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Noise contours around Brussels Airport for the year 2014

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1. Introduction

Noise contours are calculated in order to be able to make an objective assessment of the noise impact caused by an airport in the surrounding area. These noise contours reflect changes and events that can have an impact on the noise production by air traffic during arrival and take-off, and as such, can be used to describe the situation as well as to evaluate the effects of changes in the aircraft fleet, changes in number of movements and any actions taken. The accuracy of the noise contours is compared with sound measurements taken at a number of locations around the airport.

Laboratorium voor Akoestiek – KU Leuven has been calculating noise contours annually since 1996, to show the noise impact caused by flight traffic from and to Brussels Airport. It is commissioned to do this by the airport operator, currently Brussels Airport Company. The calculations are imposed for Brussels Airport in the Flemish environmental legislation (VLAREM) which was amended in 2005[1] in accordance with the European Directive relating to the assessment and management of environmental noise, and in the environmental licence [2] of Brussels Airport Company.

[1] Belgian Official Journal, *Decision by the Flemish Government on the evaluation and control of environmental noise and 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 about the appeals lodged against the decision with reference D/PMVC/04A06/00637 of 8 July 2004 by the provincial executive of the provincial council of Flemish Brabant, on granting of the environmental licence for a period expiring on 8 July 2024 to NV Brussels International Airport Company (B.I.A.C), Vooruitgangsstraat 80 bus 2, 1030 Brussels, to continue operating and to alter (by adding to it) an airport located at Brussels National Airport in 1930 Zaventem, 1820 Steenokkerzeel, 1830 Machelen and 3070 Kortenberg*, 30 December 2004

1.1 Calculations imposed for Brussels Airport

Under the VLAREM environmental legislation, the operator of an airport classified in category 1[3] is bound to 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 24h and to determine the number of people potentially highly 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 licence of Brussels Airport Company imposes extra noise contour calculations:

- L_{night} and L_{den} noise contours as in the current VLAREM obligations;
- Frequency contours for 70 dB(A) and 60 dB(A); Brussels Airport Company[4] requested the Laboratory of Acoustics 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) during the night period (23.00 to 07.00) 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, 200x
  - Frequentiecontouren voor 60 dB(A) during the night period (23h00 tot 07h00) with frequencies 10x, 15x, 20x, 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 higher.

The number of people liable potentially highly inconvenienced within the various L_{den} contour zones must be determined on the basis of the dose-effect ratio laid down in the VLAREM.

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

[3] Category 1 airports: Airports that meet the definition of the Chicago Convention of 1944 establishing the International Civil Aviation Organization and with a take-off and arrival runway of at least 800 metres

[4] On July 1, 2013 Brussels Airport Company nv (BAC) and Brussels Airport Holding nv (BAH) were seen to merge. The name was changed into Brussels Airport Company nv (BAC).

1.2 History of noise contour calculations for Brussels Airport

The Laboratorium voor Akoestiek – KU Leuven has calculated noise contours annually since 1996 for the noise impact of flight traffic from and to Brussels airport, commissioned by the airport operator. Prior to the VLAREM being brought into line with the European directive on environmental noise in 2005, the following operational division of the day was used (day: 06.00 – 23.00; night 23.00 – 06.00). After the VLAREM was brought into line with the Directive, the official noise contours to be reported were calculated according to the division of the day in the Directive (day: 07.00 – 19.00; evening: 19.00 – 23.00; night 23.00 – 07.00).

1.3 Version of the Integrated noise Model

For the calculation of the noise contours since 2011, the latest version of the INM calculation model, i.e. the INM 7 (subversion INM 7.0b) has been used. For the years 2000 through 2010, the model's 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 through 2010 were recalculated with version 7.0b[5]. In this way, it is possible to assess the evolution of the noise contours since 2000 without being affected by the calculation model used.

1.4 Population data

In order to determine the number of people living within the contour zones and the number of people potentially highly inconvenienced, the most recent data available is used. On inquiry with the Office for Statistics and Economic Information (also still called National Institute for Statistics), these were revealed to be the population figures as of 1 January 2010.

1.5 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 9.

1.6 INM study

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

- KUL_PV5864_EBBR14_INM_studie.zip (the INM study used) (22/04/2015)
- KUL_PV5864_EBBR14_noise contours.zip (the contours as calculated in shape format) (22/04/2015)
- KUL_PV5864_EBBR14_opp_inw.zip (the number of residents and the surface area as calculated within the noise contours) (22/04/2015)

[5] With regard to the frequency contours of 60 and 70 dB(A), only the year 2010 was recalculated using the 7.0b version of the INM computer model.

2. Definitions for the evaluation of noise contours

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 any point around the airport. Due to a difference in distance from the noise source, the 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. Further away from the noise source, the value of the noise contours is lower.

2.1.2 Frequency contours

The acoustic impact of overflight by an aircraft can be characterised at any point around the airport by, among other factors, 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 ($L_{Aeq,1s,max.}$)[6] during that overflight.

For the passage of an entire fleet, the number of times that the maximum sound pressure level exceeds a particular value can be calculated. 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

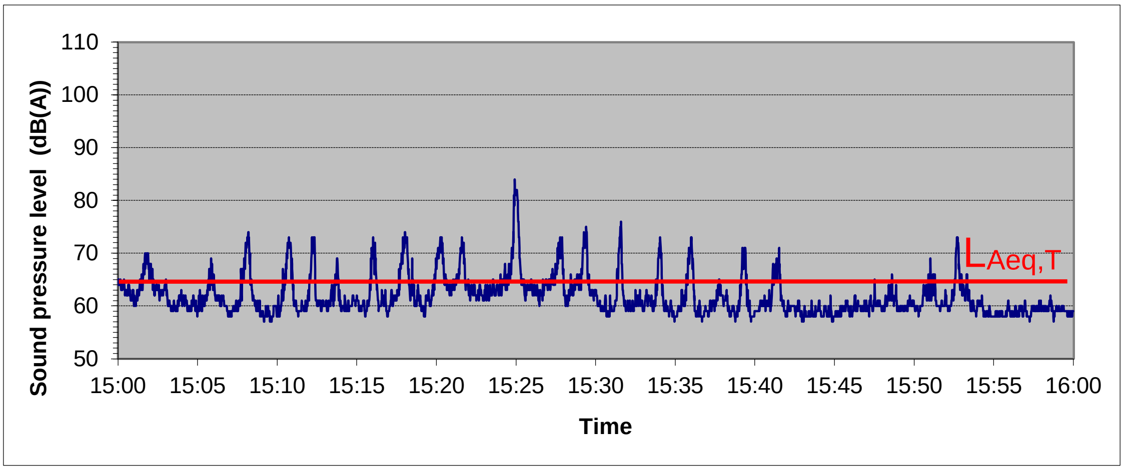
A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

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 average energy of the sound pressure observed during the period is used (see Figure 1).

[6] The INM computer program calculates the variable $L_{Amax,slow}$. The numeric values for this variable are fairly comparable with those for the variable $L_{Aeq.1s,max.}$.

Figure 1 Graph of the A-weighted equivalent sound pressure level ($L_{Aeq,T}$)



The A-weighted equivalent sound pressure level $L_{Aeq,T}$, over a period T, is the sound pressure level of the *constant* sound containing the same acoustic energy in that same period, or is a representation of the average quantity of acoustic energy observed over the period T per second. The unit for 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 level. 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, the A-weighting is accepted as THE measurement for determining noise impact around airports. This A-weighting is also applied in the VLAREM legislation on airports.

In this report, 3 types of $L_{Aeq,T}$ contours are calculated, i.e.:

- 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}

To obtain an overall picture of the nuisance around the airport, it is usually opted not to use the equivalent sound pressure level over 24 hours. or $L_{Aeq,24h}$. Noise during the evening or night period is always perceived as more annoying than the same noise during the daytime period. LAeq,24h, for example, takes no account whatever of this difference.

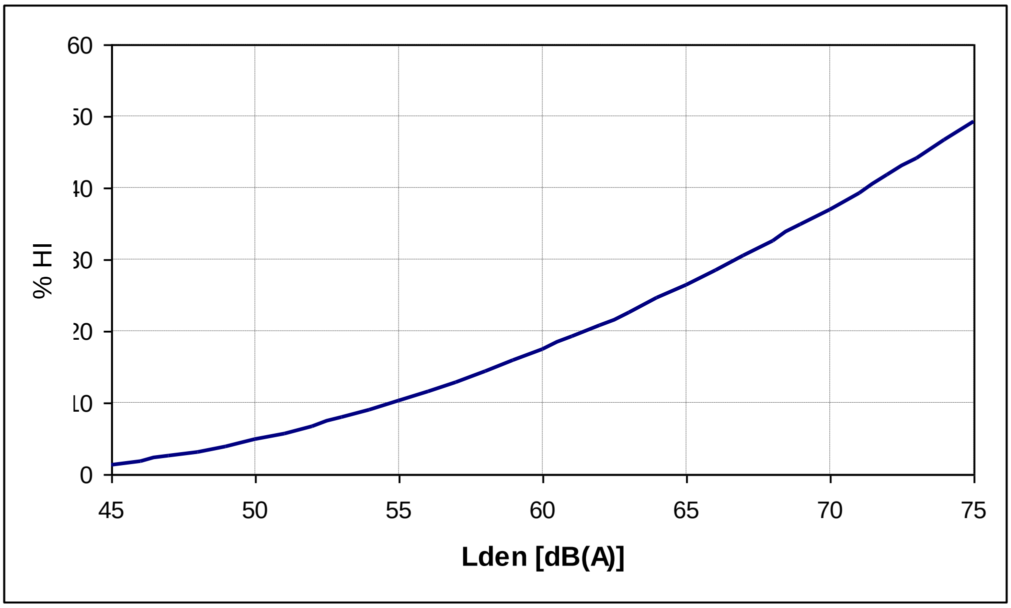
The European directive on assessment and management of environmental noise (implemented in the VLAREM), recommended using the Lden parameter to determine the nuisance. The L_{den} (Level Day-Evening-Night) is the A-weighted equivalent sound pressure level over 24 hours, with a (penalty) correction of 5 dB(A) being applied for noise during the evening period (equivalent to an increase of the number of evening flights by a factor of 3.16), which rises to 10 dB(A) during the night (equivalent to an increase of the number of night flights by a factor of 10). For the calculation of the L_{den} noise contours, the day is divided in the way used in VLAREM heading 57, where the evening period runs from 19.00 to 23.00 and the night period from 23.00 to 07.00.

2.2 Link between nuisance and noise impact

To determine the number of people potentially highly inconvenienced within the L_{den} 55 dB(A) noise contour, a dose-effect ratio is incorporated in the VLAREM. This equation shows the percentage of the population that is highly inconvenienced (%HI) from the noise impact expressed in L_{den} (Figure 2).

$$\%HI = -9.199 \cdot 10^{-5}(L_{den}-42)^3 + 3.932 \cdot 10^{-2}(L_{den}-42)^2 + 0.2939(L_{den} - 42)$$

Figure 2 Percentage of people potentially highly inconvenienced due to L_{den} from aircraft noise (source: VLAREM – environmental legislation based on Miedema 2000)



This relation was established from a synthesis/analysis of various noise nuisance studies at various European and American airports carried out by Miedema[7] and was adopted by the European Commission WG2 Dose/effect [8].

[7] Miedema H.M.E, Oudshoorn C.G.M, Elements for a position paper on relationships between transport noise and inconvenience, TNO report PG/VGZ/00.052, July 2000

[8] European Commission, WG2 – Dose/effect, *Position paper on close response relationships between transport noise and inconvenience*, 20 February 2002

3. Methodology for the calculation of the noise contours around Brussels Airport

To determine noise contours, places have to be found around the airport where an identical level of noise impact has been observed. However, measuring noise impact at every point is inconceivable. For this reason, an internationally accepted method has been devised for determining noise contours using simulations with computer models.

In Belgium, just as in many other countries, the Integrated noise Model (INM) of the United States Federal Aviation Administration (FAA) is used to calculate noise contours around airports. 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 can be broken down into 3 phases:

- Collection of information concerning the relevant flight movements, the routes flown and the characteristics of the airport as an input for INM;
- Performance of contour calculations;
- Post-processing of the contours into a Geographic Information System (GIS).

3.1 Collection of input data

INM calculates noise contours around airports based on a 'average day (night, 24h,…)' input file. The meaning of an average day is **NOT** that a day is chosen on which all the conditions satisfied an average value. Based on the data for a complete year, 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.

All these aircraft movements follow determined routes, which are essentially determined by the runway used and the SID flown (Standard Instrument Departure) as regards departures or by the runway used and the STAR (Standard Instrument Arrival) as regards arrivals. The existing SIDs and STARs are shown in the AIP, Aeronautical Information Publication, and they determine the procedure that must be followed by the pilot in flight movements from and to Brussels Airport.

3.1.1 Information aircraft movements

In order to take a movement into account to determine the input for INM, a number of items of data are required:

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

For the contour calculations of Brussels Airport for the year 2014, the flight information was obtained from Brussels Airport Company in the form of an extract from the central database (CDB). This database includes all the necessary data per aircraft movement. The quality of the data is very good.

For each aircraft type in the flight list, an equivalent INM type is searched on the basis of type, engines, registration, etc. In most cases, the aircraft types are present in INM, or INM provides for a substitute type, and as model versions are developed, more and more types are included in it. For a small fraction that cannot yet be identified in INM, an equivalent is sought based on other noise data, the number and type of engines and the MTOW (maximum take-off weight). Helicopter movements are not included in this model. Their contribution to the sound pressure level is factored in by extrapolating the results for the flights involving different airplane types to the total number of flights, including those by helicopter.

Based on the distance to be flown, using the conversion table provided by INM,[9], the aircraft weight is taken into account in its climb profile. The standard departure and arrival profiles contained in INM are always used for the calculation of the annual noise contours around Brussels Airport.

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 that must be followed after take-off from Brussels Airport. For example, these procedures require pilots to carry out a manoeuvre after reaching a particular height or reaching a given geographical location. When an aircraft to reach a particular height is heavily dependent on the aircraft type (size, number of engines, etc.), weight (including the fuel load necessary to fly a particular distance) and the weather conditions, there is a wide geographical spread on the actual routes when following a particular SID.

The actual location of the average horizontal projection per SID is determined on the basis of radar data[10] during the year. The definition of a number of sub-routes besides this average route takes account of the actual spread on this SID. For a number of SIDs, just as in recent years, a split can be made based on the aircraft type to obtain a proper description of the tracks actually flown.

To determine the location of the tracks actually flown, aircraft movements are selected at random so that, on the one hand, a representative number of movements can be obtained and, on the other hand, all days of the week and seasons are taken into account. The ultimate location of the INM track with the spread is determined with an INM tool, which calculates the average route together with the location of a number of subtracks symmetrically around this average route.

More information about the method used can be found in Appendix 3.

[9] INM user's guide: INM 6.0, Federal Aviation Administration, Office of Environment and Energy

[10] These radar data are available in the NMS of Brussels Airport up to a height of 9,000 feet

3.1.3 Meteorological data

For the calculation of the contours, the actual average meteorological conditions during the year 2014 were input into the INM. As basic data to determine these averages, the weather data used was that per hour recorded during the past year in the NMS. The use of this data makes it possible to calculate an actual average headwind for each runway at the airport at the time that the runway is in use.

The average headwind for each runway of the airport is calculated as follows:

- First, the movements per runway are selected separately. The departures and arrivals are considered together.
- Each movement is connected to the meteorological data at the time of the flight via the departure or arrival time.
- Next, the component of wind speed at the time of the movement and in the direction of the runway concerned is calculated.
- Finally, an average is produced of the component of wind speed on the runway concerned across all selected movements.

The results of these calculations for departures are:

- 4.0 knots headwind on runway 25R during the operational day period (06.00-23.00)
- 3.3 knots headwind on runway 25R during the operational night period (23.00-06.00)
- 3.5 knots headwind on runway 25L
- 3.8 knots headwind on runway 07L
- 4.0 knots headwind on runway 07R
- 3.3 knots headwind on runway 01
- 6.2 knots headwind on runway 19

The average temperature for 2014 that is entered into the computer model (averaged out per movement) is 11.7°C.

3.2 Performance of contour calculations

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

INM enables calculations on specific locations around the airport. To check the calculated noise contours, the noise impact as calculated with INM is compared with sound measurements taken at a number of locations.

This comparison gives an answer to the question of comparability of noise impact from calculations and measurements. Since the results of noise calculations with INM show the incident noise whereas noise measurements are always influenced by specific local conditions, and in view of the uncertainties associated with (unmanned) noise measurements (background noises, linkage to flight traffic, reflections, etc.), these comparative studies cannot make any pronouncements about the absolute accuracy of the results of the INM calculations, but can do so about the comparability with noise measurements at a number of specific locations around Brussels Airport.

3.2.2 Technical data with regard to the calculation

The calculations were carried out with the INM 7.0b with a refinement 9 and tolerance 0.5 within a grid with origin at -8 nmi[11] in the horizontal direction and -8 nmi in the vertical direction in relation to the airport reference point, and dimensions of 18 nmi in the horizontal direction and 16 nmi in the vertical direction.

The altitude of the airport reference point in relation to sea level is 184 ft.

3.2.3 Calculation of frequency contours

All noise contours, except the frequency contours, were determined and shown directly in the INM. For frequency contours, a rather more elaborate method is necessary, since the INM does not determine these contours directly.

On a regular grid around the airport, the INM was used to calculate the maximum sound pressure level for each aircraft configuration in the input files. The result of this grid calculation is a very large file in which, per grid point, for all combinations of aircraft type, INM stage, track and sub-track, the maximum sound pressure level is recorded.

This grid was exported to an external computer program (database analysis) to count per grid point the number of times that a particular level was exceeded. This result was imported into a GIS system for further processing.

The contour lines were drawn in Arcview 3.2 using ARCISO, a contour drawing algorithm from Stuttgart University. . Further smoothing of the contour lines obtained in this way is required.

3.3 Post-processing in a GIS

The importation of the noise contours into a Geographic Information System (GIS) makes it possible not only to print out the noise contour maps, but also to carry out a geographic analysis. So, in the first instance, the area within the various contour zones can be calculated per local authority area.

In addition, the combination of the contours with a digital population map also allows a calculation of the number of people living within the various contour zones. The population data were supplied by the National Institute for Statistics (NIS) and show the demographic situation on 1 January 2010.

The population numbers are available at the level of statistical sectors. On the assumption that the population is spread evenly across the statistical sector, and by only counting the portion of the sector that lies within the contour, this gives a good approximation of reality.

[11] 1 nmi (nautical mile) = 1.852 km (kilometre)

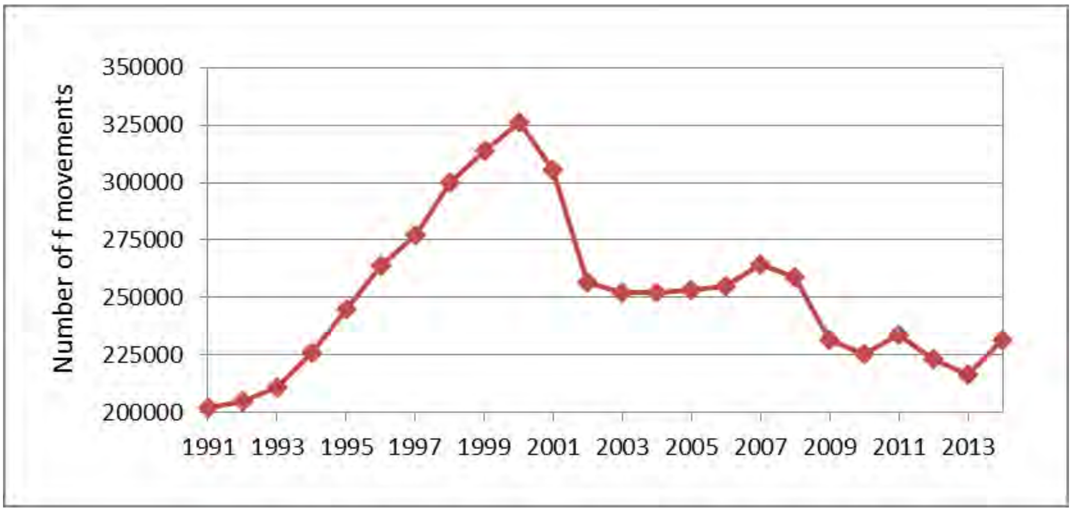
4. Results

4.1 Background information about interpretation of the results

4.1.1 Change in the number of movements

One of the important factors in the calculation of the annual noise contours around an airport is the number of movements that took place over the past year. In the wake of the decline of the number of movements at Brussels Airport in the previous 3 years, compared to 2013 the year 2014 again saw a rise of approximately 6.9%, going up from 216,678 movements in 2013 to 231,528 in 2014.

