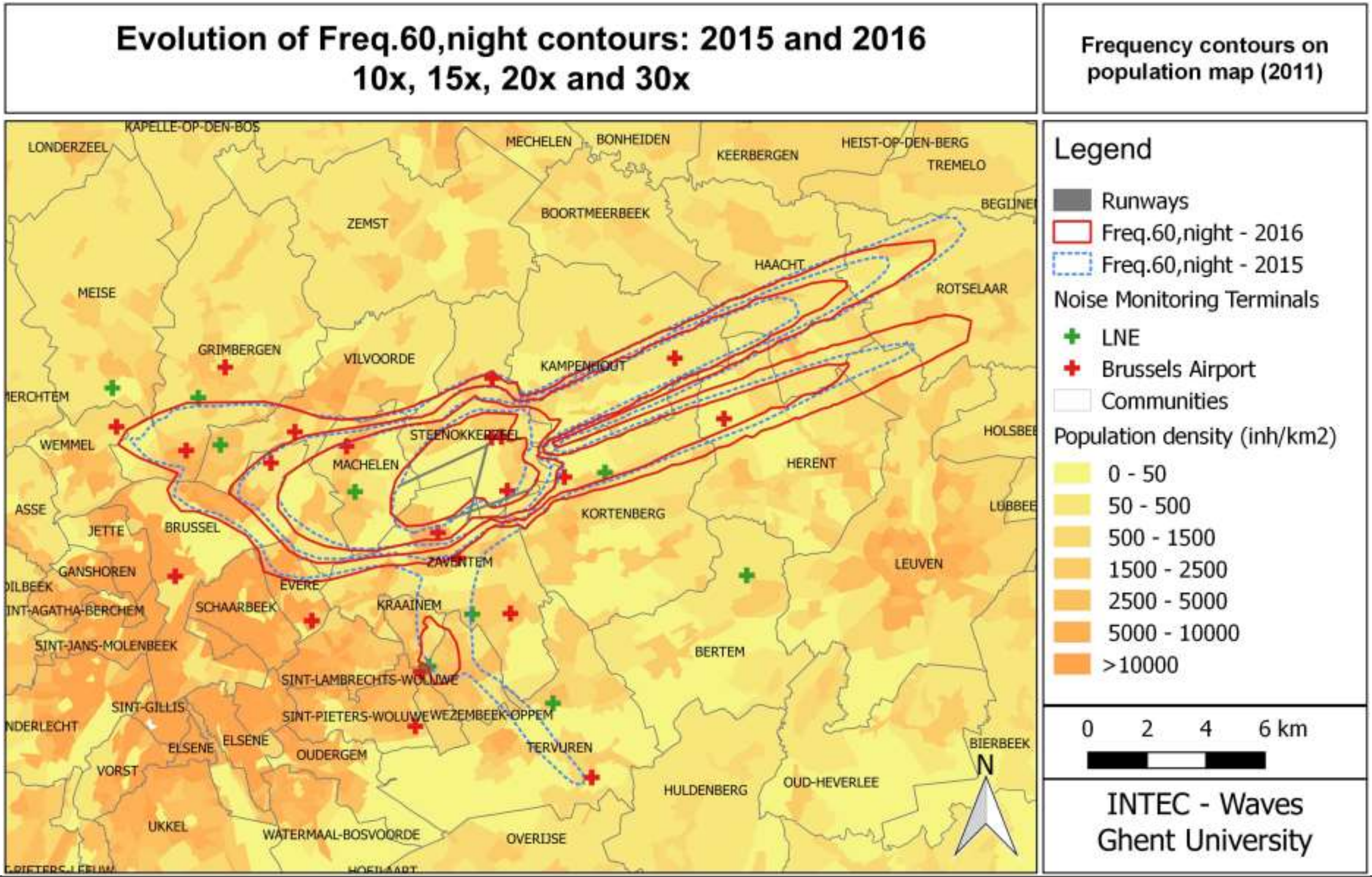
Evolution of Freq.70,day contours: 2015 and 2016
5x, 10x, 20x, 50x and 100x
Frequency contours on population map (2011)
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
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
Legend
Runways
Freq.70,day - 2016
Freq.70,day - 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University


Evolution of Freq.70,night contours: 2015 and 2016
1x, 5x, 10x, 20x and 50x
Frequency contours on population map (2011)
Legend
Runways
Freq.70,night - 2016
Freq.70,night - 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
HOLSBEE
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
LUBBEE
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: 2015 and 2016
50x, 100x, 150x and 200x

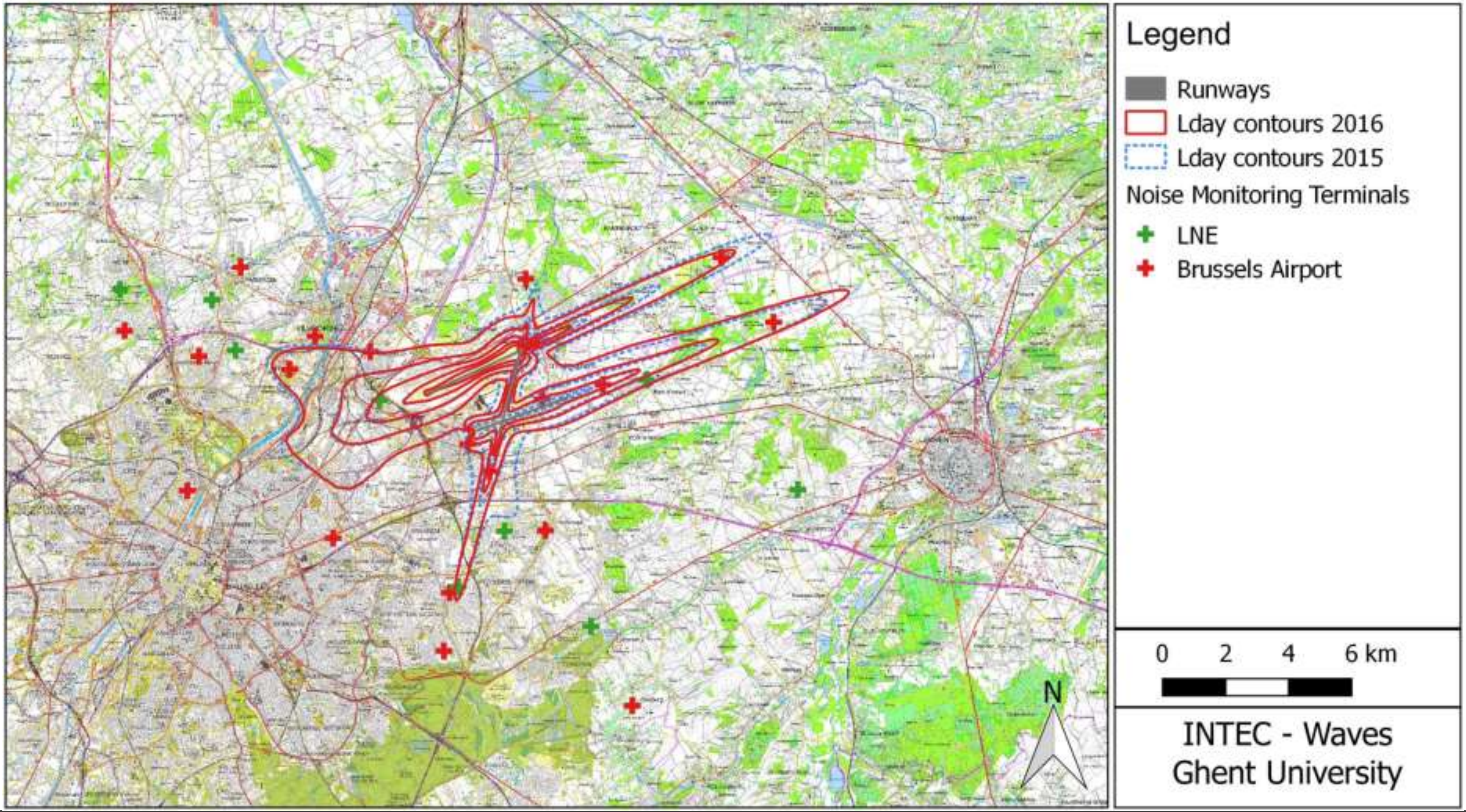
Frequency contours on population map (2011)