Figure 3 Change in flight traffic at Brussels Airport 1991-2014 (Source: Brussels Airport Company)

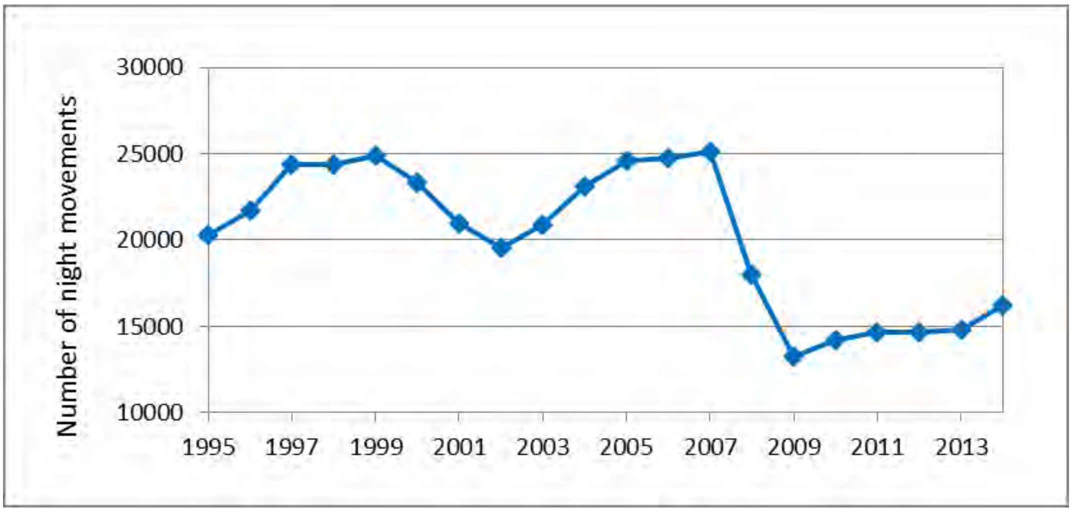


The number of night-time movements (23:00-06:00) went up by 9.1%, rising from 14,831 in 2013 to 16,187 (of which 4.682 departures) in 2014. This figure includes helicopter movements (176 in 2014) and the movements exempt from slot co-ordination such as Government flights, military flights, … (246 in 2014).

For 2014, the number of night slots assigned, 15,746, of which 4,396 for departures, remained within the limitations imposed on the airport's slot coordinator, who since 2009 has been authorised to distribute a maximum of 16,000 night slots, of which a maximum of 5,000 may be allocated to departures (MD 21/01/2009, official amendment to the environmental approval dd. 29/01/2009).

The number of movements during the operational day period (06:00 – 23:00) increased by 6.7% from 201,847 in 2013 to 215,341 in 2014.

Figure 4 Change in flight traffic during the night (23.00-06.00) at Brussels Airport 1995-2014 (Source: Brussels Airport Company)



As a result of the amendment to the VLAREM legislation in 2005, the 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 2014 counted in accordance with that breakdown, split into departures and landings, is represented, together with the number of movements in 2013, and with the trend, in Table 1. The numbers for the night period are further broken down in this table between the operational night-time period (23:00-06:00) and the morning hour between 06:00 and 07:00.

For the daytime period (07:00 – 19:00) there is an increase of the number of movements of approximately 6.6% as compared to 2013, both for landings and departures.

For the evening period (19:00 – 23:00), the number of departures increased with about 4.8% while the number of landings increased with about 9.9%.

The number of departures during the night period (23:00 – 07:00) rose by approximately 5.0% as compared to 2013. Both the number of departures during the operational night period and the number of departures during the morning period between 06:00 and 07:00 increased. The number of landings during the night-time period rose by 10.3%. This is mainly a consequence of a strong increase (11.5%) of the number of landings during the operational night period. During the morning hour between 06:00 and 07:00, the number of landings rose by 3.4%

Table 1 Number of flights (incl. helicopter movements) in 2014 and 2013 and the change of 2014 compared with 2013, according to the division of the day used in VLAREM

period	2013			2014			change compared to 2013		
	departures	arrivals	total	departures	arrivals	total	departures	arrivals	total
day (07.00-19.00)	73,874	71,432	145,306	77,841	77,064	154,905	5.4%	7.9%	6.6%
evening (19.00-23.00)	22,504	23,824	46,328	24,726	24,967	49,693	9.9%	4.8%	7.3%
night (23.00-07.00)	11,959	13,085	25,044	13,196	13,734	26,93	10.3%	5.0%	7.5%
0h00-24h00	108,337	108,341	216,678	115,763	115,765	231,528	6.9%	6.9%	6.9%
06h00-23h00	*98,014*	*103,833*	*201,847*	*104,258*	*111,083*	*215,341*	*6.4%*	*7.0%*	*6.7%*
23h00-06h00	*10,323*	*4,508*	*14,831*	*11,505*	*4,682*	*16,187*	*11.5%*	*3.9%*	*9.1%*
06h00-07h00	*1,636*	*8,577*	*10,213*	*1,691*	*9,052*	*10,743*	*3.4%*	*5.5%*	*5.2%*

4.1.2 Other important changes

In addition to the number of movements there are also a number of parameters that determine the size and the position of the noise contours, including the runway and route use, the flight procedures and the fleet deployed. The most important changes that occurred in 2014 are summarised below.

Fleet changes

Same as in the previous three years during the operational night-time period of the year 2014, most departures were performed by B752 aircraft (25.7%). Other than the B752, the aircraft types most used for departures were the A306 (11.8%), B763 (10.9%), B733 (10.7%), ATP (8.6%), A320 (6.8%) and A319 (4.9%) types. Out of these aircraft types, the ATP in particular saw a marked increase. The majority of the landings were made by aircraft types A320 (23.7%), B738 (13.6%), B752 (10.2%), A319 (9.6%), A333 (5.7%), A306 (4.9%), B733 (4.4%) and B763 (4.3%).

The number of movements in the year 2014 involving aircraft with an MTOW in excess of 136 tonnes (heavy aircraft) during the operational night-time period increased by 18.3% compared against the previous year. The most widely used heavy aircraft were B763s, followed by A306s, A333s, A332s and B77Ls. The use of aircraft types A306, B763 and B77L has gone up substantially. 2014 witnessed significantly fewer movements involving aircraft types A310, MD11, A333, A332, B744. The number of movements involving A30B aircraft dropped off almost completely in 2014 as a result of the completion of a fleet replacement operation at DHL, which saw this type of aircraft gradually replaced by the A306 in recent years.

The changes in the most commonly used airplane types during the operational night-time period are set out in Table 2**Error! Not a valid bookmark self-reference.**.

In 2014 the most frequently used aircraft during the daytime period were A319s (21.6%), A320s (15.9%), RJ1Hs (10.2%), B738s (8.5%), E190s (4.7%) and DH8Ds (4.6%). Compared against 2013, there was a notable increase (from 5.3% to 8.5%) in the use of B738 aircraft, especially due to the arrival of Ryanair. B788 aircraft (Dreamliners) also made a notable entry (from 0.1% in 2013 to 0.7% in 2014).

Among the heavy aircraft (MTOW>136 tonnes), the most commonly seen aircraft were A333s (2.6% of all daytime movements), A332s (1.5%), B763s (1.4%), B744s (1.0%), B772s (0.9%), and B788s (0.7%). Further to the drops seen in 2012 and 2013, on the whole, the number of daytime movements involving heavy aircraft went back up again by 4.6%. Especially the rise in B772s (from 0.5% to 0.9%) and B788s (from 0.1% to 0.7%) was striking.

Table 2 Change in the number of flight movements per aircraft type during the operational night period (23.00-06.00) for the most common heavy (>136 tonnes, top) and light (<136 tonnes, bottom) aircraft types

	arrivals				**departures**			
ICAO type >136 tons	**2013**	**2014**	**evolution**	**evolution (%)**	**2013**	**2014**	**evolution**	**evolution (%)**
A306	291	563	272	93%	292	551	259	89%
B763	368	494	126	34%	409	510	101	25%
A333	811	655	-156	-19%	9	3	-6	-67%
A332	349	323	-26	-7%	5	4	-1	-20%
B77L	1	0	-1	-100%	21	152	131	624%
B744	62	24	-38	-61%	29	25	-4	-14%
A310	25	17	-8	-32%	18	17	-1	-6%
B772	4	22	18	450%	0	0	0	
B748	0	10	10		0	7	7	
B788	12	16	4	33%	0	1	1	
MD11	43	5	-38	-88%	52	4	-48	-92%

	arrivals				**departures**			
ICAO type <136 tons	**2013**	**2014**	**evolution**	**evolution (%)**	**2013**	**2014**	**evolution**	**evolution (%)**
A320	2109	2729	620	29%	411	318	-93	-23%
B752	1240	1177	-63	-5%	1310	1204	-106	-8%
B738	1133	1559	426	38%	239	193	-46	-19%
A319	1055	1104	49	5%	282	230	-52	-18%
B733	532	505	-27	-5%	539	502	-37	-7%
B734	398	459	61	15%	155	154	-1	-1%
ATP	96	187	91	95%	263	404	141	54%
A321	393	363	-30	-8%	28	57	29	104%
B737	301	295	-6	-2%	7	7	0	0%
E190	226	293	67	30%	6	3	-3	-50%
EXPL	91	113	22	24%	56	63	7	13%
RJ1H	248	145	-103	-42%	27	21	-6	-22%
DH8D	119	114	-5	-4%	9	10	1	11%

After the decrease by 2% in the previous year, the number of movements taking place with an aircraft with an MTOW of more than 136 tonnes (heavies) during the operational daytime period continue to decrease by 5.9% in 2013. The most frequently used aircraft types within this group are as follows (the changes of the number of movements as compared to 2012 are shown in parentheses): A333 (+80%), B763 (+2%), A332 (-39%), B744 (-35%), B772(-36%), B774(+785%), MD11 (+36%), B762 (-13%), A306 (+56%), B77W (-14%). As concerns the use of aircraft types under 136 tonnes during the operational daytime period, more than 70% of all movements in 2013 took place with the aircraft types A319 (+11%), A320 (+10%), RJ1H (-6%), DH8D (+43%), B738 (+11%) en E190 (+50%). In contrast, the older aircraft types RJ85 (-85%), B733 (-51%) and B734 (-68%) are gradually being phased out from the fleet.

Runway and route use

The preferential runway use, published in the AIP (Aeronautical Information Publication, a Belgocontrol publication), shows which runway should preferably be used, depending on the time when the movement occurs, and in some cases the destination. During the year 2014 no changes were imposed to this scheme.

Table 3 Preferential runway use since 19/09/2013 (local time) (source : AIP 11/12/2014

		Day		Night
		06:00 to 15:59	16:00 to 22:59	22:59 to 05:59
Mon, 06:00 - Sun, 05:59	Departure	25R		25R/20[1]
	Arrival	25L/25R		25R/25L[2]
Tue, 06:00 - Wed, 05:59	Departure	25R		25R/20[1]
	Arrival	25L/25R		25R/25L[2]
Wed, 06:00 - Thu, 05:59	Departure	25R		25R/20[1]
	Arrival	25L/25R		25R/25L[2]
Thu, 06:00 - Fri, 05:59	Departure	25R		25R/20[1]
	Arrival	25L/25R		25R/25L[2]
Fri, 06:00 - Sat, 05:59	Departure	25R		25R[3]
	Arrival	25L/25R		25R
Sat, 06:00 - Sun, 05:59	Departure	25R	25R/19 [1][5]	25L[4]
	Arrival	25L/25R	25R/25L[2]	25L
Sun, 06:00 - Mon, 05:59	Departure	25R/19[1] [5]	25R	19[4] [5]
	Arrival	25R/25L[2]	25L/25R	19[5]

(1) Runway 25R for traffic via ELSIK, NIK, HELEN, DENUT, KOK and CIV / runway 19 for traffic via LNO, SPI, SOPOK, PITES and ROUSY (aircrafts with MTOW between 80 and 200 tonnes can use runway 25R or runway 19, aircraft with MTOW>200 tonnes have to 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

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 of the weather conditions, the equipment of the runways, the traffic density, etc. Conditions are tied the preferential runway use arrangements, including wind limits expressed as a maximum crosswind and maximum tailwind at which a particular runway can be used. If these limits are exceeded, air traffic control must switch to an alternative configuration.

Under preferential runway use conditions, the maximum tailwind for gusts is 7 kt and the maximum crosswind is 20 kt. In case of alternative runway use, the maximum speeds for gusts are also 20 kt for the crosswind component but only 3 kt for the tailwind component.

In the area of flight paths (SIDs), over the course of 2014 a number of major changes were put in place for departures from runways 25R, 25L, 07R and 07L.

- 9/1/2014 - Changes in the departure routes of runways 25R and 25L involving a curve in a westerly direction (AIP 9/1/2014).
    - CIV2C was replaced by CIV3C
    - DENUT4C was replaced by DENUT5C
    - HELEN4C was replaced by HELEN5C
- 16/1/2014 - Scrapping of the NIK5Z night-time route of runway 25R. This night-time route was replaced by the NIK2C route, which previously was already being used during the daytime period for flights headed for the Nicky exit point (NOTAM 16/1/2014)
- 06/02/2014 Changes in the departure routes and distribution of the flight traffic for the routes of runways 25R and 25L (AIP 06/02/2014)
    - Exit point CIV: the CIV3C ring route which was used during the daytime on week days for all traffic headed for CIV, was closed to heavy aircraft (aircraft with an MTOW in excess of 136 tonnes). These flights were re-routed to the canal route headed for CIV, whose name was also made to change from CIV8D into CIV1Y for runway 25R and from CIV3Q into CIV1W for runway 25L.
    - Exit points SOPOK, PITES and ROUSY during the daytime period: the routes involving a short curve to the east (SOPOK3C, PITES3C and ROUSY3C), which were used by all aircraft except for the heavy 4-engine aircraft, were replaced by routes that have a wider curve towards the east (SOPOK4C, PITES4C and ROUSY4C for runway 25R and SOPOK1Q, PITES1Q and ROUSY1Q for runway 25L). These new routes only continue to be used for the non-heavy aircraft. All heavy aircraft headed for these beacons, including the 4-engine aircraft which previously used the Delta routes (straight ahead, climbing up to 4,000 feet; SOPOK3D, ROUSY3D and PITES3D), were re-routed to new routes which initially follow the canal route (SOPOK1Y, ROUSY1Y and PITES1Y for runway 25R and SOPOK1W, ROUSY1W and PITES1W for runway 25L). The Delta routes on the other hand remain available in the event the new canal routes cannot be used if part of the military airspace is not opened up to civil air traffic.
    - Exit points LNO and SPI during the daytime period: the routes involving a curve towards the east have remained unchanged (short curve). As a P-RNAV description was added, this did prompt a name change from LNO2C and SPI2C into LNO3C and SPI3C for runway 25R and from LNO2Q and SPI2Q into LNO3Q and SPI3Q for runway 25L. For the remainder, the changes implemented were the same as those for the routes headed for exit points SOPOK, PITES and ROUSY: a curve to the east only for the non-heavy aircraft; all heavy aircraft assigned to the new canal routes (LNO1Y and SPI1Y for runway 25R and LNO1W and SPI1W for runway 25L) except in the event the required part of military airspace is unavailable, for which the former Delta routes (LNO2D and SPI2D) remain available.
    - Exit points SOPOK, PITES, ROUSY, LNO and SPI of runway 25R during the night-time period: the night-time traffic headed towards these beacons was re-routed from the Zoulou routes (SOPOK5Z, PITES4Z, ROUSY4Z, LNO4Z and SPI5Z) to the new canal routes (SOPOK1Y, ROUSY1Y, PITES1Y, LNO1Y and SPI1Y). Here too, the Zoulou routes

remained available in case the part of the military airspace that is needed for these canal routes cannot be opened up to civil air traffic.

- Exit points SOPOK, PITES, ROUSY, LNO and SPI of runway 25L during the night-time period: the night-time traffic headed towards these beacons was re-routed from the daytime routes to the new canal routes (SOPOK1W, ROUSY1W, PITES1W, LNO1W and SPI1W). In the event the part of the military airspace that is needed for these canal routes is not opened up to civil air traffic, the Delta routes are used (SOPOK3D, ROUSY3D, PITES3D, LNO2D and SPI2D).

- 06/03/2014 Introduction of the 'Leuven Rechtdoor' take-off procedure for runways 07R and 07L (AIP 06/03/2014) and changes to route SOPOK4C (runway 25R) and SOPOK1Q (runway 25L)
  - Runway 07L: routes LNO3H, SPI4H, SOPOK3H, PITES4H and ROUSY4H were replaced by LNO4H, SPI5H, SOPOK4H, PITES5H and ROUSY5H
  - Runway 07R: routes LNO3J, SPI3J, SOPOK3J, PITES4J and ROUSY4J were replaced by LNO4J, SPIH4J, SOPOK4J, PITES5J and ROUSY5J
  - Runway 25R: route SOPOK4C was replaced by route SOPOK5C which only deviates from SOPOK4C further away from the airport (outside the zone of the noise contours)
  - Runway 25L: route SOPOK1Q was replaced by route SOPOK2Q which only deviates from SOPOK1Q further away from the airport (outside the zone of the noise contours)

- 29/05/2014 Minor adjustment to the description of the departure routes involving a wide curve of runway 25R (routes SOPOK5C, ROUSY4C and PITES4C were replaced by SOPOK6C, ROUSY5C and PITES5C).

Concerning the flight paths (SIDs), no essential changes were made in the course of 2014.

Operating restrictions

During the year 2014 there were no changes of the operating restrictions imposed to BAC.

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

The INM software enables a number of acoustic parameters to be calculated at a given location around the airport. By performing this calculation at the locations of the measuring stations of the noise Monitoring System[12], it can be examined to what extent the calculated values correspond to the values

[12] On 1/10/2012, an entirely modernised NMS system was commissioned at Brussels Airport (ANOMS). A number of different data sources are fed into this system and correlated among themselves: they include noise measurements, CDB, radar tracks and meteorological data. No changes to the locations or the manner in which the noise is recorded at the different noise measurement positions were made at the time the new system was commissioned.

recorded by the monitoring system. This comparison is carried out 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 on the monitoring network. To select the events resulting from aircraft, an automatic link is made in the NMS to the flight and radar data, and the events are correlated with an overflight if possible.

The system of correlation is definitely not perfect and events are regularly attributed to overflying traffic and vice versa. In order to minimise the contribution of these events in the comparison, the only events taken into account are those with a duration of less than 75 s.

In the tables shown below, the calculated values at the different measurement positions are compared to the values calculated on the basis of the correlated events for the parameters $L_{Aeq,24h}$, L_{night} and L_{den}. In addition to the measurement positions of Brussels Airport Company, the results of the LNE measurement positions (NMT 40-1 and higher) were also recorded, with these data also being available and correlated to the flight data within the airport's NMS. An overview of the location of all measuring positions is given in Appendix 2.

Table 4 Match between calculations and measurements for parameter $L_{Aeq,24h}$

		$L_{Aeq,24h}$ [dB]		
		INM	NMS	INM-NMS
NMT01-2	STEENOKKERZEEL	62,9	59,3	3,6
NMT02-2	KORTENBERG	68,5	68,5	0,0
NMT03-3	HUMELGEM-Airside	63,7	63,5	0,2
NMT04-1	NOSSEGEM	61,8	63,4	-1,6
NMT06-1	EVERE	50,6	50,5	0,1
NMT07-1	STERREBEEK	47,0	48,3	-1,3
NMT08-1	KAMPENHOUT	54,2	54,4	-0,2
NMT09-2	PERK	48,4	44,6	3,8
NMT10-1	NEDER-OVER-HEEMBEEK	54,6	54,2	0,4
NMT11-2	SINT-PIETERS-WOLUWE	50,2	51,1	-0,9
NMT12-1	DUISBURG	42,2	39,4	2,8
NMT13-1	GRIMBERGEN	46,7	45,5	1,2
NMT14-1	WEMMEL	47,3	46,0	1,3
NMT15-3	ZAVENTEM	55,3	45,0	10,3
NMT16-2	VELTEM	56,6	56,8	-0,2
NMT19-3	VILVOORDE	53,3	52,0	1,3
NMT20-2	MACHELEN	54,7	51,8	2,9
NMT21-1	STROMBEEK-BEVER	50,3	49,8	0,5
NMT23-1	STEENOKKERZEEL	66,8	64,9	1,9
NMT24-1	KRAAINEM	50,9	51,8	-0,9
NMT26-2	BRUSSEL	49,6	50,4	-0,8
NMT40-1*	KONINGSLO	52,0	52,5	-0,5
NMT41-1*	GRIMBERGEN	48,0	47,5	0,5
NMT42-2*	DIEGEM	64,6	64,0	0,6
NMT43-2*	ERPS-KWERPS	57,2	56,3	0,9
NMT44-2*	TERVUREN	44,6	45,9	-1,3
NMT45-1*	MEISE	45,8	45,7	0,1
NMT46-2*	WEZEMBEEK-OPPEM	53,0	53,8	-0,8
NMT47-3*	STERREBEEK	48,3	48,7	-0,4
NMT48-3*	BERTEM	33,5	31,5	2,0

* noise data LNE off-line correlated by the NMS

The measuring stations NMT 1-2, NMT 3-3, 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 or 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 immission from overflying aircraft.

The comparison between calculations and measurements based on the $L_{Aeq,24h}$ shows that the discrepancy between the calculated value and the measured value for the vast majority of the measuring stations remains limited to 2 dB(A). For more than half of the measuring stations, this discrepancy is even limited to less than 1 dB(A).

For NMT 9-2 (Perk), NMT 12-1 (Duisburg) and NMT 20-2 (Machelen) the model clearly predicts higher levels than the effectively measured ones. These differences can most likely be attributed to the sound pressure levels caused by an overflight being comparable with the trigger level of these measuring station. Some of the overflights are therefore not recorded as a noise event, since the trigger level is exceeded for less than 10s, or not at all.

A good correlation between the measured and calculated values was also found for the parameters L_{night} and L_{den} (see tables below), except for the exemptions mentioned above.

Table 5 Match between calculations and measurements for parameter L_{night}

		L_{night} [dB]		
		INM	NMS	INM-NMS
NMT01-2	STEENOKKERZEEL	61,3	59,9	1,4
NMT02-2	KORTENBERG	70,0	70,1	-0,1
NMT03-3	HUMELGEM-Airside	65,4	65,2	0,2
NMT04-1	NOSSEGEM	63,0	64,4	-1,4
NMT06-1	EVERE	51,9	51,6	0,3
NMT07-1	STERREBEEK	46,5	47,0	-0,5
NMT08-1	KAMPENHOUT	54,7	54,9	-0,2
NMT09-2	PERK	49,4	45,7	3,7
NMT10-1	NEDER-OVER-HEEMBEEK	55,6	55,7	-0,1
NMT11-2	SINT-PIETERS-WOLUWE	51,6	52,6	-1,0
NMT12-1	DUISBURG	42,3	39,1	3,2
NMT13-1	GRIMBERGEN	47,6	46,7	0,9
NMT14-1	WEMMEL	48,7	47,7	1,0
NMT15-3	ZAVENTEM	56,6	41,9	14,7
NMT16-2	VELTEM	58,1	58,3	-0,2
NMT19-3	VILVOORDE	53,8	53,3	0,5
NMT20-2	MACHELEN	55,5	52,9	0,9
NMT21-1	STROMBEEK-BEVER	51,7	51,3	0,4
NMT23-1	STEENOKKERZEEL	67,1	65,2	1,9
NMT24-1	KRAAINEM	52,3	53,3	-1,0
NMT26-2	BRUSSEL	50,9	51,7	-0,8
NMT40-1*	KONINGSLO	53,3	54,0	-0,7
NMT41-1*	GRIMBERGEN	49,3	49,1	0,2
NMT42-2*	DIEGEM	65,9	65,6	0,3
NMT43-2*	ERPS-KWERPS	58,8	58,0	0,8
NMT44-2*	TERVUREN	44,6	45,8	-1,2
NMT45-1*	MEISE	47,2	47,6	-0,4
NMT46-2*	WEZEMBEEK-OPPEM	54,4	55,2	-0,8
NMT47-3*	STERREBEEK	48,2	47,9	0,3
NMT48-3*	BERTEM	34,7	33,6	1,1

* noise data LNE off-line correlated by the NMS

Table 6 Match between calculations and measurements for parameter L_{den}

		L_{den} [dB]		
		INM	NMS	INM-NMS
NMT01-2	STEENOKKERZEEL	70,7	64,9	5,8
NMT02-2	KORTENBERG	72,3	72,3	0,0
NMT03-3	HUMELGEM-Airside	67,0	66,8	0,2
NMT04-1	NOSSEGEM	66,2	68,1	-1,9
NMT06-1	EVERE	54,6	54,8	-0,2
NMT07-1	STERREBEEK	54,1	55,9	-1,8
NMT08-1	KAMPENHOUT	59,6	59,8	-0,2
NMT09-2	PERK	53,1	49,5	3,6
NMT10-1	NEDER-OVER-HEEMBEEK	58,6	57,9	0,7
NMT11-2	SINT-PIETERS-WOLUWE	53,9	54,8	-0,9
NMT12-1	DUISBURG	48,4	46,5	1,9
NMT13-1	GRIMBERGEN	50,7	49,4	1,3
NMT14-1	WEMMEL	50,8	48,8	2,0
NMT15-3	ZAVENTEM	59,6	53,6	6,0
NMT16-2	VELTEM	60,4	60,6	-0,2
NMT19-3	VILVOORDE	57,4	56,2	1,2
NMT20-2	MACHELEN	58,9	56,2	2,7
NMT21-1	STROMBEEK-BEVER	54,2	53,4	0,8
NMT23-1	STEENOKKERZEEL	72,5	70,8	1,7
NMT24-1	KRAAINEM	54,5	55,4	-0,9
NMT26-2	BRUSSEL	53,6	54,3	-0,7
NMT40-1*	KONINGSLO	55,8	56,1	-0,3
NMT41-1*	GRIMBERGEN	51,8	50,7	1,1
NMT42-2*	DIEGEM	68,3	67,8	0,5
NMT43-2*	ERPS-KWERPS	60,8	59,7	1,1
NMT44-2*	TERVUREN	51,1	52,6	-1,5
NMT45-1*	MEISE	49,0	48,2	0,8
NMT46-2*	WEZEMBEEK-OPPEM	56,6	57,5	-0,9
NMT47-3*	STERREBEEK	55,1	56,1	-1,0
NMT48-3*	BERTEM	37,5	33,6	3,9

* noise data LNE off-line correlated by the NMS

4.3 Change in the event $L_{Aeq,24h}$level

Figure 5 shows the evolution of the $L_{Aeq,24h}$ levels based on noise measurements throughout the year, over the period 1990-2013. These $L_{Aeq,24h}$ levels are shown, on one hand, based on all noise events (unfilled bars) and, on the other hand, from the year 2000 onward, also based on these noise events linked to an aircraft movement (red coloured bars).

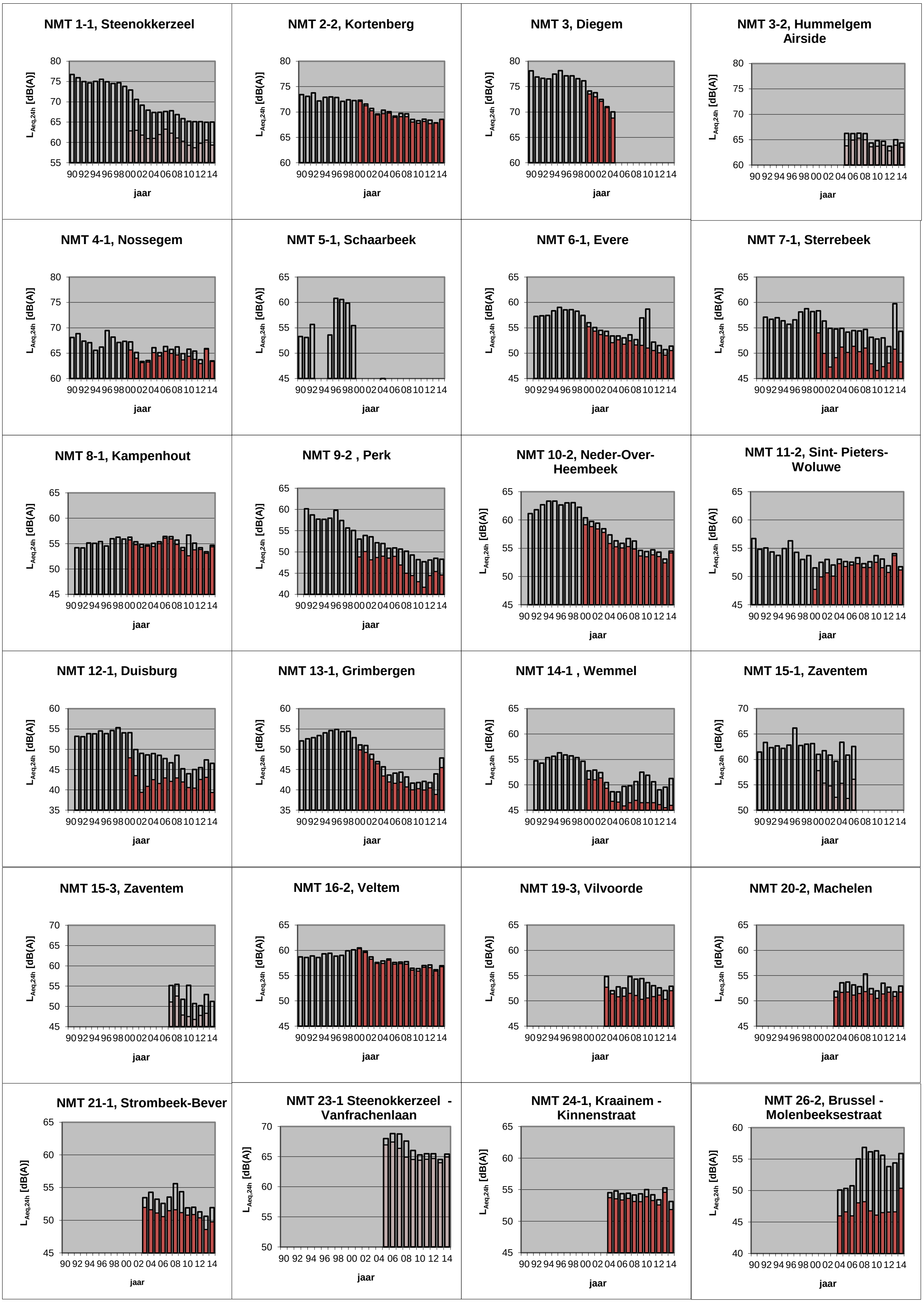
To determine $L_{Aeq,24h}$ levels based on all noise events, we started from the logarithmic average of the measured $L_{Aeq,24h}$ values recorded at the measuring stations. It was observed that outliers within these data clouds have a strong influence in the logarithmic averages, and therefore they were excluded. Outliers are defined as values that lie outside 3 standard deviations from the arithmetic average (of the dB(A) values!) These outliers are caused during calibration and testing of the NMTs or as a result of wind during stormy weather conditions.

For the determination of the aircraft linked $L_{Aeq,24h}$ level, an off-line linking procedure was used for the data up to 30/04/2004, and for the data after 30/04/2004, the correlation procedure of the B&K NMS was used (until 30/9/2012); that of the new B&K ANOMS system was used from 1/10/2012 onwards.

For the measurement stations NMT 1-2, NMT 2-2, NMT3-3, NMT 9-2, NMT 10-2, NMT 11-2, NMT 16-2, NMT 19-3, NMT 20-2 and NMT 26-2, the data recorded at the previous locations is shown on the same graph so that the minor shifts in the measurement station have no influence on the recorded noise levels.

The values for the aircraft-linked $L_{Aeq,24h}$ level for the measuring stations NMT 1-2, NMT 3-3, , NMT 15-1, NMT 15-3 and NMT 23-1 are less relevant for the reasons set out in 0 for the assessment of the noise immission as a result of overflights by aircraft. These values are shown in a lighter colour on the graph.

Figure 5 Change in $L_{Aeq,24h}$ level at the monitoring stations in the network of Brussels Airport Company



4.4 Discussion of the noise contours and tables

The results of the noise contour calculations for the parameters described above (L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day, freq.70,night, freq.60,day and freq.60,night) are recorded in Appendix 6 and Appendix 7. The surface of the respective contour zones on one hand and the number of inhabitants within the contours on the other hand were determined by means of a projection of the calculated noise contours on a topographic map and a population map in a GIS system. As already stated earlier, in this report we have chosen to determine the number of inhabitants per contour zone on the basis of the most recent population data, more particularly those as of 1 January 2010. The detailed results of this calculation for each merger district can be found in Appendix 4.

Appendix 5 contains the change in the surface area for each contour zone and the number of inhabitants within the various contour zones. As already stated, version 7.0b of the INM calculation model was used for the first time for the calculation of the noise contours for 2011. In order to be able to analyse the trend over the long term, the noise contours for the years 2006 through 2010 were recalculated with the new version (INM 7.0b) of the calculation model for the parameters L_{day}, $L_{evening}$, L_{night} en L_{den}. The number of inhabitants within these recalculated noise contours was calculated by means of the population figures used for the official reporting of that year. For the frequency contours, only 2010 was recalculated with the new calculation model. The changes reported in Appendix 5 also use these recalculated figures to enable a comparison to be made over the different years that is independent of the calculation model used.

In Appendix 8, the contours for 2013 and 2014 are printed out together on a population map for comparison purposes.

Runway use plays an important role for the interpretation of the results of noise contour calculations around an airport. For the sake of completeness, these data are summarised in Appendix 1.

4.4.1 Lday contours

The L_{day} contours represent the A weighted equivalent sound pressure level over the period 07:00 to 19:00 and are reported from 55 dB(A) through 75 dB(A) in steps of 5 dB(A). The changes in the L_{day} noise contours for the years 2013 and 2014 are also reproduced in Figure 6.

The evaluation period for the L_{day} contours falls entirely within the operational daytime period, 06:00 – 23:00, as determined at Brussels Airport. This means that the 'Departure 25R – Landing 25L/25R' runway use is to be preferred at all times, except for the off-peak period at weekends (Saturdays from 16:00 onwards and Sundays until 16:00) where the 'Departure 19/25R – Landing 25L/25R' configuration is used. Under the latter configuration, runway 19 is used for departures in an easterly direction, and runway 25R for the other departures, except for aircraft with an MTOW of more than 200 tonnes, which always take off from runway 25R.

The runway use statistics also show that runway 25R was used for approximately 82.2% of departures during the daytime period in 2014. This is similar to what was seen in 2012 and substantially more than in 2013 (67%), when - as a result of the greater number of days involving wind coming in from easterly directions - a higher rate of alternative runway use was seen to take place. As a result of these movements, the L_{day} noise contours consequently clearly show a fanning out take-off lobe in the extended line of runway 25R. In 2014, runway 19 - as the preferential take-off runway during the off-peak period at the weekend for the departures in an easterly direction with airplanes that have an MTOW of less than 200 tonnes - was used for just 2.6% of the take-off movements during the daytime period. This is considerably less than in 2013, when runway 25R was closed in August for maintenance works, prompting extra heavy use of runway 19, as a result of which the small bulge on the landing contour of runway 01 is now no longer visible. As an alternative take-off runway, runway 07R handles 13.8% of the departures. This almost constitutes a reduction by half compared against 2013, as a result of which the widening towards the north and the south, in relation to the narrow landing lobe of runway 25L, in the zone close to the airport, has contracted. The other runways 07L, 01 and 25L were used only for a small minority of the departures in 2014, i.e. 0.7%, 0.7% and 0.0% respectively.

With regard to the landings, the landing lobe at runway 25L is clearly the largest. This runway handles close to 58% of all landings during the daytime period. Slightly smaller, although still very distinct, are the landing lobes at runway 25R and 01 as a result of 24.0% and 12.9% respectively of arrivals traffic. Runway 19, whose extended line also shows a clear landing lobe, handled 3.7% of all landings in 2014.

The total number of departures during the daytime period in 2014 was again seen to rise up to 211 per day, after the fall down to 196 per day in 2013. This equally exceeds the level for 2012 (203 per day). Flight path changes implemented in the spring of 2014 in amongst other things caused the shape and size of the take-off lobes of 25R to change.

Previously, aircraft taking off from 25R before veering off in a southeasterly direction, a short curve. Since the route changes were introduced, these movements observe a wider curve in part. As a result, the southerly bulge of the 25R take-off lobe has flattened compared against 2013, with the take-off lobe in question seen to be slightly more pronounced in a southwesterly direction in 2014.

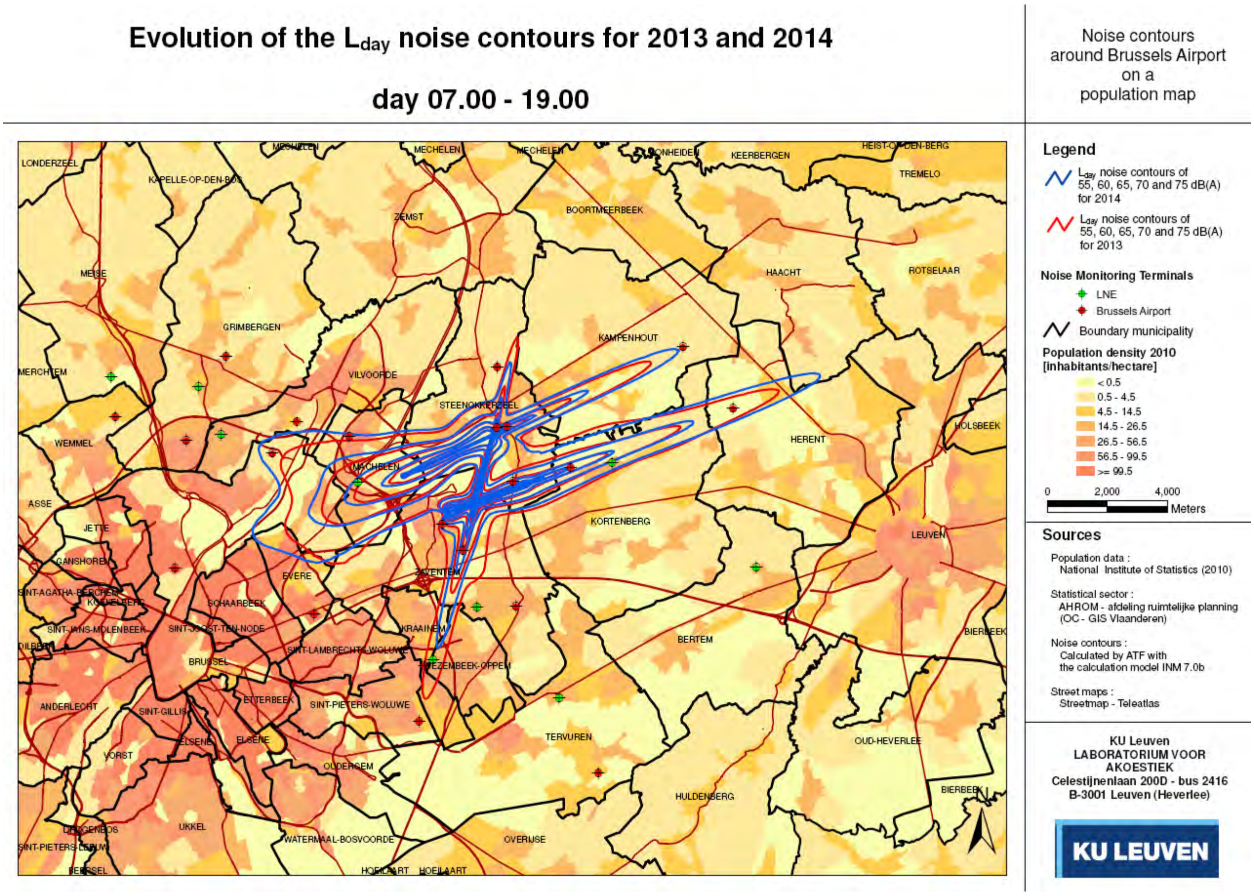
Due to a rise in 2014 in the number of departures flying straight ahead from runway 25R (9.9% of all take-offs in 2014 compared against 4.6% in 2013), in amongst other things by heavy aircraft, and as a result of the increased use of the canal route, the lobe concerned is more marked and slightly more north-oriented compared against 2013. The take-off lobe from the 25R in a northwesterly direction too has increased in size is compared against 2013 (a rise in the total number of departures, from 26.7% in 2013 to 36.2% in 2014).