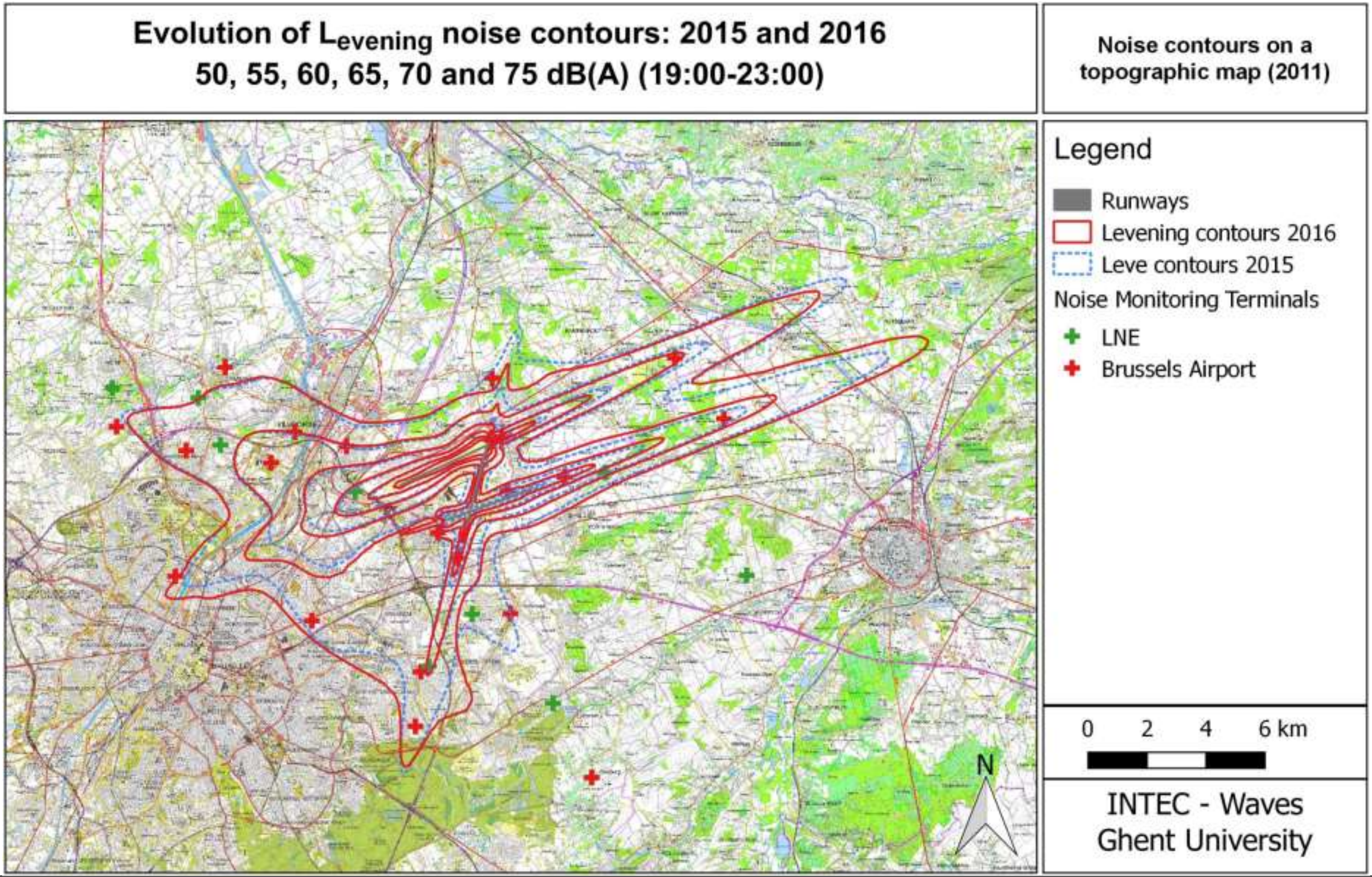



Evolution of Freq.60,night contours: 2015 and 2016
10x, 15x, 20x and 30x
Frequency contours on population map (2011)
Legend
Runways
Freq.60,night - 2016
Freq.60,night - 2015
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
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
HOLSBEE
ASSE
JETTE
BRUSSEL
KORTENBERG
LUBBEE
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 L_{day} noise contours: 2015 and 2016
55, 60, 65, 70 and 75 dB(A) (07:00-19:00)

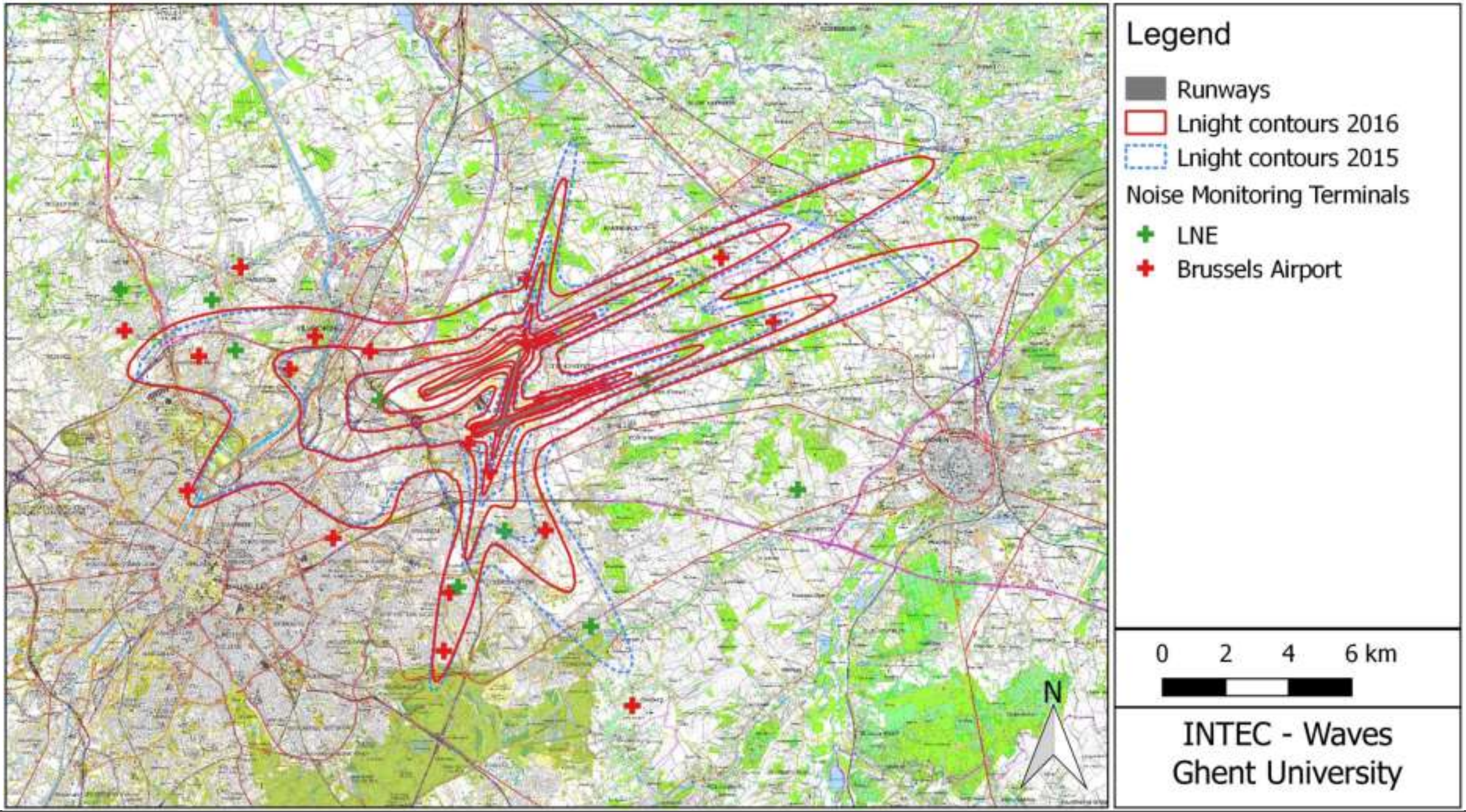
Noise contours on a topographic map (2011)