The relative shift of take-off movements to runway 25R in 2014 goes hand in hand with a fall in the number of take-off movements from runways 07R and 19. As stated previously, this has the effect that the easterly widening of the runway 19 lobe and the southerly widening of the 07R lobe was much more confined in 2014 than it was in 2013.

In 2014, the total number of landings during the daytime period went up to 213 per day compared against 202 per day in 2013. With regard to the runway use, compared against 2013 the main thing that stands out especially is the increased use of runways 25R and 25L, and a corresponding reduction (almost by half) of the number of landings op runways 01 and 19. This is chiefly the result of the difference in average weather conditions: as stated above, 2014 witnessed fewer easterly winds, which prompted a greater degree of preferential runway use than in 2013.

In 2014, the total surface area within the L_{day} noise contour of 55 dB(A) went up by approximately 3.9% from 2013 (4,821 ha in 2014 compared against 4,637 ha in 2013). The number of residents living inside this noise contour rose by approximately 7%, from 31,546 in 2013 to 33,920 in 2014.

Figure 6 L_{day} noise contours of 55 dB(A) around Brussels Airport for 2013 (red) and 2014 (blue)



4.4.2 $L_{evening}$ contours

These contours show the A-weighted equivalent sound pressure level over the 19:00 to 23:00 time frame. Unlike the L_{day} contours that are shown as from 55 dB(A) and above, in accordance with the VLAREM regulations the $L_{evening}$ contours need to be reported starting from 50 dB(A), which has an amplifying effect on the $L_{evening}$ contour areas shown. The rendition of 50 dB(A) contours in the evening period is also to do with the fact that, in considering the overall noise level through the L_{den} statistic lends a 5 dB(A) greater weight to the $L_{evening}$ value than to the L_{day} value. The changes in the $L_{evening}$ noise contours for 2013 and 2014 are also shown in figure 7.

This evening period is entirely situated within the operational daytime period, so that more or less the same runway use as in the L_{day} contours is reflected.

During the evening period, the airport had an average 17.1 departures per hour, slightly fewer by comparison with the daytime period (17.6 departures per hour). The evenings also has slightly fewer landings than during the day (16.9 per hour between 19:00 and 23:00 compared against 17.8 per hour between 07:00 and 19:00). The runway use for both take-offs and landings during the evening period was greatly similar to that seen during the daytime period, with the minor difference that take-offs from the 25R taking place in the evening involved an easterly veering manoeuvre to a slightly higher degree A comparison between the 55 dB(A) contours also throws up minor differences in runway use between the evening and daytime period. Compared against 55 dB(A) contours, the 50 dB(A) evening contour is slightly more sensitive to route use. For instance, the 50 dB(A) contour shows a minor easterly bulge along the runway 01 landing lobe as a result of the fact that take-offs from runway 19 veer off in an easterly direction. In 2014, this bulge was a lot smaller than it had been in 2013, due to the fact that fewer take-offs were made to occur from this runway in 2014 (2.9% in 2014 compared to 5.3% in 2013). The 50 dB(A) also illustrates the veering off along the canal route of aircraft taking off straight ahead (in a straight forward direction?) from runway 25R.

Compared against 2013, 2014 witnessed more northerly veering manoeuvres being performed from runway 25R to the effect that the lobe in question has magnified in size.

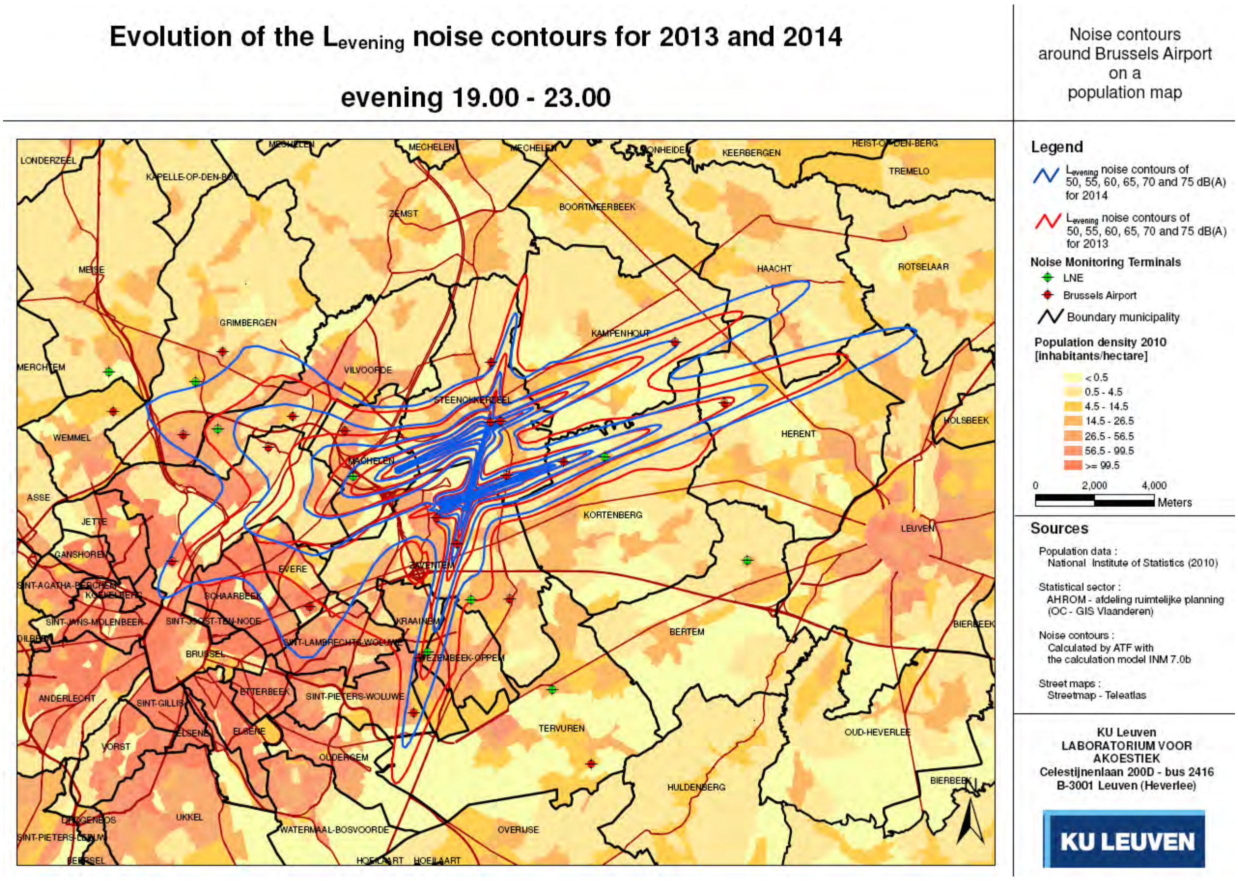
The number of take-offs during the evening period (an average 68.4 per evening period) has returned to 2012 levels (an average 67.9 per evening period), further to the decline seen in 2013.

The total number of landings in 2014 during the evening period (an average 67.7 per evening period) has significantly risen compared against the total number of landings witnessed in 2013 (an average 61.7 per evening period).

Compared against 2013, a number of trends are similar to those seen in the daytime contours. We are seeing an enlargement of the take-off and landing lobes from runway 25R and a contraction of the landing lobes of runways 19 and 01. This is a result of a more frequent preferential runway use, and a more frequent use of the canal route by heavy aircraft, and the wider curve performed by a portion of the aircraft flying in an easterly direction after they took off from runway 25R. The latter not only caused the corresponding 25R take-off lobe to change shape but also resulted in a contraction of the widening of the 01 landing contour by aircraft that fly over the landing contour of runway 01 when taking off.

The total surface area within the $L_{evening}$-noise contour of 50 dB(A) magnified from 11,222 ha in 2013 to 12,283 ha in 2014, a rise of around 9%, which more or less corresponds to the year 2012. Because of the fact that the contour - as a result of the route changes implemented in the spring of 2014 (greater easterly curve for part of the aircraft taking off from 25R and heading east; intensified use of the canal route) - changed shape close to some densely populated zones in the northern and north-western parts of the Brussels Capital Region, the number of residents living inside this noise contour rose from 182,247 in 2012 to 223,324 in 2013, although this figure remained below that of 2012 (269,635).

Figure 7 $L_{evening}$ noise contours of 50 dB(A) around Brussels Airport for 2013 (red) and 2014 (blue)



4.4.3 L_{night} contours

The L_{night} contours represent the A weighted equivalent sound pressure level over the 23:00 to 07:00 time span and are reported from 45 dB(A) through 70 dB(A). The changes in the L_{night} noise contours for 2013 and 2014 are also shown in figure 8.

The evaluation period of the L_{night} contours does not completely match the operational division of the day at Brussels Airport. In operational terms, the night time is from 23:00 to 06:00. The time between 06:00 and 07:00 is operationally the day period to the effect that for this time period, the runway use that was already described in the discussion of the L_{day} noise contours is applied preferentially. During the operational night period, the preferential runway use is the 'Departures 25R/19 - Landings 25R/25L' configuration, except for weekend nights, when there is alternating use of runway 25R (Friday night), 25L (Saturday night) and runway 19 (Sunday night) for both departures and arrivals.

When runways 25R and 19 are jointly in operation (Monday through Thursday night), in all cases runway 19 is used for the take-offs in an easterly direction by airplanes with an MTOW <200 tonnes.

More specifically, in terms of route use, during the operational nighttime period there are no departures from runway 25R because of the tight left turn in a southerly direction.

These movements taking off from runway 25R by contrast observed a route involving a curve to the right (cf. CIV2C/CIV3C ring route) up until 6/2/2014. From 6/2/2014 forward, they took a straight ahead route (canal route or Delta route). The smaller airplanes headed to the Chièvres beacon taking off from runway 25R during the operational night-time period up until 6/2/2014 also observed the canal route, whereas the larger aircraft took the ring route. Since 6/2/2014, all aircraft headed to the Chièvres beacon have been taking a straight ahead route on from runway 25R (canal route or Delta route).

Due to the contribution to the night-time noise of the peak time between 06:00 and 07:00 in parameter L_{night}, approximately 78% of all departures in this evaluation period were seen to take off from runway 25R (9,052 of the 13,734 take-offs between 23:00 and 07:00 were performed during the hour between 06:00 and 07:00; see As a result of the amendment to the VLAREM legislation in 2005, the 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 2014 counted in accordance with that breakdown, split into departures and landings, is represented, together with the number of movements in 2013, and with the trend, in Table 1. The numbers for the night period are further broken down in this table between the operational night-time period (23:00-06:00) and the morning hour between 06:00 and 07:00.

For the daytime period (07:00 – 19:00) there is an increase of the number of movements of approximately 6.6% as compared to 2013, both for landings and departures.

For the evening period (19:00 – 23:00), the number of departures increased with about 4.8% while the number of landings increased with about 9.9%.

The number of departures during the night period (23:00 – 07:00) rose by approximately 5.0% as compared to 2013. Both the number of departures during the operational night period and the number of departures during the morning period between 06:00 and 07:00 increased. The number of landings during the night-time period rose by 10.3%. This is mainly a consequence of a strong increase (11.5%) of the number of landings during the operational night period. During the morning hour between 06:00 and 07:00, the number of landings rose by 3.4%

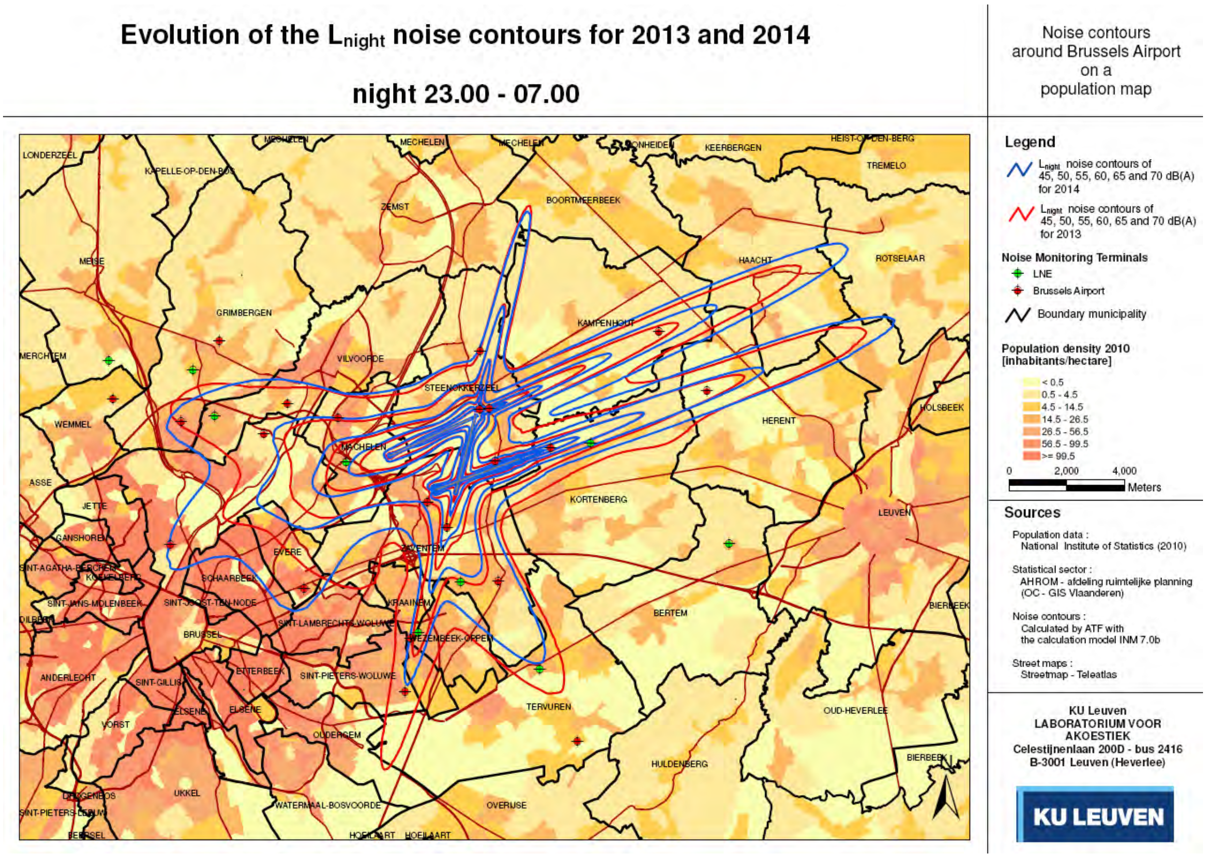
Table 1). In spite of the fact that the routes involving a left curve in a southerly direction on from runway 25R were not used during the operational night-time period, for the L_{night} noise contours a distinct take-off lobe is seen to unfold in a southerly direction which is comparable in size to the take-off lobe of runway 25R in a northerly direction, as a result of the take-offs between 06:00 and 07:00 There is also a clear take-off lobe for 25R straight ahead along the canal route. Furthermore, the take-off lobe in a southeasterly direction from runway 19 is also clearly visible (15.0% of all departures). With regard to the landings, the bulk of the landings is handled by runways 25R and 25L (jointly representing 83.4% of all landings). Other than this clear landing contours can be seen in the extended line of runways 01 (7.6% of landings) and 19 (8.7% of landings).

Compared against 2013, the total number of take-off movements during the night-time period from 23:00 to 07:00 in 2014 climbed by 5.0%.

The overall number of landings during the night-time period went up by 10.3% (from 4.1 landings per hour in 2013 to 4.5 landings per hour in 2014). In combination with the changed runway use, this is especially visible in an expansion of the 25R landing contour, which was used for 37.4% of night-time landings. The increase in 2013 up to 18.2% of the landings on runway 01, in 2014 was driven down again to below the 2012 level to handle 7.6% of all landings.

On balance, the combination of these developments did not affect any material change in the surface area within the L_{night} noise contour of 45 dB(A), which rose from 12,501 ha in 2013 to 12,583 ha in 2014. The number of residents living inside this noise contour on the other saw a substantial increase: from 126,754 in 2013 to 196,362 in 2014. This increase is largely due to the amplification of the southerly 25R take-off lobe, which is especially the result of aircraft, which - since the route changes that were implemented in the spring of 2014 - between 6:00am and 7:00am fly a wide curve in an easterly direction over an area with a high population density. In 2013, this turn was performed more sharply over a less densely populated area.

Figure 8 L_{night} noise contours of 45 dB(A) around Brussels Airport for 2012 (red) and 2013 (blue)



4.4.4 L_{den} contours (day 07.00-19.00, evening 19.00-23.00, night 23.00-07.00)

The L_{den} parameter is a composite of L_{day}, $L_{evening}$ and L_{night}, giving an A-weighted equivalent level over the whole 24-hour period, but where evening flights are subject to a correction factor of 3.16 (or + 5 dB) and night flights to a factor of 10 (or +10 dB). These contours are reported between 55 dB(A) and 75 dB(A).

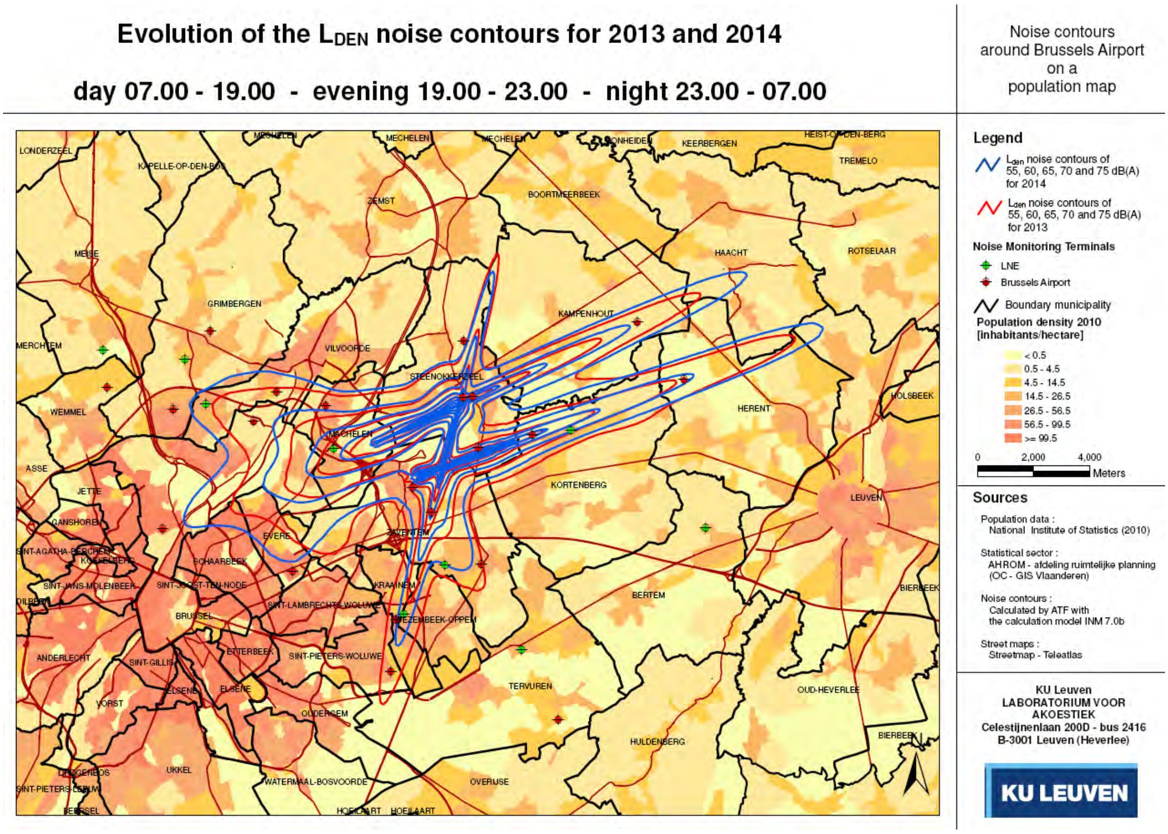
As each of the three time periods contributes to the weighted L_{den} average, the observations put forward in the previous paragraphs in respect of the L_{day}, $L_{evening}$ and L_{night} noise contours are seen to pop up again in the L_{den} noise contours. The changes in the L_{den} noise contours for 2013 and 2014 are also shown in Figure 9.

2013 witnessed a significant contraction of the contours that were dominated by the take-off movements of runway 25R, and an expansion of the contours that were impacted by take-offs from runways 07R and 19, which were chiefly a result of a more frequent alternative runway use. 2014 again saw a larger share of preferential runway use, to the effect that the take-off contours of 25R were back to expanding again (a rise of approximately 5% of the straight ahead and northerly 25R take-offs, and approximately 3% for southeasterly 25R take-offs), and those of 07R and 19 (which roughly saw the number of take-offs halved) contracted. The route changes that got under way in the spring also have an effect on the contours: the southerly bulge of the landing contour towards runway 07L has vanished as - since the spring - aircraft taking off from 07R continue to fly straight ahead instead of veering off in a southerly direction over Herent. As the bulk of the aircraft taking off from 25R and having a southeasterly destination are flying a wider curve since the spring, the pertaining contour lobe has shifted in a westerly direction and the widening of the landing lobe towards runway 01 has deceased. What is also notable is the expansion of the take-off lobe for aircraft flying straight on from 25R before taking the canal route towards the south, due to the intensified use of this route.

With regard to the landings, in the wake of the reduction in 2013 as a result of increased alternative runway use (as a result of the more frequent easterly winds), 2014 again saw a rise in the number of landings on runways 25L and 25R, which primarily came at the expense of the number of landings on runway 01 (a fall in the number of landings from 22.5% in 2013 down to 12.5% in 2014).

The total surface area within the 55 dB(A) amplified by 4%, from 8,415 ha in 2013 to 8,756 ha in 2014. The number of residents went up by 38%, from 77,229 in 2013 to 106,725 in 2014. This strong rise is mainly a result of the changed shape of the night-time contours.

Figure 9 L den noise contours of 55 dB(A) around Brussels Airport for 2013 (red) and 2014 (blue)



4.4.5 Freq.70,day – contours (day 07.00-23.00)

The freq.70,day contours were calculated for an evaluation period that consists of the evaluation periods of L_{day} and $L_{evening}$ combined. The observations discussed above for these parameters therefore recur in the freq.70,day contours to a certain extent. The change in the freq.70,day noise contours for 2013 and 2014 is also shown in Figure 10.

Some aspects stand out. Compared against 2013, the landing contours on runways 25L and 25R in 2014 have become more oblong again, and those of runway 19 have become shorter, as a result of the increased preferential runway use. The expansion in 2014 of the 25R take-off lobes compared against 2013 is even more distinct than in the L_{day} and $L_{evening}$ contours. The lobe that corresponds to aircraft taking off from 25R and flying straight ahead in order to veer off along the canal is very clear to see. The rise in the number of take-off movements from 25R which make a large curve in a southerly direction, in 2014 produced a marked southerly bulge in the contours. On the other hand, the fall in the number of take-offs from runway 19 which immediately veer off in an easterly direction has caused the related easterly bulge of the 01 landing contour to contract.

The total surface area within the 5x above 70dB(A) contour consequently remained more or less unchanged (15,372 ha in 2014 compared against 15,557 ha in 2013). In spite thereof, the number of residents living inside the contour went up by approximately 80%, from 239,376 in 2013 to 434,746 in 2014, which is also much higher than the figure for 2012 (302,136). The magnifying effect of the contour expansion of runway 25R in a densely populated area on the number of residents living inside the contours is clearly much higher than the diminishing effect of the contraction of the take-off contour of runway 19 in areas that are less densely populated.

4.4.6 Freq.70,night contours (night 23.00-07.00)

The freq.70,night contours were calculated for the same evaluation period as the L_{night} noise contours. The change in the freq.70,night noise contours for 2013 and 2014 is also shown in Figure 11.

For the freq.70,night contours the amplification of the northerly and westerly lobe of the 25R is more confined than seen in the daytime contours. In 2014, the southerly contour showed up a substantial distortion as a result of the wider curve in a southerly direction flown by part of the aircraft flying in a southeasterly direction from the 25R. Compared against the daytime period, the night-time period showed a smaller drop in the number of take-offs from runway 19, to the effect that the easterly bulge of the 01 landing contour associated therewith was barely any smaller in 2014 than it had been in 2013. The 01 landing contour itself was shorter in 2014 than it had been in 2013 as a result of a lower number of landings (in case of alternative runway use) on that runway (7.6% in 2014 compared against 18.2% in 2013).

The total surface area within the 1x above 70 dB(A) contour dropped from 14,944 ha in 2013 to 13,813 ha in 2014. By contrast, as a result of the southerly bulge of the 25R take-off contour, (which is primarily the result of the movements veering off in a southerly direction further to take-off from the 25R runway during the first hour of the operational day, i.e. between 6:00am and 7:00am) the number of residents went up substantially from 199,913 in 2013 to 279,251 in 2014, due to the fact that a contour contraction in a sparsely populated area was not cancelled out by a contour expansion in a densely populated area.

Figure 10 Freq.70,day noise contours of 5x above 70 dB(A) around Brussels Airport for 2012 (red) and 2013 (blue)

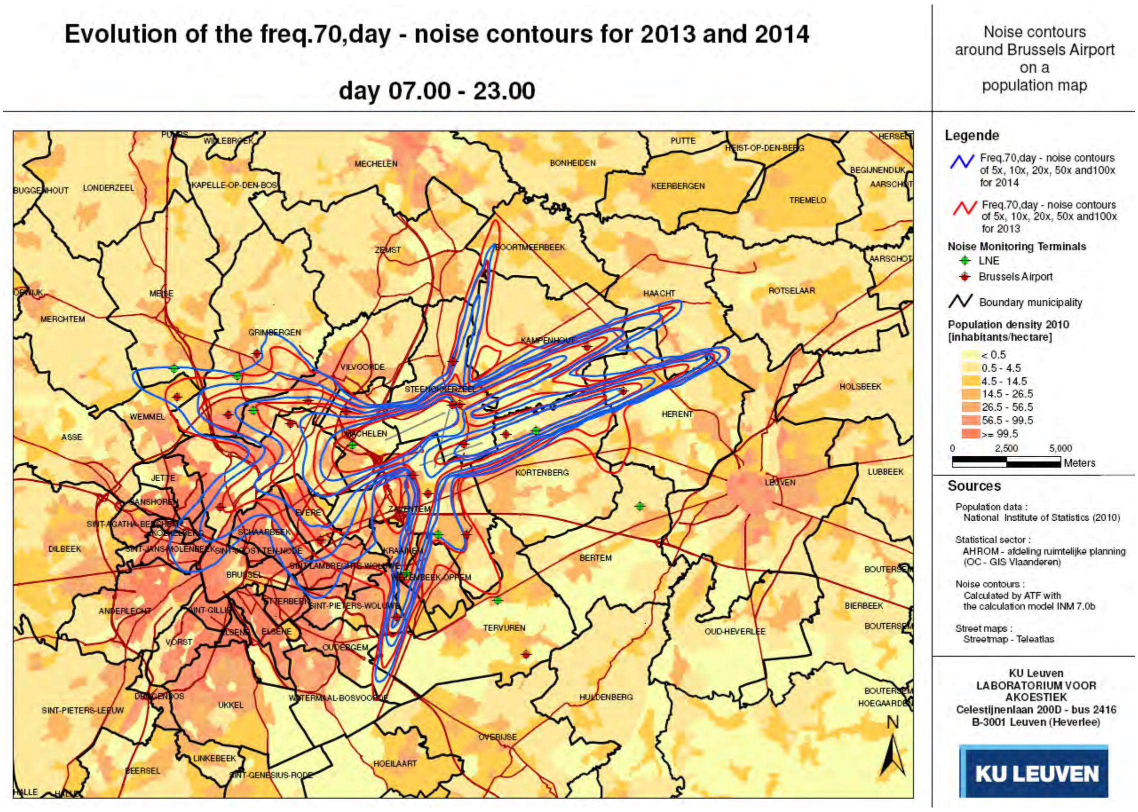
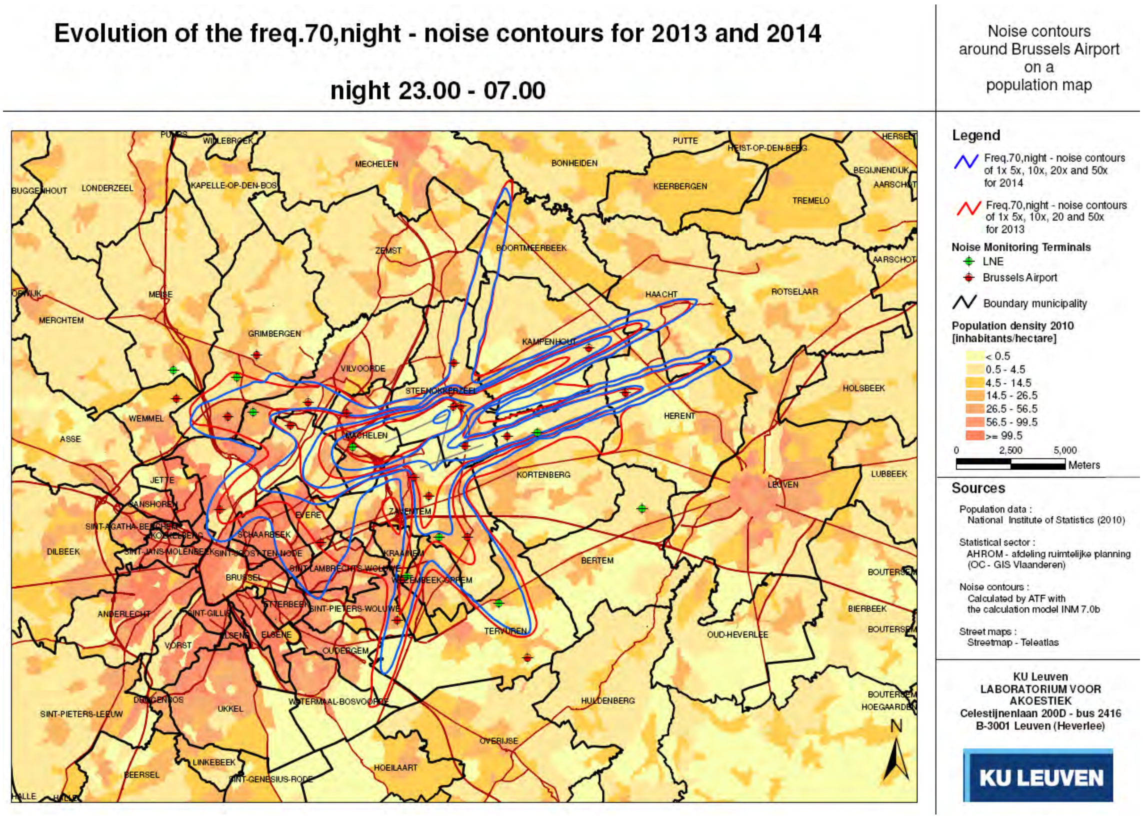


Figure 11 Freq.70,night noise contours of 1x above 70 dB(A) around Brussels Airport for 2012 (red) and 2013 (blue)



4.4.7 Freq.60,day – contours (day 07.00-23.00)

In view of the narrower angle in the vertical profile and the narrower spread of the landing flight traffic compared with departing flight traffic, the frequency contours for 60 dB(A) in the landing zones soon extend a long way from the airport. This means that these frequency contours can only be determined as from the contour 50x above 60 dB(A), where the main runway use is shown in the form of contours: landings on runways 25L and 25R, departures from runway 25R with a turn away north on the one hand, and with a turn away east on the other. Owing to the higher spatial concentration of the departures from runway 25R and 20 in an easterly direction to the Huldenberg beacon, the 50x above the 60 dB(A) contour for these departures reaches beyond that for a turnaway from runway 25R in a northerly direction.

The changes in the freq.60,day noise contours for 2013 and 2014 is also shown in Figure 12. These noise contours have slightly magnified in most directions, especially showing up an accentuation of the westward take-offs and landings by the preferential runway use that has grown away. For all that, two developments stand out in particular. For one thing, the movements taking off from runway 25R and performing a wide curve in a southerly direction produce an elongated lobe of 50 exceedances of the 60dB(A) threshold level per day. For another, the southerly lobes - which may be associated with (i) aircraft taking off from runway 25R which perform a short curve in a southeasterly direction, (ii) aircraft taking off from runway 19 and veering off in an easterly direction and (iii) landings on runway 01 - have greatly contracted as a result of sharply declining numbers of movements: in 2014 the areas outside of the lobes saw fewer than 50 exceedances per day.

The total surface area within the 50x above 60 dB(A) contour during the daytime period amplified from 13,632 ha in 2013 to 15,352 in 2014, i.e. a relapse to what was more or less the 2012 level (15,337 ha). As a consequence, the number of residents living inside this contour line went up from 174,921 in 2013 to 323,042 in 2014. To a very large degree, this substantial increase is to be attributed to the shift of the outer contour line of the 25R take-off lobe in a westerly direction.

4.4.8 Freq.60,night contours (night 23.00-07.00)

For the same reasons as with the freq.60,day contours, for the freq.60,night contours too, only contours for relatively high frequencies can be calculated (the lowest frequency is 10x above 60 dB(A)). This means that these contours too reflect the main runway use during the night period: landings on 25R and 25L, departures from runway 25R with a turn to the north (or to the south during the morning period) and, in principle, departures from runway 19 that subsequently veer off in an easterly direction. The changes of the freq.60,night noise contours for 2013 and 2014 are shown in Figure 13. The number of 60dB(A) exceedances as a result of take-offs from 25R has clearly increased, resulting in a westward expansion of the 25R take-off contours, whereas the number of exceedances for take-offs from runway 19 dropped to fewer than 50 per night, which has caused the contour lobe in question in the extended line of runway 19 to melt away completely.

The total surface area within the 10x above 60 dB(A) contour rose slightly from 10,369 ha in 2013 to 10,864 in 2014. The number of residents living inside this contour amplified from 93,438 in 2013 to 138,420 in 2014. In terms of resident numbers, the westward expansion of the contours of residents outweighs the southerly contraction.

Figure 12 Freq.60,day noise contours of 50x above 60 dB(A) around Brussels Airport for 2012 (red) and 2013 (blue)

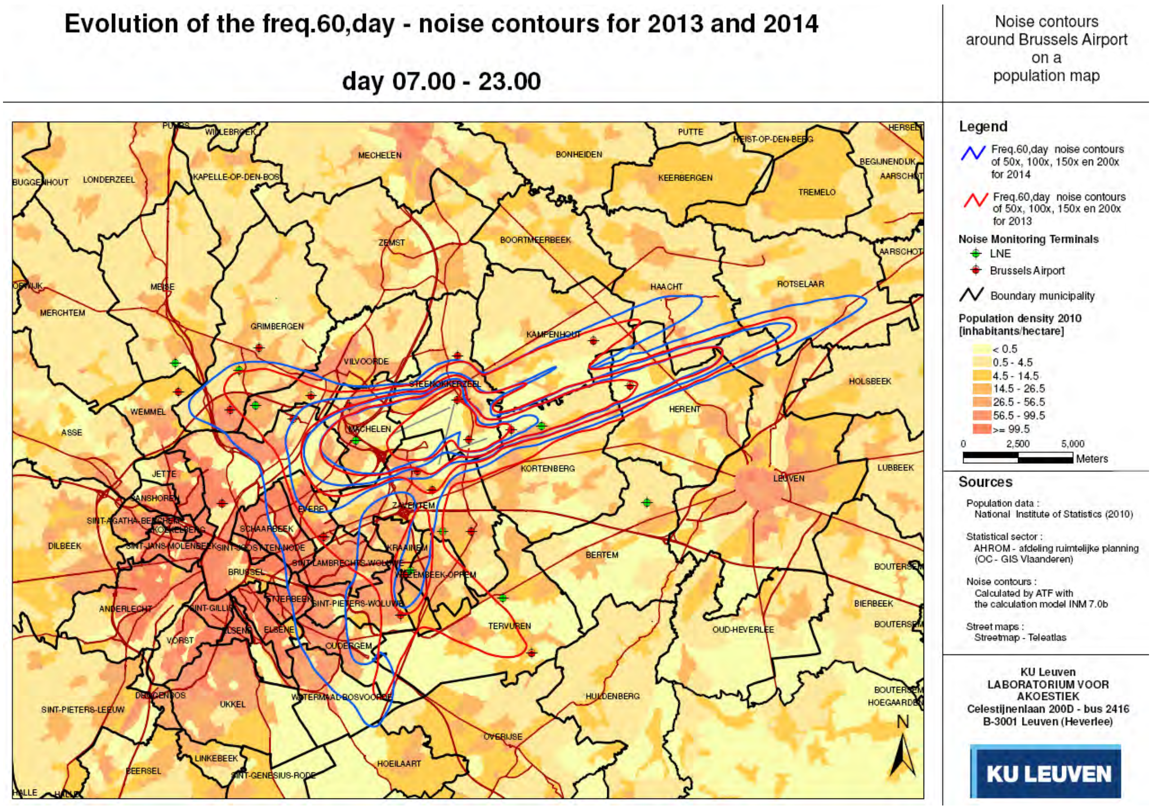
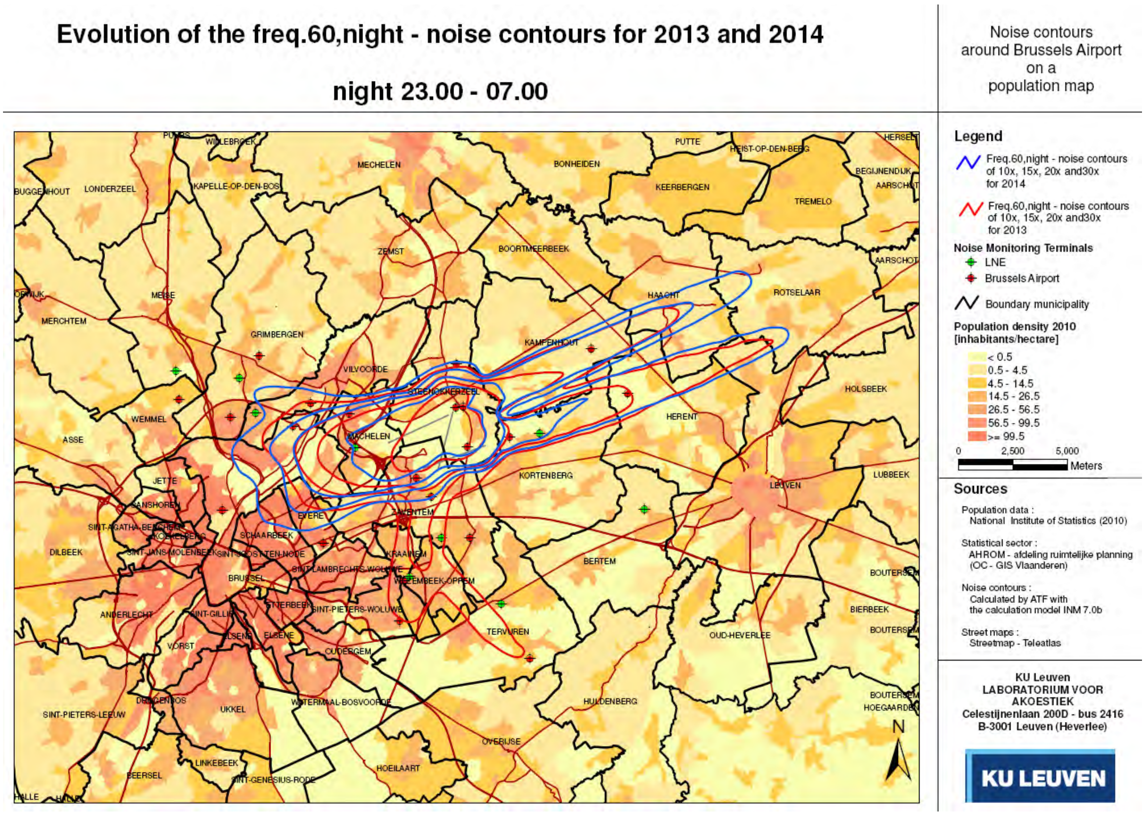