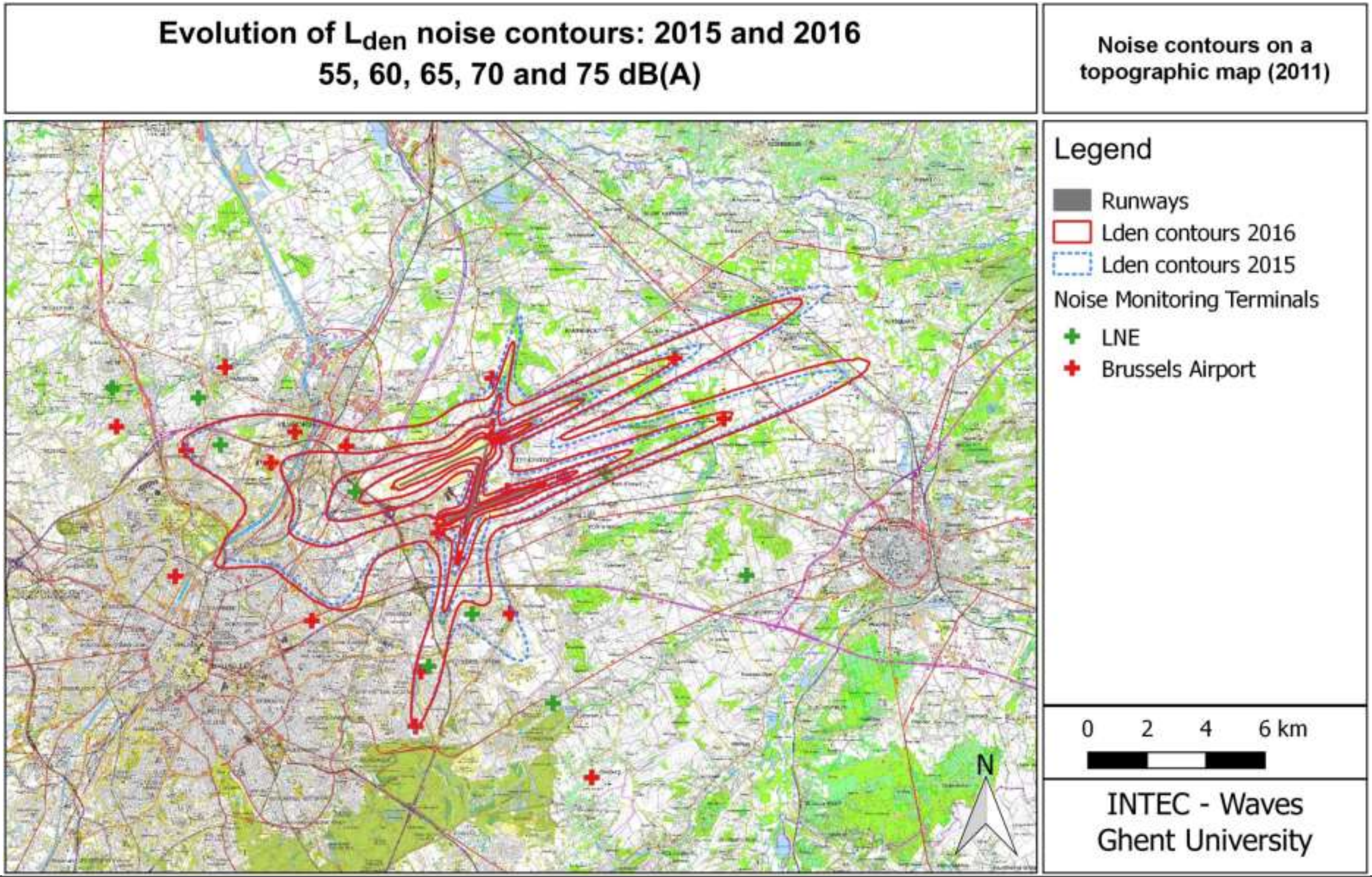



Evolution of $L_{evening}$ noise contours: 2015 and 2016
50, 55, 60, 65, 70 and 75 dB(A) (19:00-23:00)
Noise contours on a topographic map (2011)
Legend
Runways
Levening contours 2016
Leve contours 2015
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University

Evolution of L_{night} noise contours: 2015 and 2016
45, 50, 55, 60, 65 and 70 dB(A) (23:00-07:00)

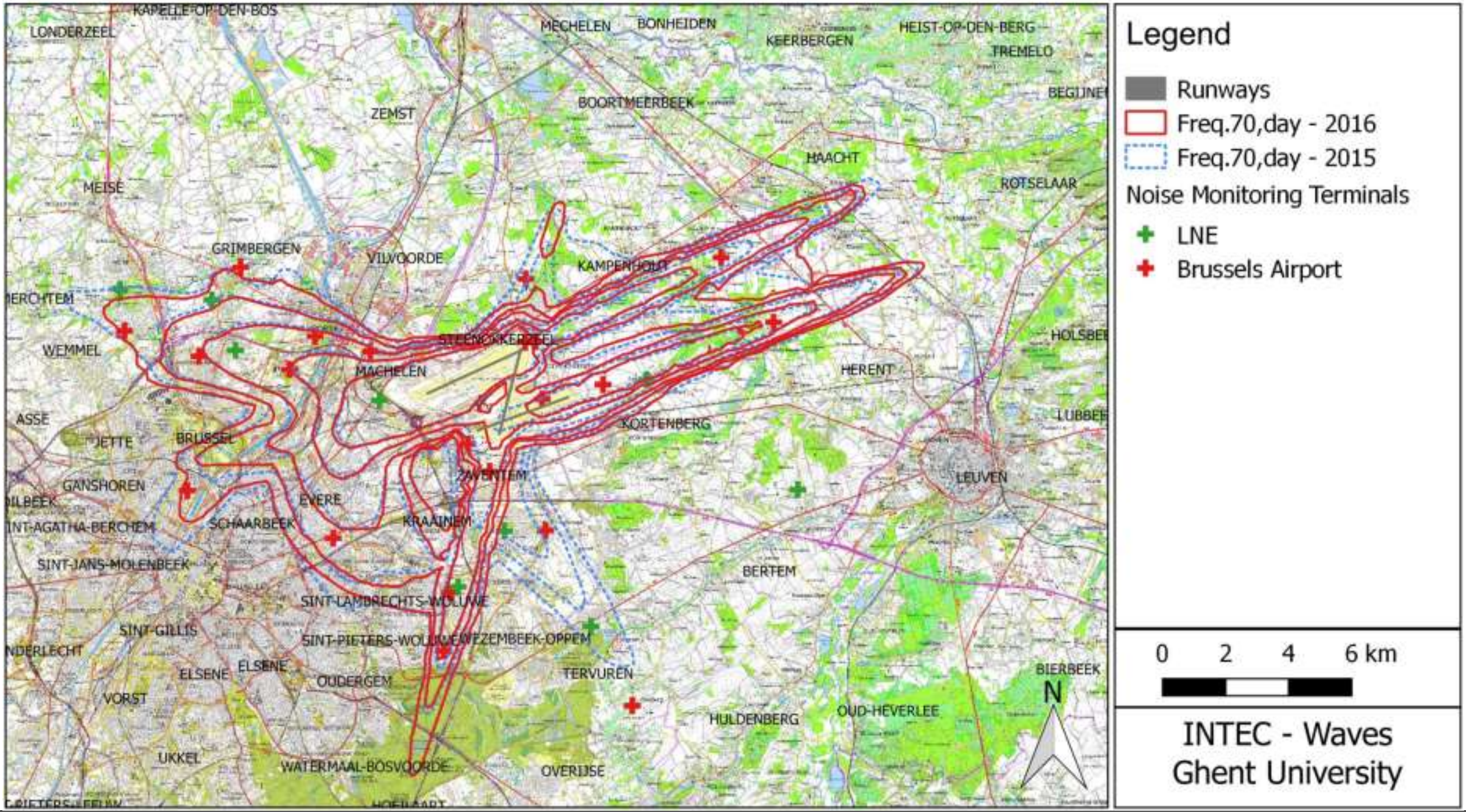
Noise contours on a topographic map (2011)




Evolution of L_{den} noise contours: 2015 and 2016
55, 60, 65, 70 and 75 dB(A)
Noise contours on a topographic map (2011)
Legend
Runways
Lden contours 2016
Lden contours 2015
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University