Figure 13 Freq.60,night noise contours of 10x above 60 dB(A) around Brussels Airport for 2012 (red) and 2013 (blue)



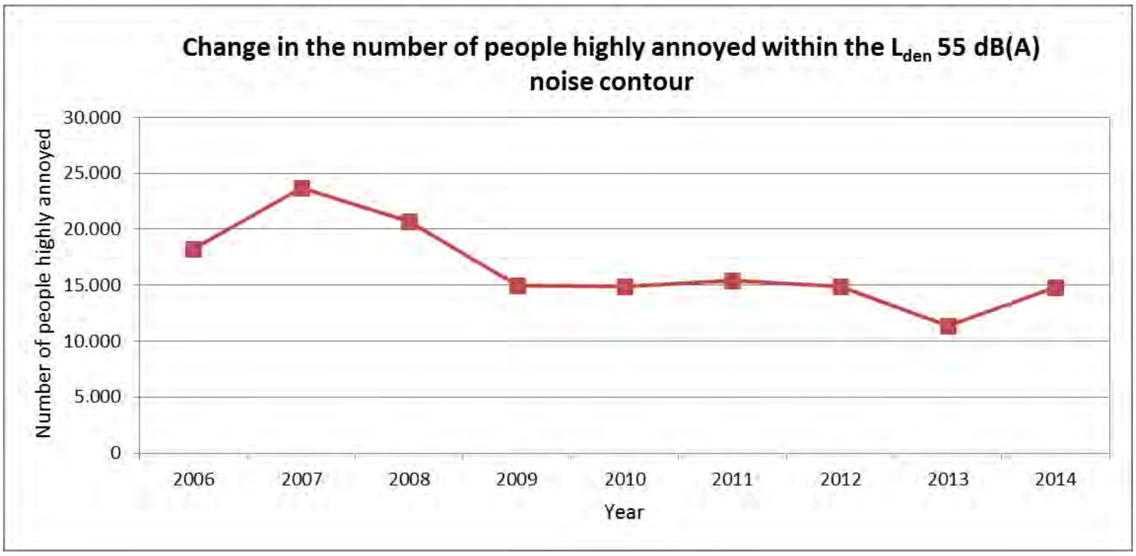
4.5 Number of people potentially highly inconvenienced based on L_{den} noise contours

For 2014, the total number of people who are potentially highly inconvenienced living inside the L_{den}-55 dB(A) contour amounted to 14,825. This signifies a rise of approximately 30% compared against 2013 when 11,399 people were potentially highly inconvenienced. This is mainly the result of the westward shift of the southerly take-off lobe from runway 25R (as a result of new routes that veer off in a southerly direction in a wide curve) towards densely populated zones of the Brussels Capital Region, and of the increased preferential use of runway 25R for take-offs Table 7 shows a summary per municipality is shown. The detailed data in this respect are set out in Appendix 4.3.

Table 7 Change in the number of people potentially highly inconvenienced within the L_{den} 55 dB(A) noise contour

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
INM version	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
Brussel	1.254	1.691	1.447	1.131	1.115	1.061	1.080	928	1.780
Evere	2.987	3.566	3.325	2.903	2.738	2.599	2.306	1.142	2.975
Grimbergen	479	1.305	638	202	132	193	120	0	175
Haacht	103	119	58	36	31	37	37	24	50
Herent	88	140	162	119	115	123	134	107	152
Kampenhout	747	727	582	453	483	461	399	430	469
Kortenberg	548	621	604	512	526	497	422	603	443
Kraainem	934	1.373	1.277	673	669	667	500	589	111
Leuven	0	9	22	2	1	3	5	0	11
Machelen	2.411	2.724	2.635	2.439	2.392	2.470	2.573	2.278	2.505
Schaarbeek	995	1.937	1.440	603	1.153	1.652	1.703	76	1.647
Sint-L.-Woluwe	382	1.218	994	489	290	196	150	0	0
Sint-P.-Woluwe	411	798	607	396	477	270	82	390	0
Steenokkerzeel	1.530	1.584	1.471	1.327	1.351	1.360	1.409	1.455	1.439
Tervuren	0	0	0	0	0	0	0	0	0
Vilvoorde	1.158	1.483	1.177	894	812	868	851	302	1.012
Wezembeek-O.	739	878	670	359	425	408	399	457	172
Zaventem	3.490	3.558	3.628	2.411	2.152	2.544	2.716	2.618	1.884
ZEMST	0	0	0	0	0	0	0	0	0
Total	**18.257**	**23.732**	**20.737**	**14.950**	**14.861**	**15.409**	**14.886**	**11.399**	**14.825**

Figure 14 Change in the number of people highly inconvenienced within the L_{den} 55 dB(A) noise contour



Appendix 1. Runway use in 2014 (compared with 2013)

The runway use was derived from the Central Database (CDB) of Brussels Airport Company. In Figure 16 up to and including Figure 19 the average runway use is shown for the whole 24-hour period and for the day, evening and night period, concerning both departures and arrivals for the year 2014. As a comparison, the statistics for the year 2013 are included in brackets each time.

In view of the importance of runway 25R and the impact on the counters, runway use for departures from runway 25R was divided into the 3 main directions: aircraft which turn north shortly after take-off, aircraft which turn south immediately after take-off, and those which first fly straight after take-off. his latter group also contains flights along the canal route and along the route that curves once they have reached a height of 4000 feet turn towards the south.

In the tables under the figures, the absolute figures for runway use are given for the years 2013 and 2014.

In Figure 15 the nomenclature of the runways is shown.

Figure 15 Configuration and nomenclature of the departure and arrival runways at Brussels Airport

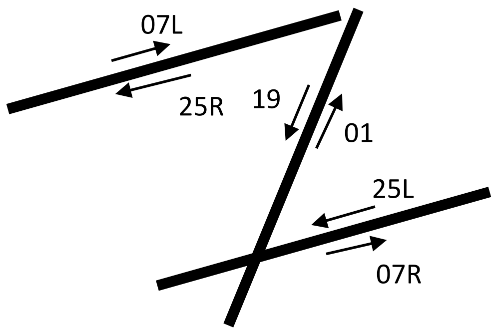
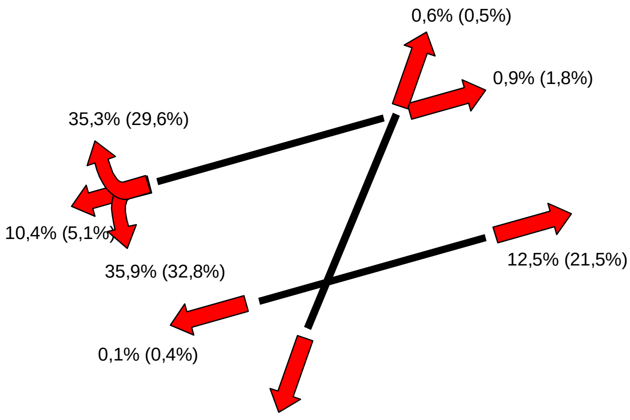
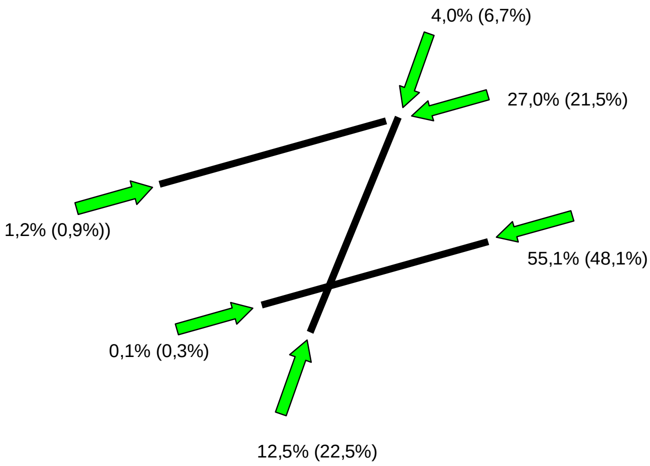


Figure 16 The runway use of the total number of departures and landings in 2014 (and 2013)

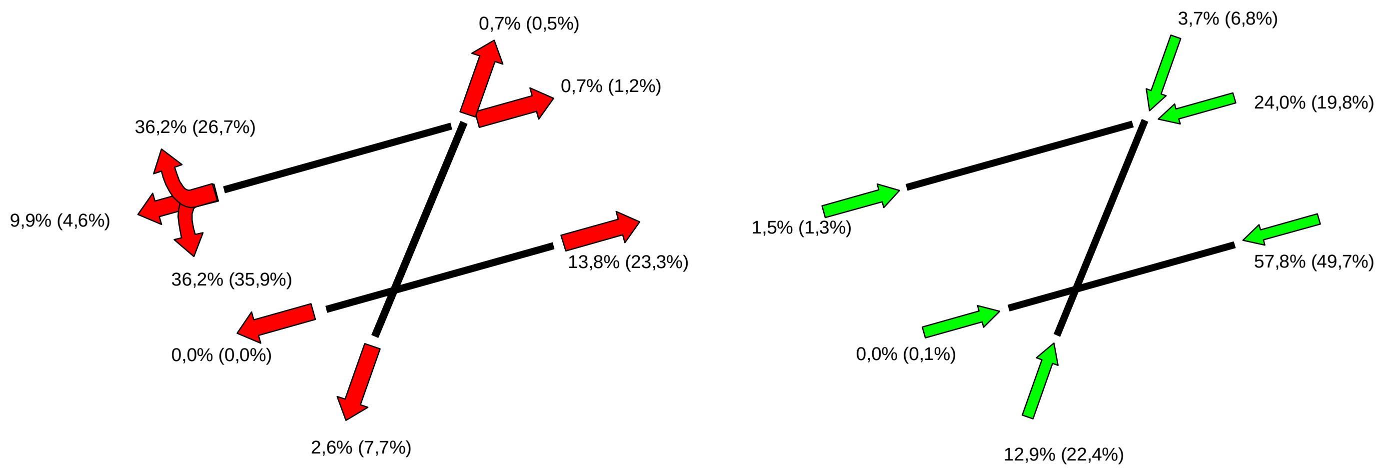




Departures total		
Runway	**2013**	**2014**
01	617	734
07L	2,023	992
07R	23,030	14,226
19	8,910	4,713
25L	397	158
25R	73,364	92,647

Landings total		
Runway	**2013**	**2014**
01	24,163	14,525
07L	1,006	1,380
07R	316	147
19	7,229	4,672
25L	51,710	63,814
25R	23,912	31,225

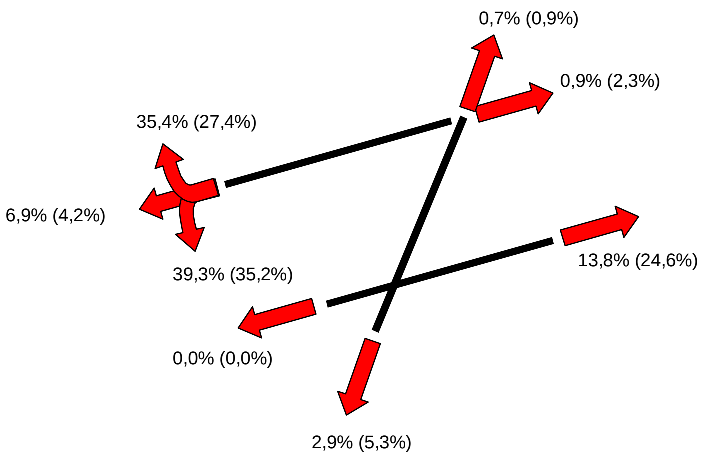
Figure 17 The runway use of the total number of departures and arrivals in 2014 (and 2013) during the day (07.00-19.00)

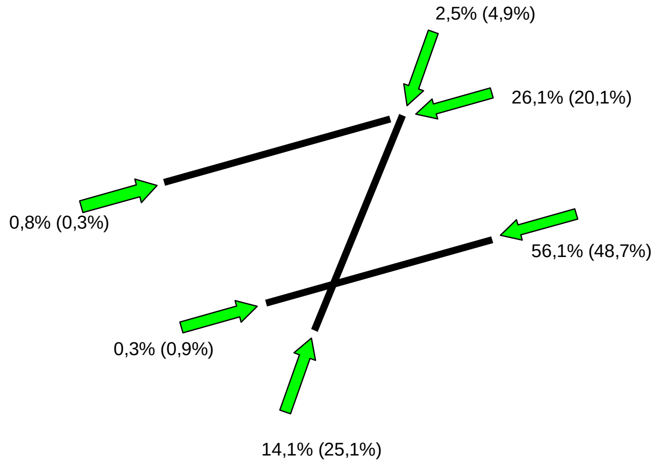


Departures day		
Runway	**2013**	**2014**
01	379	525
07L	913	499
07R	15,700	10,402
19	5,254	1,990
25L	36	8
25R	49,150	62,149

Landings day		
Runway	**2013**	**2014**
01	16,389	10,026
07L	924	1.180
07R	73	36
19	5,022	2,906
25L	36,390	44,997
25R	15,075	18,695

Figure 18 The runway use of the total number of departures and arrivals in 2014 (and 2013) during the evening (19.00-23.00)

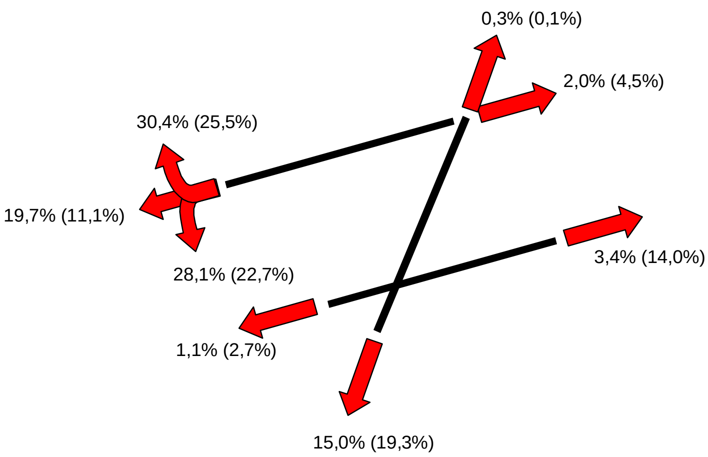


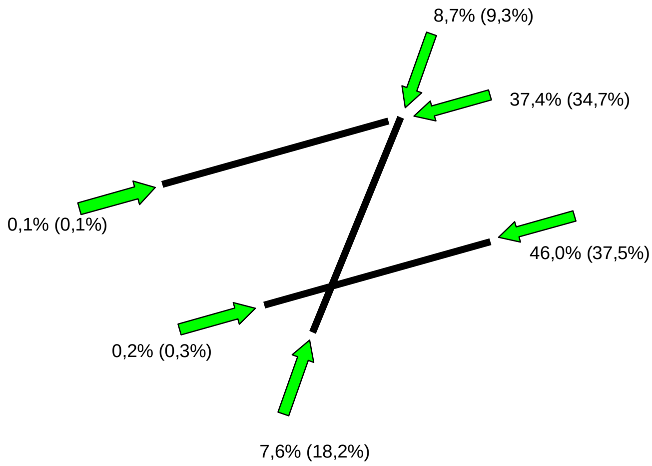


Departures evening		
Runway	**2013**	**2014**
01	218	168
07L	532	221
07R	5,548	3,368
19	1,193	708
25L	12	5
25R	16,321	19,994

Landings evening		
Runway	**2013**	**2014**
01	5,614	3,497
07L	68	193
07R	210	80
19	1,106	613
25L	10,877	13,882
25R	4,629	6,462

Figure 19 The runway use of the total number of take-offs and landings in 2014 (and 2013) during the night (23.00-07.00)



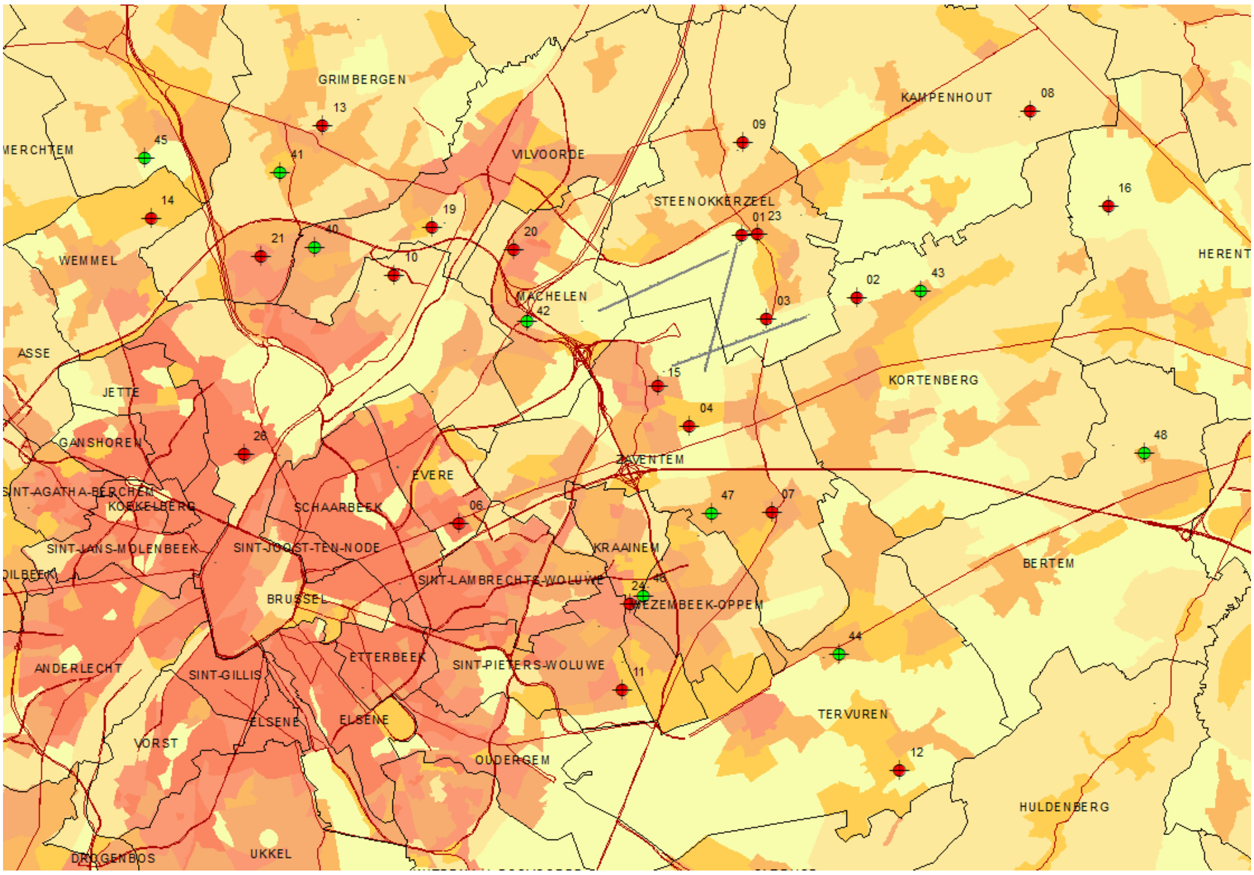


Departures night		
Runway	**2013**	**2014**
01	20	41
07L	578	272
07R	1,782	456
19	2,463	2,015
25L	349	145
25R	7,893	10,504