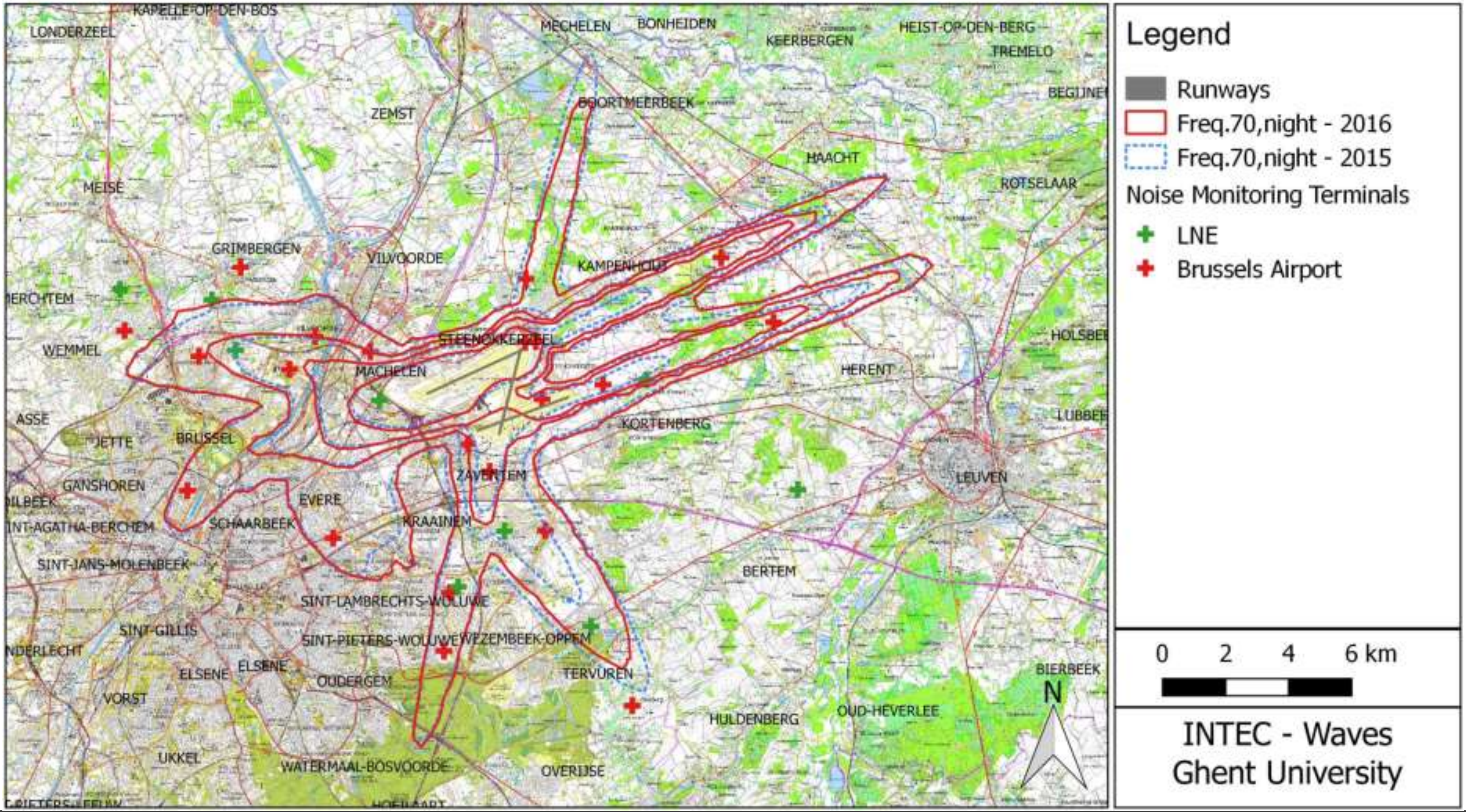
Evolution of Freq.70,day contours: 2015 and 2016
5x, 10x, 20x, 50x and 100x

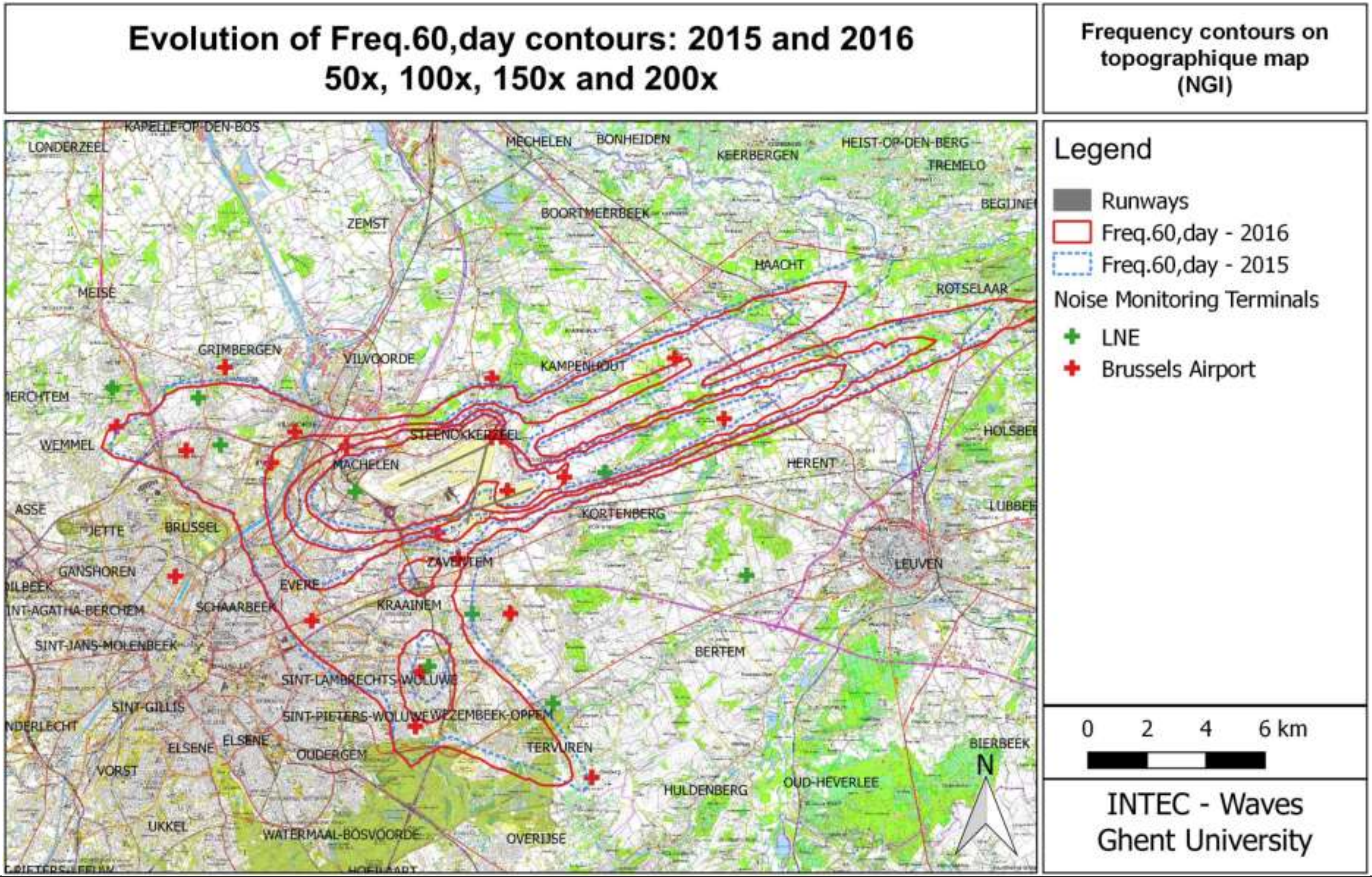
Frequency contours on topographique map (NGI)

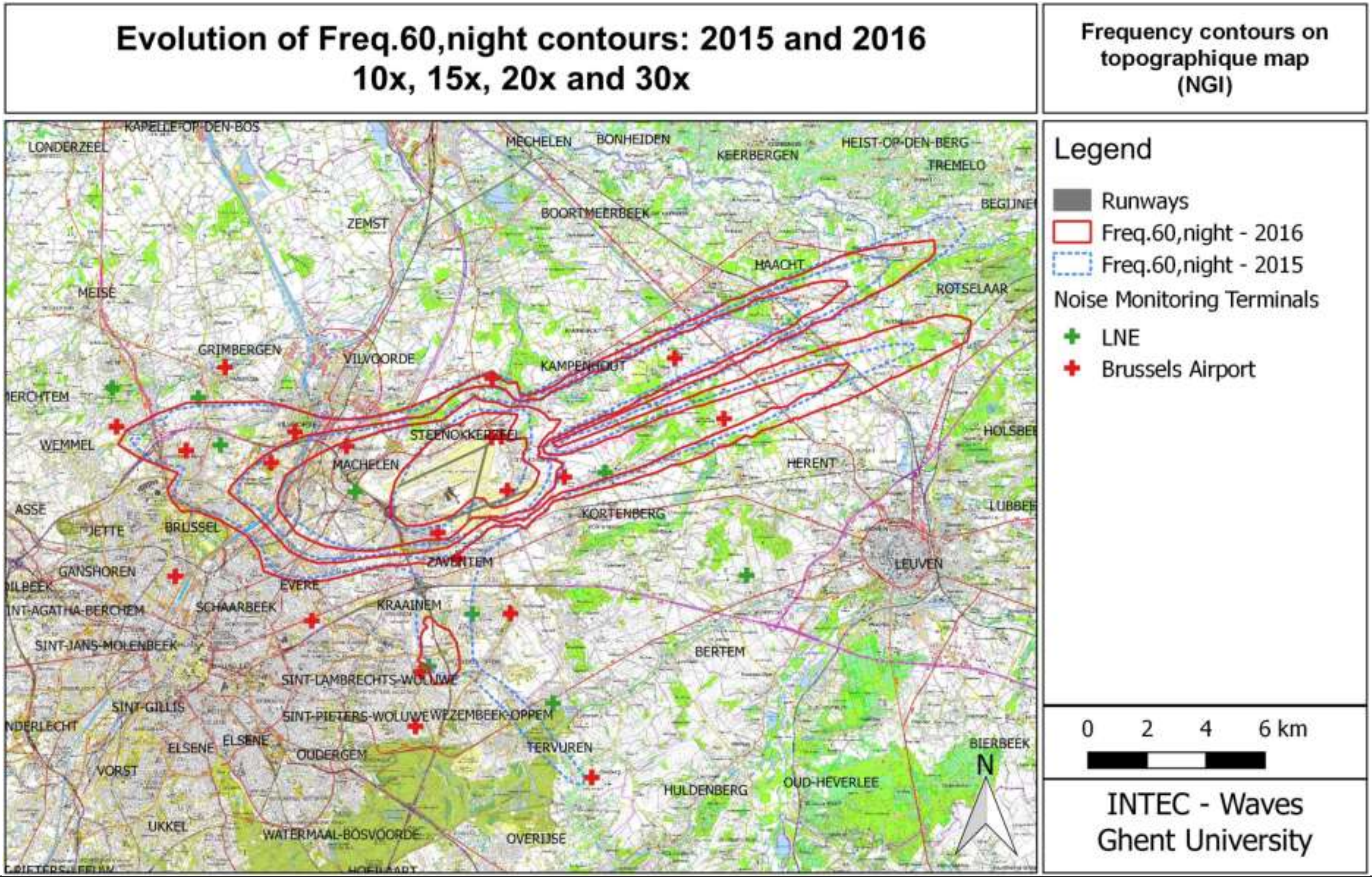


Evolution of Freq.70,night contours: 2015 and 2016
1x, 5x, 10x, 20x and 50x

Frequency contours on topographique map (NGI)




Evolution of Freq.60,day contours: 2015 and 2016
50x, 100x, 150x and 200x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.60,day - 2016
Freq.60,day - 2015
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
MEISE
ROTSELAAR
GRIMBERGEN
VILVOORDE
KAMPENHOUT
STEENOKKERZEEL
MACHELEN
WEMMEL
HERENT
HOLSBEEK
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,night contours: 2015 and 2016
10x, 15x, 20x and 30x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.60,night - 2016
Freq.60,night - 2015
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
HOLSBEEK
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

5.5 Evolution of the surface area and the number of residents

5.5.1 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 31: Evolution of the surface area inside the L_{day} contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 17: Evolution of the surface area inside the L_{day} contours (2000, 2006-2016).

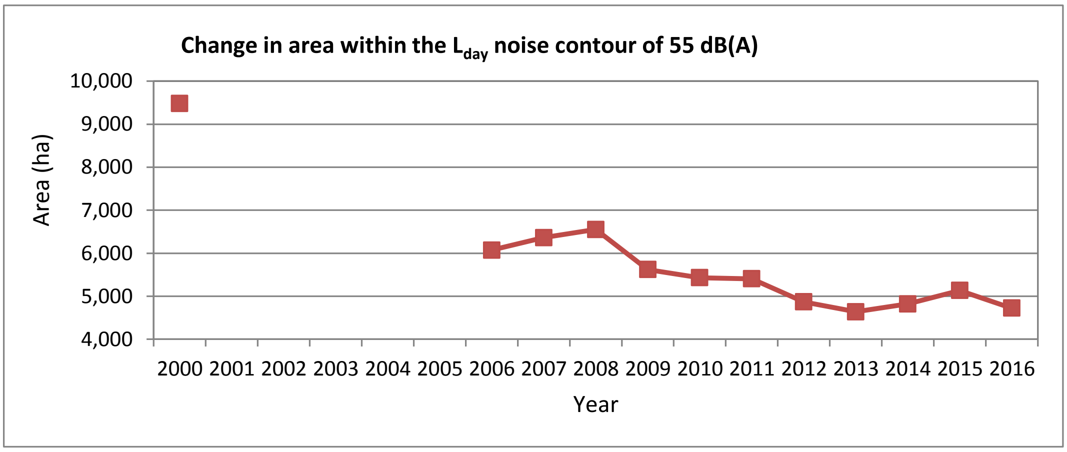


Table 32: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 18: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2016).

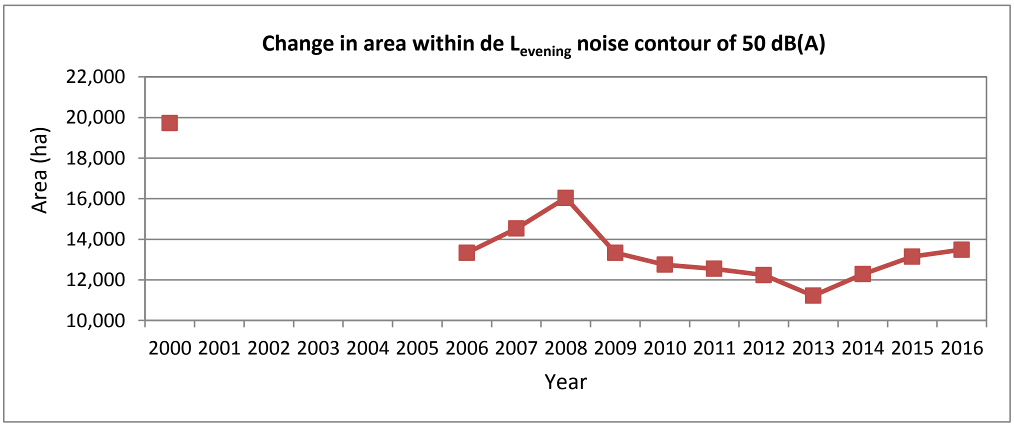


Table 33: Evolution of the surface area inside the L_{night} contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 19: Evolution of the surface area inside the L_{night} contours (2000, 2006-2016).

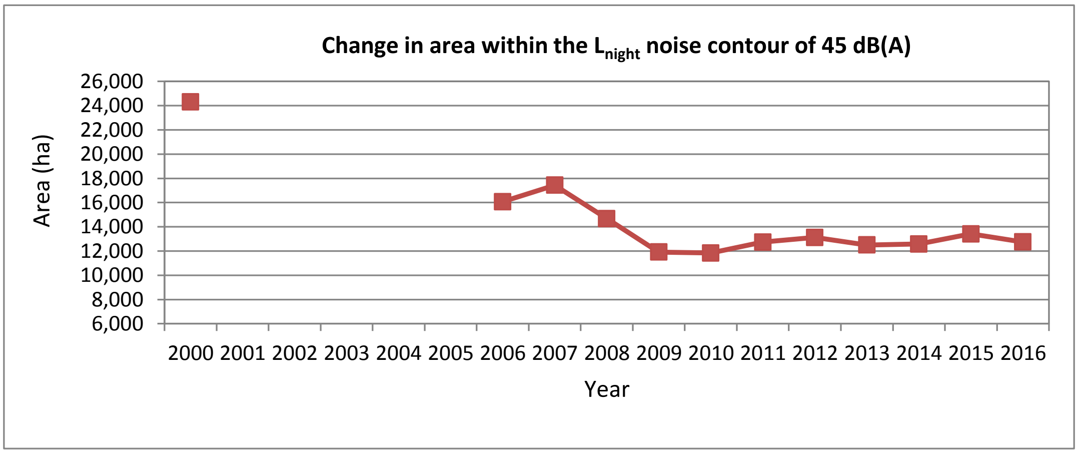


Table 34: Evolution of the surface area inside the L_{den} contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 20: Evolution of the surface area inside the L_{den} contours (2000, 2006-2016).