Landings night		
Runway	**2013**	**2014**
01	2,160	1,002
07L	14	7
07R	33	31
19	1,101	1,153
25L	4,443	4,934
25R	4,208	6,068

Appendix 2. Location of the noise monitoring terminals

Figure 20 Location of the noise monitoring terminals (situation as of 31/12/2014)



(source background: population map, density 1/1/2010)

Table 8 List of the noise monitoring terminals around Brussels Airport

NMT	Owner	Type	Location
1-2	Brussels Airport Company	Fixed	Steenokkerzeel
2-2	Brussels Airport Company	Fixed	Kortenberg
3-3	Brussels Airport Company	Fixed	Humelgem-Airside
4-1	Brussels Airport Company	Fixed	Nossegem
6-1	Brussels Airport Company	Fixed	Evere
7-1	Brussels Airport Company	Fixed	Sterrebeek
8-1	Brussels Airport Company	Fixed	Kampenhout
9-2	Brussels Airport Company	Fixed	Perk
10-2	Brussels Airport Company	Fixed	Neder-Over-Heembeek
11-2	Brussels Airport Company	Fixed	Sint-Pieters-Woluwe
12-1	Brussels Airport Company	Fixed	Duisburg
13-1	Brussels Airport Company	Fixed	Grimbergen
14-1	Brussels Airport Company	Fixed	Wemmel
15-3	Brussels Airport Company	Fixed	Zaventem
16-2	Brussels Airport Company	Fixed	Veltem
19-3	Brussels Airport Company	Fixed	Vilvoorde
20-2	Brussels Airport Company	Semi-mobile	Machelen
21-1	Brussels Airport Company	Semi-mobile	Strombeek - Bever
23-1	Brussels Airport Company	Semi-mobile	Steenokkerzeel
24-1	Brussels Airport Company	Semi-mobile	Kraainem
26-2	Brussels Airport Company	Semi-mobile	Brussel
40-1	LNE	Fixed	Koningslo
41-1	LNE	Fixed	Grimbergen
42-2	LNE	Semi-mobile	Diegem
43-2	LNE	Semi-mobile	Erps-kwerps
44-2	LNE	Fixed	Tervuren
45-1	LNE	Semi-mobile	Meise
46-2	LNE	Semi-mobile	Wezembeek-Oppem
47-3	LNE	Semi-mobile	Wezembeek-Oppem
48-3	LNE	Semi-mobile	Bertem

Appendix 3. Technical note - methodology for route input into INM

Appendix 3.1. Grouping of SIDs

For each aircraft type held in its data file, and for each route the INM allows noise levels to be calculated at every location on ground level. In principle, noise levels for an average day could be determined by factoring in the individual contribution to the noise exposure for each movement based on available radar data and aircraft type data. Given the very large number of movements and the complexity of the calculation, the INM allows movements that are similar in terms of route to be clustered, and for each group to factor in the joint contribution by drawing on their average route and the distribution surrounding this route.

For the take-offs, the clustering was performed pursuant to 2 movement aspects: the SID and the aircraft type. For each runway, SIDs were batched that have identical imposed routes or flight procedures in the part of the take-off movement that makes a relevant contribution to the noise level at ground level (Table 9). For all movements flying these SIDs, the mean value and the spread were subsequently determined. For runways 25R and 07R, which were very frequently used for take-offs, the aircraft types were clustered into subgroups per SID group, before determining the mean value and the spread. In doing so, aircraft types A319 and A320, which were most frequently used in 2014, were clustered into a single subgroup. Other frequently used aircraft types, whose take-off runways were established to be similar, were broken down into 4 additional subgroups. Movements involving aircraft types that were not frequently used were clustered in a 6^{th} subgroup.

The INM subsequently went on to determine the total noise levels generated as the energy sum of the noise levels per (sub-)group, which were each calculated based on the respective average route for that particular (sub-)group, the distribution around the averages, and the number of movements.

Table 9 Grouping of SIDs for determining the average INM routes

01	
GX_DEN7F	DENUT7F
	KOK2F
GX_HEL7F	HELEN7F
GX_SOP5F	CIV8F
	LNO5F
	PITES5F
	ROUSY5F
	SOPOK5F
	SPI5F
HX_NIK4F	NIK4F

07L	
GX_CIV5H	CIV1P
	CIV5H
	KOK1H
GX_CIV6H	CIV6H
GX_HEL4H	HELEN4H
GX_NIK1H	ELSIK1H
	NIK1H
GX_SOP3H	LNO3H
	PITES4H
	ROUSY4H
	SOPOK3H
	SPI4H
HX_DEN4H	DENUT4H
HX_SOP4H	LNO4H
	PITES5H
	ROUSY5H
	SOPOK4H
	SPI5H

07R	
GX_CIV1U	CIV1U
GX_DEN4H	DENUT4H
GX_HEL1J	HELEN1J
GX_HEL4H	HELEN4H
GX_LNO3J	LNO3J
	SPI3J
GX_NIK1H	NIK1H
GY_CIV6J	CIV6J
GY_DEN1J	DENUT1J
GY_NIK1J	ELSIK1H
	ELSIK1J
	KOK1J
	NIK1J
GY_SOP3J	CIV5J
	PITES4J
	ROUSY4J
	SOPOK3J
GY_SOP4J	LNO4J
	PITES5J
	ROUSY5J
	SOPOK4J
	SPI4J

25R'	
GP_CIV1Y	CIV1Y
GP_CIV3C	CIV3C
GP_CIV8D	CIV8D
GP_DEN5C	DENUT5C
GP_HEL5C	HELEN5C
GP_LNO3C	SPI3C
GP_NIK2C	NIK2C
	NIK5Z
GP_PIT5C	PITES5C
	ROUSY5C
	SOPOK6C
GP_ROU4C	PITES4C
	SOPOK5C
GP_SOP1Y	LNO1Y
	PITES1Y
	ROUSY1Y
	SOPOK1Y
	SPI1Y
GP_SOP5Z	LNO4Z
	ROUSY4Z
	SOPOK5Z
	SPI5Z

19	
GX_CIV1L	CIV1L
GX_DEN5N	DENUT5N
GX_DEN6L	DENUT6L
	KOK6L
GX_HEL5L	HELEN5L
GX_NIK3L	NIK3L
	NIK3N
GX_SPI4L	LNO5L
	SPI4L
GY_SOP5L	PITES6L
	ROUSY6L
	SOPOK5L
HX_HEL4N	HELEN4N

25R	
GX_CIV2C	CIV2C
GX_CIV8D	CIV8D
GX_DEN4C	DENUT4C
GX_ELS2C	ELSIK2C
GX_HEL4C	HELEN4C
GX_KOK3C	KOK3C
GX_LNO2C	LNO2C
	SPI2C
GX_SOP4C	SOPOK4C
GY_CIV1Y	CIV1Y
GY_CIV3C	CIV3C
GY_DEN5C	DENUT5C
GY_HEL5C	HELEN5C
GY_NIK2C	ELSIK2D
	NIK2C
GY_PIT5C	PITES5C
	ROUSY5C
	SOPOK6C
GY_ROU4C	PITES4C
	ROUSY4C
	SOPOK5C
GY_SOP1Y	LNO1Y
	PITES1Y
	ROUSY1Y
	SOPOK1Y
	SPI1Y
GY_SOP3D	LNO2D
	PITES3D
	ROUSY3D
	SOPOK3D
	SPI2D
HX_PIT3C	PITES3C
	ROUSY3C
	SOPOK3C
HY_LNO3C	LNO3C
	SPI3C

25L	
GX_CIV1W	CIV1W
	CIV3Q
	LNO1W
	PITES1Q
	PITES1W
	ROUSY1W
	SOPOK1W
	SOPOK2Q
	SOPOK3C
	SPI1W
	SPI2C
GX_DEN5C	DENUT4C
	DENUT5C
GX_HEL5C	HELEN5C
	KOK3C
GX_NIK2C	NIK2C

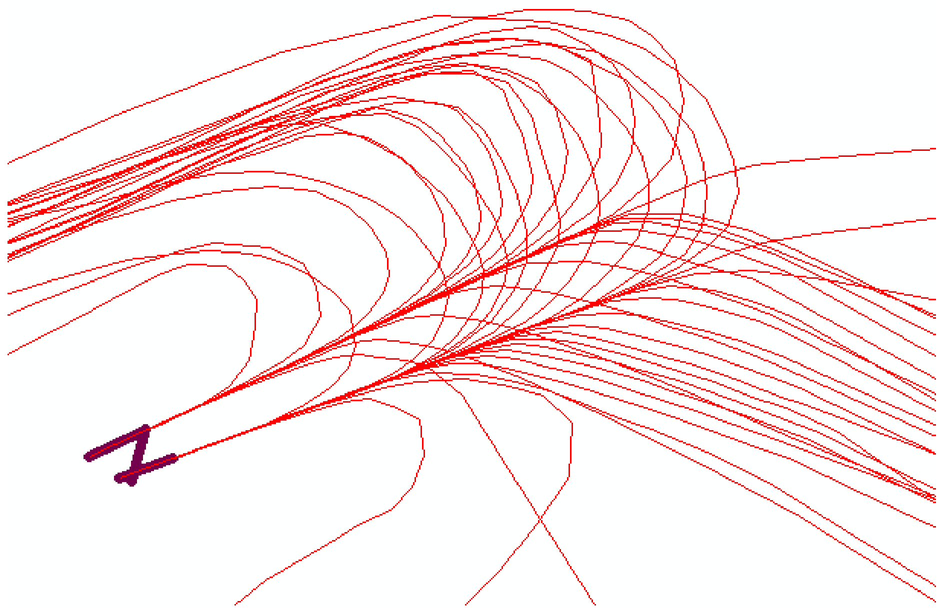
(1) Runway 25R': ditto runway 25R, albeit with a more easterly point of departure, usage during operational night-time period.

(2) GY and HY groups were further broken down into subgroups according to aircraft type

Appendix 3.2. Grouping of arrival routes

For the landings, there is very little spread for the portion of the route that supplies a relevant contribution to the noise pollution at ground level. Which is why, all relevant landings were batched for all runways except for 25R and 25L. For landings on runways 25R and 25L, a statistic was compiled of the directions used by the incoming aircraft. Based on this, for both runways the movements was assigned to one of 20 angle sectors. For each angle sector, the mean value and the spread around it were subsequently determined. The average routes of these arrival runways are shown in Figure 21.

Figure21 INM main routes for modelling arrivals at bigger distance from Brussels Airport



Appendix 4. Results of contour calculations 2014

Appendix 4.1. Area per contour zone and per municipality: L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day, freq.70,night, freq.60,day, freq.60,night

Table 10 Area per L_{day} contour zone and per municipality for the year 2014

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**
BRUSSELS	656	138				794
EVERE	109					109
HAACHT	38					38
HERENT	250					250
KAMPENHOUT	272	39				311
KORTENBERG	402	212	46	5		664
KRAAINEM	30					30
MACHELEN	318	281	201	58	9	867
STEENOKKERZEEL	447	311	181	103	90	1,132
VILVOORDE	40					40
WEZEMBEEK-OPPEM	10					10
ZAVENTEM	351	141	45	21	17	575
Grand total	***2,924***	***1,120***	***474***	***187***	***116***	***4,821***

Table 11 Area per $L_{evening}$ contour zone and per municipality for the year 2014

Area (ha)	$L_{evening}$ contour zone in dB(A) (ev. 19.00-23.00)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
BRUSSELS	667	723	153	0	-	-	1,543
EVERE	417	95	-	-	-	-	512
GRIMBERGEN	815	-	-	-	-	-	815
HAACHT	424	-	-	-	-	-	424
HERENT	534	139	-	-	-	-	672
KAMPENHOUT	1,077	307	54	-	-	-	1,438
KORTENBERG	440	384	148	29	1	-	1,002
KRAAINEM	152	22	-	-	-	-	175
LEUVEN	183	-	-	-	-	-	183
MACHELEN	197	319	314	194	53	7	1,084
ROTSELAAR	10	-	-	-	-	-	10
SCHAARBEEK	382	-	-	-	-	-	382
SINT-JANS-MOLENBEEK	4	-	-	-	-	-	4
SINT-LAMBRECHTS-WOLUWE	202	-	-	-	-	-	202
SINT-PIETERS-WOLUWE	80	-	-	-	-	-	80
STEENOKKERZEEL	466	464	308	182	101	39	1,559
TERVUREN	8	-	-	-	-	-	8
VILVOORDE	476	274	-	-	-	-	750
WEZEMBEEK-OPPEM	108	6	-	-	-	-	114
ZAVENTEM	779	354	128	40	19	4	1,325
Grand total	***7,421***	***3,087***	***1,106***	***445***	***175***	***50***	***12,283***

Table 12 Area per L_{night} contour zone and per municipality for the year 2014

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
BOORTMEERBEEK	17	-	-	-	-	-	17
BRUSSEL	947	554	53	-	-	-	1,553
EVERE	485	27	-	-	-	-	512
GRIMBERGEN	240	-	-	-	-	-	240
HAACHT	711	9	-	-	-	-	720
HERENT	525	177	-	-	-	-	702
KAMPENHOUT	845	447	118	9	-	-	1,419
KORTENBERG	414	301	126	26	2	-	869
KRAAINEM	126	6	-	-	-	-	132
LEUVEN	205	-	-	-	-	-	205
MACHELEN	266	342	304	147	32	5	1,097
ROTSELAAR	61	-	-	-	-	-	61
SCHAARBEEK	301	-	-	-	-	-	301
SINT-LAMBRECHTS-WOLUWE	33	-	-	-	-	-	33
SINT-PIETERS-WOLUWE	7	-	-	-	-	-	7
STEENOKKERZEEL	525	480	298	204	122	103	1,732
TERVUREN	34	-	-	-	-	-	34
VILVOORDE	599	22	-	-	-	-	621
WEZEMBEEK-OPPEM	183	2	-	-	-	-	186
ZAVENTEM	1,232	554	222	61	23	7	2,098
ZEMST	43	-	-	-	-	-	43
Grand total	***7,800***	***2,921***	***1,120***	***448***	***179***	***115***	***12,583***

Table 13 Area per L_{den} contour zone and per municipality for the year 2014

Area (ha)	L_{den} contour zone in dB(A) (d. 07-19, ev. 19-23, n. 23-07)					
Municipality	55-60	60-65	65-70	70-75	>75	Total
BRUSSELS	824	383	27			1,234
EVERE	379	0				379
GRIMBERGEN	48					48
HAACHT	290					290
HERENT	454	49				503
KAMPENHOUT	718	229	37			984
KORTENBERG	395	297	88	16		795
KRAAINEM	82					82
LEUVEN	51					51
MACHELEN	282	328	272	116	23	1,021
SCHAARBEEK	86					86
STEENOKKERZEEL	527	411	263	159	96	1,456
VILVOORDE	497	13				510
WEZEMBEEK-OPPEM	74					74
ZAVENTEM	723	356	114	34	17	1,244
Grand total	***5,429***	***2,066***	***800***	***325***	***136***	***8,756***

Table 14 Area per freq.70,day contour zone and per municipality for the year 2014

Area (ha)	**Freq.70,day contour zone (day 07.00-23.00)**					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
ANDERLECHT	8					**8**
BOORTMEERBEEK	27					**27**
BRUSSELS	330	583	519	370	138	**1,940**
ETTERBEEK	7					**7**
EVERE		187	325	0		**512**
GANSHOREN	1					**1**
GRIMBERGEN	705	548	22			**1,275**
HAACHT	163	126	100			**390**
HERENT	270	154	179	130	28	**761**
JETTE	51					**51**
KAMPENHOUT	317	538	518	185	2	**1,560**
KOEKELBERG	70					**70**
KORTENBERG	181	144	238	193	373	**1,130**
KRAAINEM	58	76	129			**263**
LEUVEN	38	16	0			**54**
MACHELEN	43	74	140	194	558	**1,009**
MEISE	209					**209**
MERCHTEM	17					**17**
OUDERGEM	25					**25**
SCHAARBEEK	319	333	27			**680**
SINT-JANS-MOLENBEEK	236	53				**290**
SINT-JOOST-TEN-NODE	16					**16**
SINT-LAMBRECHTS-WOLUWE	369	81				**450**
SINT-PIETERS-WOLUWE	92	82	25			**199**
STEENOKKERZEEL	182	205	273	366	538	**1,565**
TERVUREN	115	21				**136**
VILVOORDE	104	221	359	19		**704**
WEMMEL	212					**212**
WEZEMBEEK-OPPEM	36	46	90			**172**
ZAVENTEM	556	255	521	172	85	**1,589**
ZEMST	50	1				**51**
Grand total	***4,809***	***3,745***	***3,465***	***1,631***	***1,722***	***15,372***

Table 15 Area per freq.70,night contour zone and per municipality for the year 2014

Area (ha)	**Freq.70,night contour zone (night 23.00-07.00)**					
Municipality	**1-5**	**5-10**	**10-20**	**20-50**	**>50**	**Total**
BOORTMEERBEEK	253					**253**
BRUSSELS	818	558	304	28		**1,709**
ETTERBEEK	0					**0**
EVERE	397	115				**512**
GRIMBERGEN	600					**600**
HAACHT	284	148				**431**
HERENT	215	240	82			**537**
KAMPENHOUT	602	272	441			**1,316**
KORTENBERG	255	197	388			**839**
KRAAINEM	222					**222**
LEUVEN	52	1				**54**
MACHELEN	175	160	191	465		**991**
MECHELEN	30					**30**
OUDERGEM	1					**1**
SCHAARBEEK	523	6				**529**
SINT-JANS-MOLENBEEK	9					**9**
SINT-JOOST-TEN-NODE	0					**0**
SINT-LAMBRECHTS-WOLUWE	305					**305**
SINT-PIETERS-WOLUWE	147					**147**
STEENOKKERZEEL	505	205	450	432	27	**1,619**
TERVUREN	555					**555**
VILVOORDE	559	77				**636**
WEZEMBEEK-OPPEM	294					**294**
ZAVENTEM	1,268	607	174	77		**2,126**
ZEMST	98					**98**
Grand total	***8,169***	***2,586***	***2,030***	***1,001***	***27***	***13,813***

Table 16 Area per freq.60,day contour zone and per municipality for the year 2014

Area (ha)	Freq.60,day contour zone (day 07.00-23.00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
BRUSSELS	492	390	275	122	**1,279**
ELSENE	15				**15**
ETTERBEEK	149				**149**
EVERE	315	197			**512**
GRIMBERGEN	868				**868**
HAACHT	483	75	136		**694**
HERENT	351	200	412		**963**
HOEILAART	4				**4**
KAMPENHOUT	1,275	99	19		**1,393**
KORTENBERG	270	188	540	117	**1,115**
KRAAINEM	207				**207**
LEUVEN	105	207	5		**317**
MACHELEN	111	134	171	693	**1,110**
OUDERGEM	548				**548**
OVERIJSE	3				**3**
ROTSELAAR	607	70			**678**
SCHAARBEEK	468				**468**
SINT-LAMBRECHTS-WOLUWE	469				**469**
SINT-PIETERS-WOLUWE	322				**322**
STEENOKKERZEEL	267	247	210	854	**1,578**
TERVUREN	39				**39**
VILVOORDE	605	47			**651**
WATERMAAL-BOSVOORDE	505				**505**
WEZEMBEEK-OPPEM	158				**158**
ZAVENTEM	692	258	97	264	**1,311**
Grand total	***9,329***	***2,112***	***1,865***	***2,050***	***15,357***