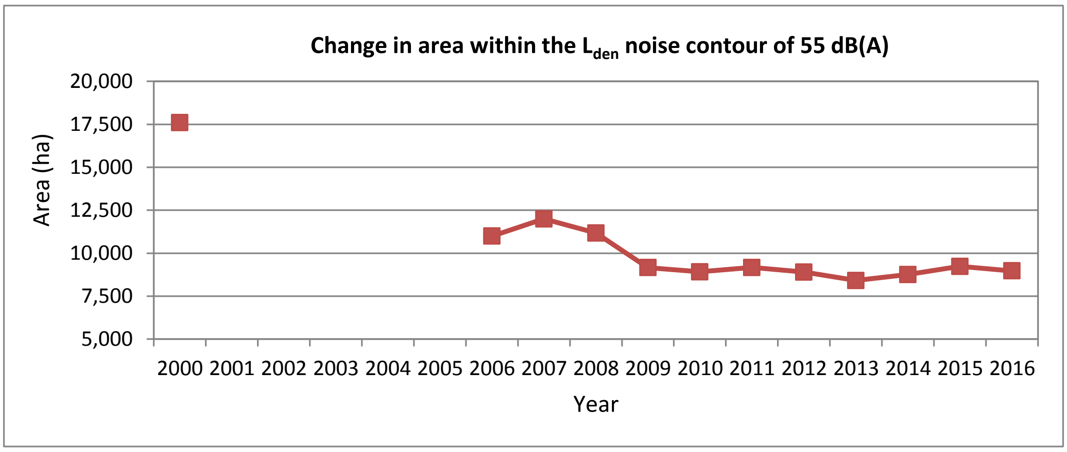


Table 35: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 21: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2016).

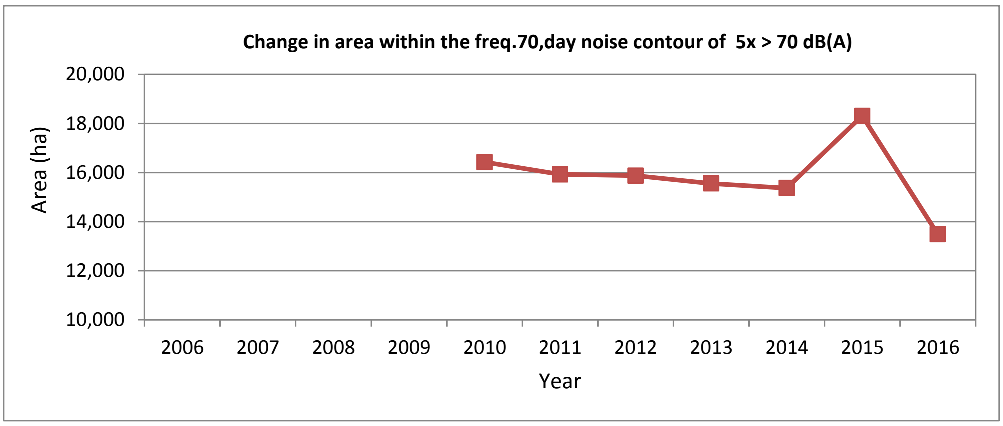


Table 36: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 22: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2016).

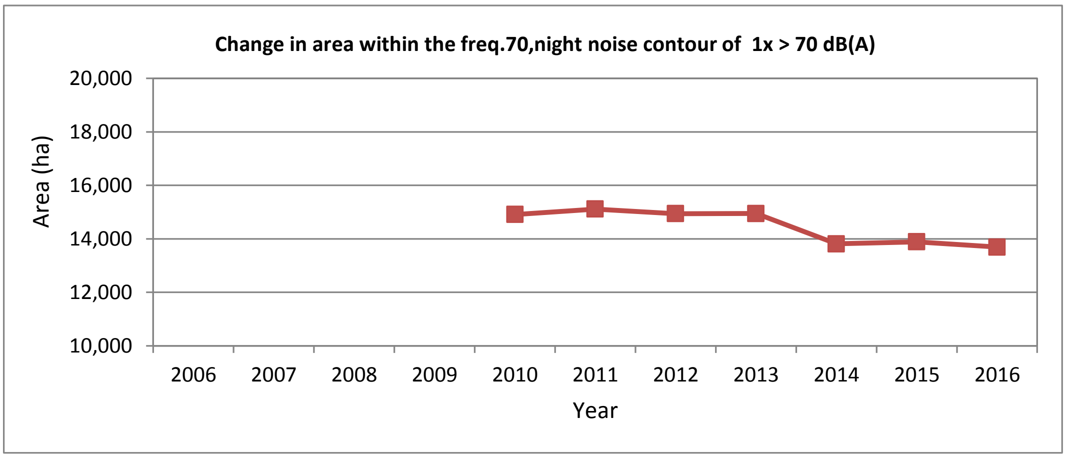


Table 37: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 23: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2016).

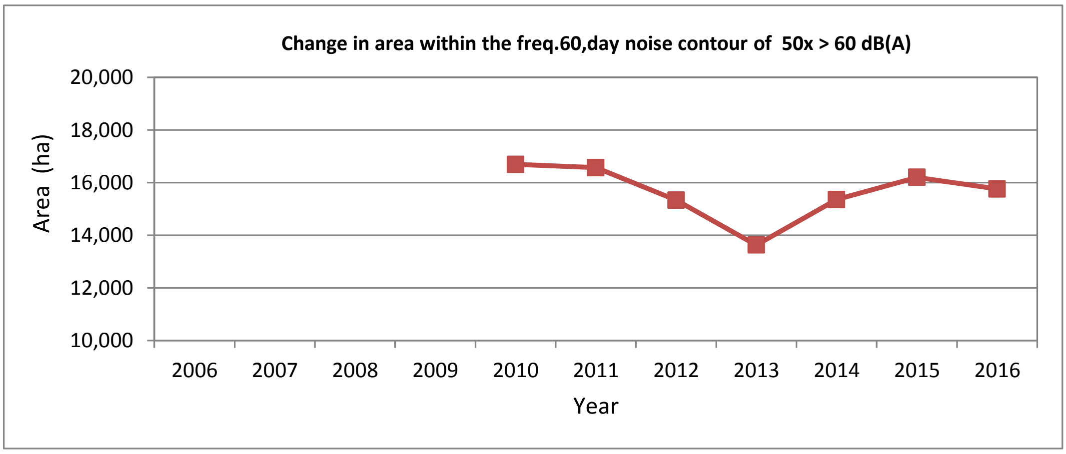
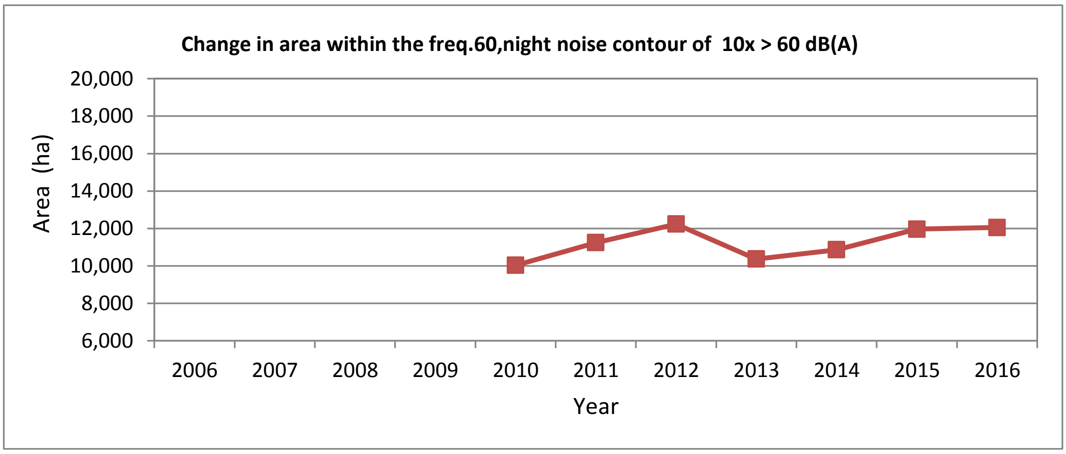


Table 38: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 24: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2016).



5.5.2 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 39: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 25: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2016).

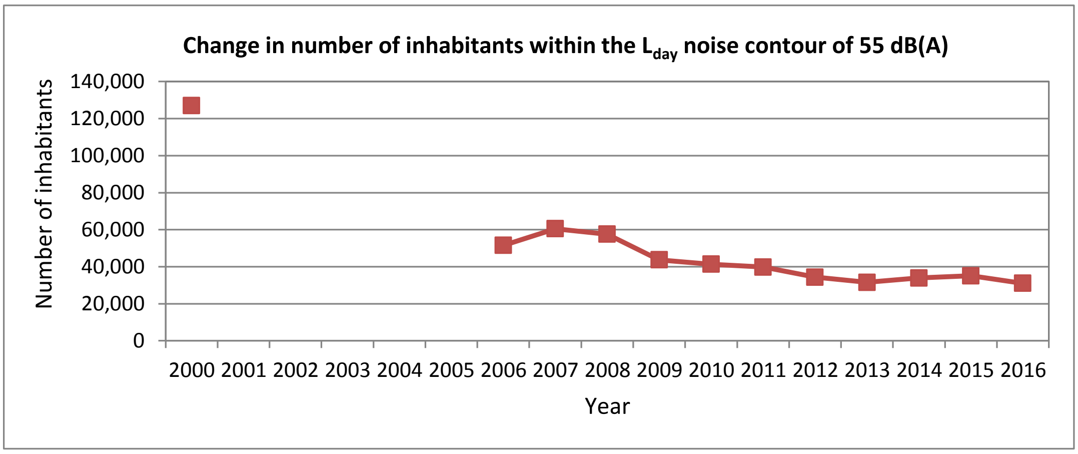


Table 40: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 26: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2016).

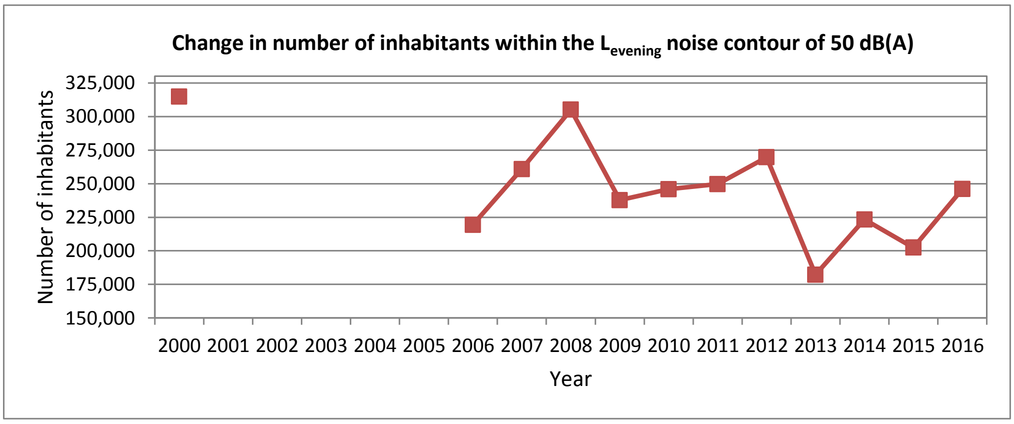


Table 41: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 27: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2016).

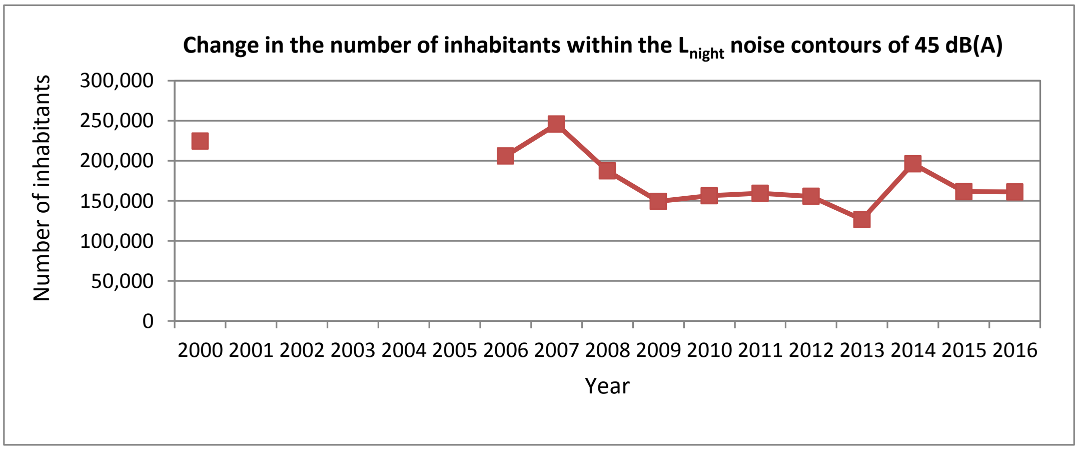


Table 42: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 28: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2016).

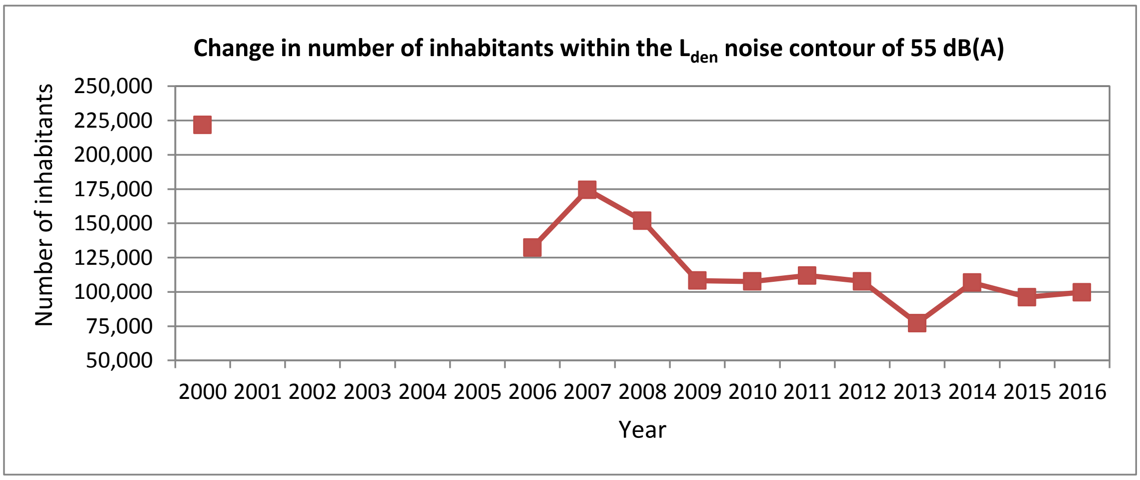


Table 43: Evolution of the number of residents inside the Freq.70,day contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 29: Evolution of the number of residents inside the Freq.70,day contours (2000, 2006-2016).

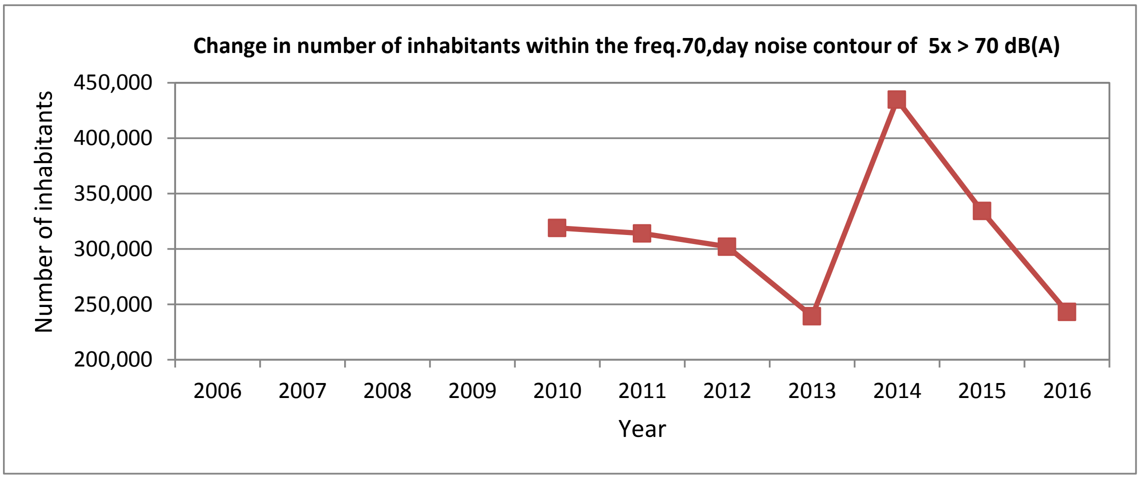


Table 44: Evolution of the number of residents inside the Freq.70,night contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 30: Evolution of the number of residents inside the Freq.70,night contours (2000, 2006-2016).

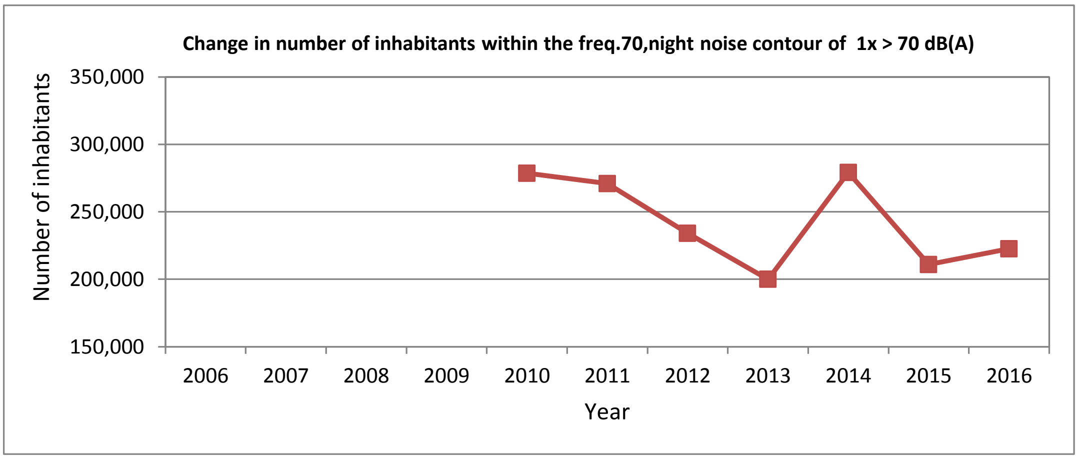


Table 45: Evolution of the number of residents inside the Freq.60,day contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 31: Evolution of the number of residents inside the Freq.60,day contours (2000, 2006-2016).

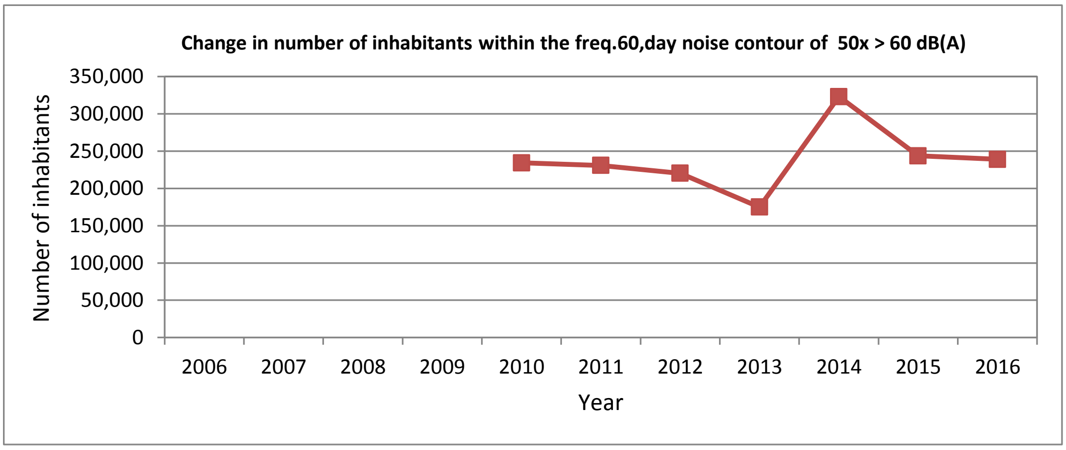
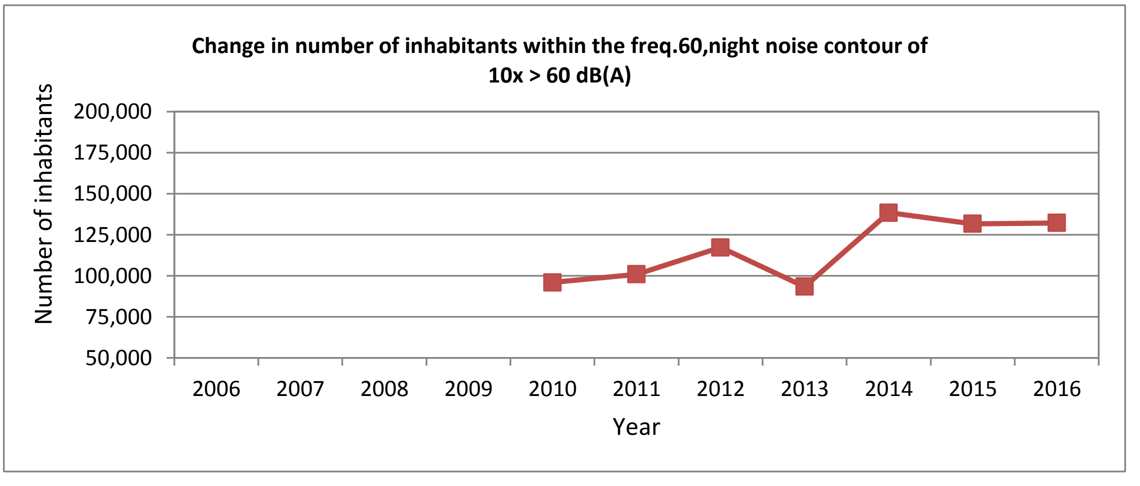


Table 46: Evolution of the number of residents inside the Freq.60,night contours (2000, 2006-2016).

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**

* Calculated with INM 7.0b

Figure 32: Evolution of the number of residents inside the Freq.60,night contours (2000, 2006-2016).



5.6 Documentation provided files

Radar data for the year 2016 (source: BAC-ANOMS)

radar_2016.zip	10/01/2017	627,962 kB

Flight data for the year 2016 (source: BAC-CDB)

cdb_2016_01_12.txt	09/01/2016	60,851 kB

Weather data for the year 2016 (source: BAC-ANOMS)

2016_meteo.xlsx	03/02/2016	1,717 kB

Noise events for the year 2016 (source: BAC-ANOMS)

2016-01_events.xlsx	27/02/2017 09:29	8340 KB
2016-02_events.xlsx	27/02/2017 9:47 AM	8663 KB
2016-03_events.xlsx	27/02/2017 9:50 AM	6990 KB
2016-04_events.xlsx	27/02/2017 9:59 AM	5996 KB
2016-05_events.xlsx	27/02/2017 10:03 AM	7985 KB
2016-06_events.xlsx	27/02/2017 10:34 AM	8450 KB
2016-07_events.xlsx	27/02/2017 10:37 AM	8945 KB
2016-08_events.xlsx	27/02/2017 10:40 AM	10821 KB
2016-09_events.xlsx	27/02/2017 10:44 AM	11025 KB
2016-10_events.xlsx	27/02/2017 10:48 AM	9755 KB
2016-11_events_update.xlsx	28/03/2017 12:21 PM	10121 KB
2016-12_events.xlsx	27/02/2017 2:32 PM	8586 KB

1 h reports noise measuring network for the year 2016 (source: BAC-ANOMS / LNE)

uur-rapporten_2016-01_03.xlsx	27/02/2017 3:15 PM	4508 KB
uur-rapporten_2016-04_06.xlsx	27/02/2017 15:15	4408 KB
uur-rapporten_2016-07_09.xlsx	27/02/2017 15:15	4670 KB
uur-rapporten_2016-10_12.xlsx	27/02/2017 3:15 PM	4664 KB
status_LNE_2016.xls	27/02/2017 3:18 PM	1912 KB

24 h reports noise measuring network for the year 2015 (source: BAC-ANOMS)

24h-rapporten-2016.xlsx	Tuesday 27/02/2017 3:12 PM	443 KB