Table 17 Area per freq.60,night contour zone and per municipality for the year 2014

Area (ha)	Freq.60,night contour zone (night 23.00-07.00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
BRUSSELS	463	333	569		**1,365**
EVERE	170	190	0		**361**
GRIMBERGEN	88				**88**
HAACHT	661	247			**907**
HERENT	759	59			**818**
KAMPENHOUT	414	940	58		**1,411**
KORTENBERG	565	362	29		**957**
LEUVEN	254				**254**
MACHELEN	87	76	501	446	**1,111**
ROTSELAAR	295				**295**
SCHAARBEEK	189				**189**
STEENOKKERZEEL	125	143	497	923	**1,688**
VILVOORDE	461	28	8		**497**
ZAVENTEM	275	165	182	301	**922**
Eindtotaal	***4,807***	***2,542***	***1,845***	***1,670***	***10,864***

Appendix 4.2. Number of inhabitants per contour zone and per municipality: L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day, freq.70,night, freq.60,day, freq.60,night

Table 18 Number of inhabitants per L_{day} contour zone and per municipality for the year 2014

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
BRUSSELS	2,200	2,518	2			4,719
EVERE	5,406					5,406
HAACHT	70					70
HERENT	636					636
KAMPENHOUT	835	169				1,004
KORTENBERG	1,609	513	18	2		2,143
KRAAINEM	77					77
MACHELEN	4,334	3,464	2,032	13		9,842
STEENOKKERZEEL	3,957	1,221	168	8	2	5,356
VILVOORDE	113					113
WEZEMBEEK-OPPEM	155					155
ZAVENTEM	3,607	764	29			4,400
Grand total	***22,998***	***8,649***	***2,249***	***22***	***2***	***33,920***

Table 19 Number of inhabitants per $L_{evening}$ contour zone and per municipality for the year 2014

Number of inhabitants	$L_{evening}$ contour zone in dB(A) (ev. 19.00-23.00)						
Municipality	50-55	55-60	60-65	65-70	70-75	>75	Total
BRUSSELS	25,656	2,030	2,914	0	-	-	30,600
EVERE	31,375	4,428	-	-	-	-	35,803
GRIMBERGEN	15,122	-	-	-	-	-	15,122
HAACHT	764	-	-	-	-	-	764
HERENT	1,259	180	-	-	-	-	1,440
KAMPENHOUT	3,962	1,128	223	-	-	-	5,314
KORTENBERG	2,631	1,310	289	12	1	-	4,242
KRAAINEM	3,266	51	-	-	-	-	3,317
LEUVEN	481	-	-	-	-	-	481
MACHELEN	2,252	4,258	4,569	1,840	17	-	12,936
ROTSELAAR	38	-	-	-	-	-	38
SCHAERBEEK	52,496	-	-	-	-	-	52,496
SINT-JANS-MOLENBEEK	651	-	-	-	-	-	651
SINT-LAMBRECHTS-WOLUWE	14,296	-	-	-	-	-	14,296
SINT-PIETERS-WOLUWE	2,086	-	-	-	-	-	2,086
STEENOKKERZEEL	3,243	4,168	1,142	194	11	0	8,758
TERVUREN	0	-	-	-	-	-	0
VILVOORDE	15,637	2,637	-	-	-	-	18,275
WEZEMBEEK-OPPEM	2,363	83	-	-	-	-	2,446
ZAVENTEM	10,120	3,639	495	5	-	-	14,260
Grand total	***187,698***	***23,913***	***9,632***	***2,052***	***29***	***0***	***223,324***

Table 20 Number of inhabitants per L_{night} contour zone and per municipality for the year 2014

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
BOORTMEERBEEK	4	-	-	-	-	-	4
BRUXELLES	28,052	3,722	751	-	-	-	32,524
EVERE	34,834	969	-	-	-	-	35,803
GRIMBERGEN	9,299	-	-	-	-	-	9,299
HAACHT	2,140	9	-	-	-	-	2,149
HERENT	1,184	402	-	-	-	-	1,586
KAMPENHOUT	2,818	1,390	367	79	-	-	4,654
KORTENBERG	1,869	1,027	216	10	1	-	3,123
KRAAINEM	2,100	12	-	-	-	-	2,112
LEUVEN	616	-	-	-	-	-	616
MACHELEN	3,517	4,646	4,316	449	0	-	12,928
ROTSELAAR	95	-	-	-	-	-	95
SCHAARBEEK	43,718	-	-	-	-	-	43,718
SINT-LAMBRECHTS-WOLUWE	753	-	-	-	-	-	753
SINT-PIETERS-WOLUWE	102	-	-	-	-	-	102
STEENOKKERZEEL	2,860	4,250	1,591	328	109	3	9,140
TERVUREN	577	-	-	-	-	-	577
VILVOORDE	12,174	63	-	-	-	-	12,237
WEZEMBEEK-OPPEM	3,115	45	-	-	-	-	3,159
ZAVENTEM	13,385	7,686	649	3	-	-	21,724
ZEMST	58	-	-	-	-	-	58
Grand total	***163,270***	***24,221***	***7,889***	***869***	***110***	***3***	***196,362***

Table 21 Number of inhabitants per L_{den} contour zone and per municipality for the year 2014

Number of inhabitants	L_{den} contour zone in dB(A) (d. 07-19, ev. 19-23, n. 23-07)					
Municipality	55-60	60-65	65-70	70-75	>75	Total
BRUSSELS	7,753	4,054	225			12,031
EVERE	25,093					25,093
GRIMBERGEN	1,701					1,701
HAACHT	433					433
HERENT	1,163	17				1,180
KAMPENHOUT	2,177	758	166			3,101
KORTENBERG	1,898	866	97	6		2,867
KRAAINEM	1,046					1,046
LEUVEN	104					104
MACHELEN	3,589	4,540	3,668	191		11,988
SCHAARBEEK	15,363	-				15,363
STEENOKKERZEEL	3,887	3,189	764	171	9	8,019
VILVOORDE	9,020	37				9,057
WEZEMBEEK-OPPEM	1,514					1,514
ZAVENTEM	10,006	3,064	156			13,226
Grand total	***84,747***	***16,525***	***5,076***	***368***	***9***	***106,725***

Table 22 Number of inhabitants per freq.70,day contour zone and per municipality for the year 2014

Number of inhabitants	Freq.70,day contour zone (day 07.00-23.00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
ANDERLECHT	1,388					**1,388**
BOORTMEERBEEK	71					**71**
BRUSSELS	35,218	30,850	1,903	2,165	2,229	**72,365**
ETTERBEEK	819					**819**
EVERE		17,046	18,756	1		**35,803**
GANSHOREN	136					**136**
GRIMBERGEN	8,153	12,592	1,017			**21,762**
HAACHT	441	164	183			**789**
HERENT	626	282	615	196	10	**1,729**
JETTE	8,022					**8,022**
KAMPENHOUT	1,043	1,620	1,554	626	1	**4,844**
KOEKELBERG	12,263					**12,263**
KORTENBERG	1,041	1,115	1,177	1,003	989	**5,324**
KRAAINEM	1,898	1,959	2,127			**5,984**
LEUVEN	77	34	0			**110**
MACHELEN	568	1,326	1,836	2,858	5,351	**11,939**
MEISE	1,085					**1,085**
MERCHTEM	13					**13**
OUDERGEM	3					**3**
SCHAARBEEK	48,501	45,518	3,393			**97,412**
SINT-JANS-MOLENBEEK	43,456	11,230				**54,686**
SINT-JOOST-TEN-NODE	995					**995**
SINT-LAMBRECHTS-WOLUWE	36,655	2,912				**39,567**
SINT-PIETERS-WOLUWE	5,991	2,397	616			**9,004**
STEENOKKERZEEL	1,000	1,199	2,566	2,354	865	**7,984**
TERVUREN	4	1				**4**
VILVOORDE	4,345	5,393	6,597	55		**16,390**
WEMMEL	1,687					**1,687**
WEZEMBEEK-OPPEM	916	1,062	1,869			**3,847**
ZAVENTEM	9,839	2,917	3,563	1,399	935	**18,652**
ZEMST	67	1				**69**
Grand total	***226,319***	***139,618***	***47,774***	***10,655***	***10,379***	***434,746***

Table 23 Number of inhabitants per freq.70,night contour zone and per municipality for the year 2014

Number of inhabitants	Freq.70,night contour zone (night 23.00-07.00)					
Municipality	**1-5**	**5-10**	**10-20**	**20-50**	**>50**	**Total**
BOORTMEERBEEK	2,032					**2,032**
BRUSSELS	38,783	592	4,018	146		**43,540**
ETTERBEEK	1					**1**
EVERE	29,700	6,103				**35,803**
GRIMBERGEN	15,639					**15,639**
HAACHT	774	229				**1,002**
HERENT	451	768	29			**1,248**
KAMPENHOUT	1,559	921	1,444			**3,924**
KORTENBERG	1,013	1,126	998			**3,138**
KRAAINEM	4,430					**4,430**
LEUVEN	107	3				**110**
MACHELEN	2,593	2,326	2,587	4,154		**11,660**
MECHELEN	131					**131**
OUDERGEM	0					**0**
SCHAARBEEK	69,169	214				**69,383**
SINT-JANS-MOLENBEEK	1,393					**1,393**
SINT-JOOST-TEN-NODE	10					**10**
SINT-LAMBRECHTS-WOLUWE	26,940					**26,940**
SINT-PIETERS-WOLUWE	5,555					**5,555**
STEENOKKERZEEL	2,939	1,696	2,382	1,382		**8,398**
TERVUREN	3,977					**3,977**
VILVOORDE	12,701	433				**13,134**
WEZEMBEEK-OPPEM	5,746					**5,746**
ZAVENTEM	14,331	5,383	1,560	651		**21,925**
ZEMST	131					**131**
Grand total	***240,106***	***19,794***	***13,018***	***6,333***		***279,251***

Table 24 Number of inhabitants per freq.60,day contour zone and per municipality for the year 2014

Number of inhabitants	Freq.60,day contour zone (day 07.00-23.00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
BRUSSELS	22,202	1,325	1,778	2,280	**27,585**
ELSENE	108				**108**
ETTERBEEK	16,979				**16,979**
EVERE	24,233	11,570			**35,803**
GRIMBERGEN	17,496				**17,496**
HAACHT	1,445	174	249		**1,867**
HERENT	650	417	1,047		**2,114**
HOEILAART	1				**1**
KAMPENHOUT	4,418	170	8		**4,595**
KORTENBERG	1,102	885	2,158	232	**4,376**
KRAAINEM	4,297				**4,297**
LEUVEN	797	603	11		**1,411**
MACHELEN	1,382	1,842	2,493	7,409	**13,126**
OUDERGEM	27,629				**27,629**
OVERIJSE	6				**6**
ROTSELAAR	4,280	119			**4,399**
SCHAARBEEK	52,883				**52,883**
SINT-LAMBRECHTS-WOLUWE	41,190				**41,190**
SINT-PIETERS-WOLUWE	18,066				**18,066**
STEENOKKERZEEL	1,836	1,789	1,316	3,831	**8,771**
TERVUREN	1				**1**
VILVOORDE	13,357	130			**13,487**
WATERMAAL-BOSVOORDE	8,153				**8,153**
WEZEMBEEK-OPPEM	3,628				**3,628**
ZAVENTEM	7,466	3,013	1,224	3,369	**15,072**
Grand total	***273,603***	***22,036***	***10,282***	***17,121***	***323,042***

Table 25 Number of inhabitants per freq.60,night contour zone and per municipality for the year 2014

Number of inhabitants	Freq.60,night contour zone (night 23.00-07.00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
BRUSSELS	17,491	4,578	4,481		**26,550**
EVERE	8,806	14,657	27		**23,490**
GRIMBERGEN	1,679				**1,679**
HAACHT	2,554	454			**3,008**
HERENT	1,790	37			**1,828**
KAMPENHOUT	1,471	3,140	493		**5,103**
KORTENBERG	2,291	1,291	13		**3,595**
LEUVEN	927				**927**
MACHELEN	1,035	992	8,720	2,358	**13,105**
ROTSELAAR	502				**502**
SCHAARBEEK	29,973				**29,973**
STEENOKKERZEEL	859	927	2,023	5,788	**9,598**
VILVOORDE	7,759	79	22		**7,859**
ZAVENTEM	2,589	1,586	2,858	4,171	**11,203**
Eindtotaal	***79,725***	***27,741***	***18,637***	***12,317***	***138,420***

Appendix 4.3. Number of people potentially highly inconvenienced per L_{den} contour zone and per municipality

Table 26 Number of people potentially highly inconvenienced per L_{den} contour zone and per municipality for the year 2014

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
INM version	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
Brussel	1,254	1,691	1,447	1,131	1,115	1,061	1,080	928	1,780
Evere	2,987	3,566	3,325	2,903	2,738	2,599	2,306	1,142	2,975
Grimbergen	479	1,305	638	202	132	193	120	0	175
Haacht	103	119	58	36	31	37	37	24	50
Herent	88	140	162	119	115	123	134	107	152
Kampenhout	747	727	582	453	483	461	399	430	469
Kortenberg	548	621	604	512	526	497	422	603	443
Kraainem	934	1,373	1,277	673	669	667	500	589	111
Leuven	0	9	22	2	1	3	5	0	11
Machelen	2,411	2,724	2,635	2,439	2,392	2,470	2,573	2,278	2,505
Schaarbeek	995	1,937	1,440	603	1,153	1,652	1,703	76	1,647
Sint-L.-Woluwe	382	1,218	994	489	290	196	150	0	0
Sint-P.-Woluwe	411	798	607	396	477	270	82	390	0
Steenokkerzeel	1,530	1,584	1,471	1,327	1,351	1,360	1,409	1,455	1,439
Tervuren	0	0	0	0	0	0	0	0	0
Vilvoorde	1,158	1,483	1,177	894	812	868	851	302	1,012
Wezembeek-O.	739	878	670	359	425	408	399	457	172
Zaventem	3,490	3,558	3,628	2,411	2,152	2,544	2,716	2,618	1,884
ZEMST	0	0	0	0	0	0	0	0	0
Total	**18,257**	**23,732**	**20,737**	**14,950**	**14,861**	**15,409**	**14,886**	**11,399**	**14,825**

Appendix 5. Change in area and number of inhabitants

Appendix 5.1. Change in area per contour zone: L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day, freq.70,night, freq.60,day, freq.60,night

Table 27 Change in the area within the L_{day} contours (2006-2014)

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**
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**

* Calculated with INM 7.0b

Figure 22 Change in the area within the L_{day} contours (2006-2014)

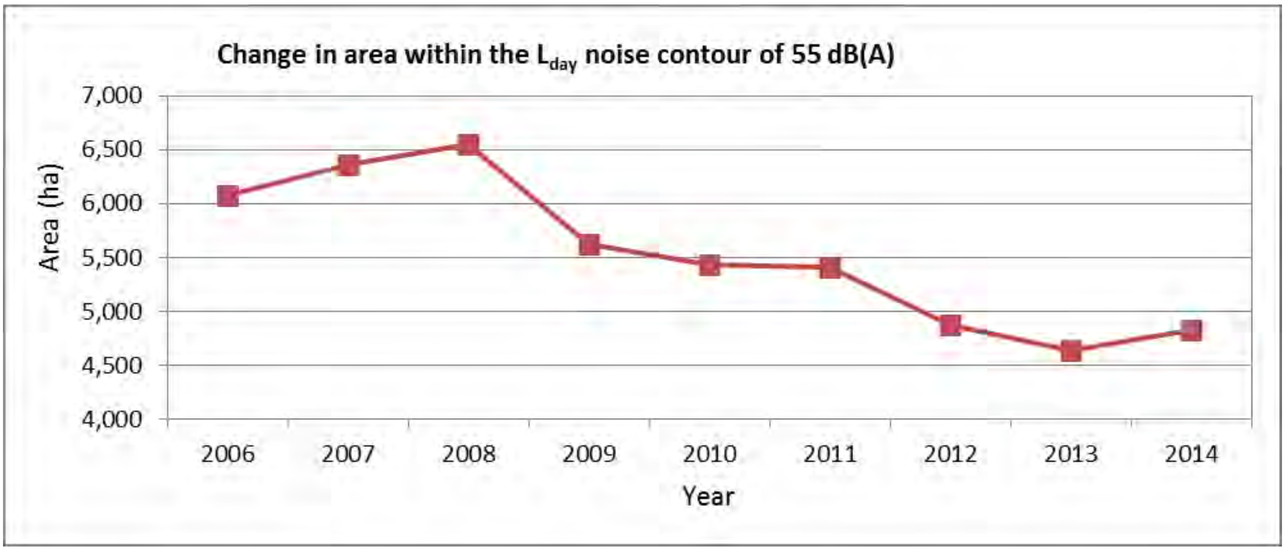


Table 28 Change in the area within the $L_{evening}$ contours (2006-2014)

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
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**

* Calculated with INM 7.0b

Figure 23 Change in the area within the $L_{evening}$ contours (2006-2014)

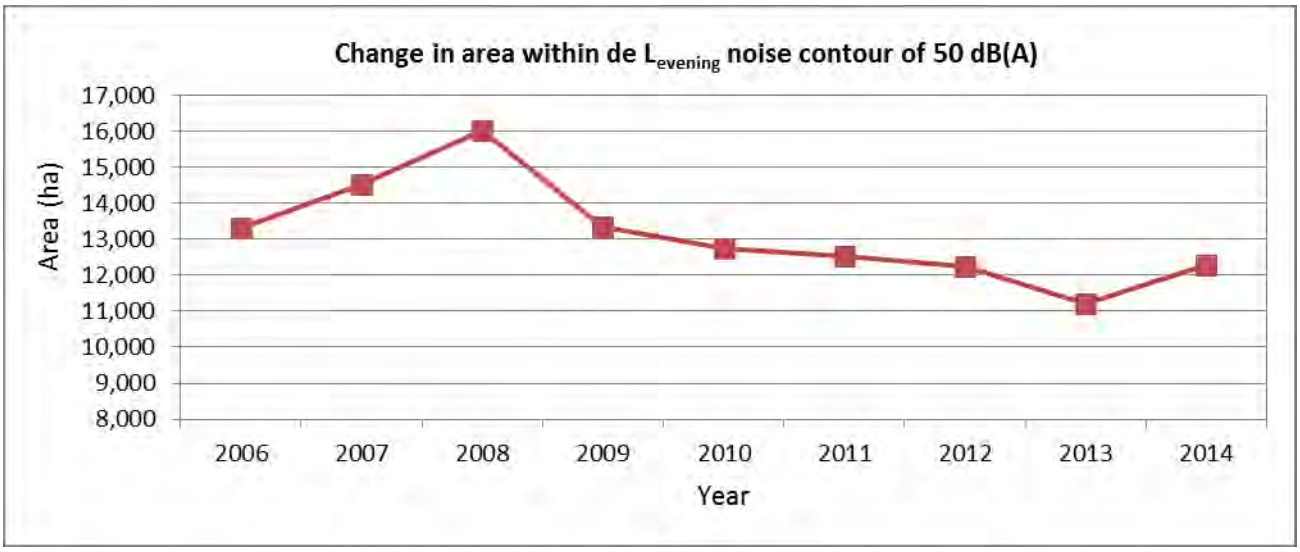


Table 29 Change in the area within the L_{night} contours (2006-2014)

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
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**

* Calculated with INM 7.0b

Figure 24 Change in the area within the L_{night} contours (2006-2014)

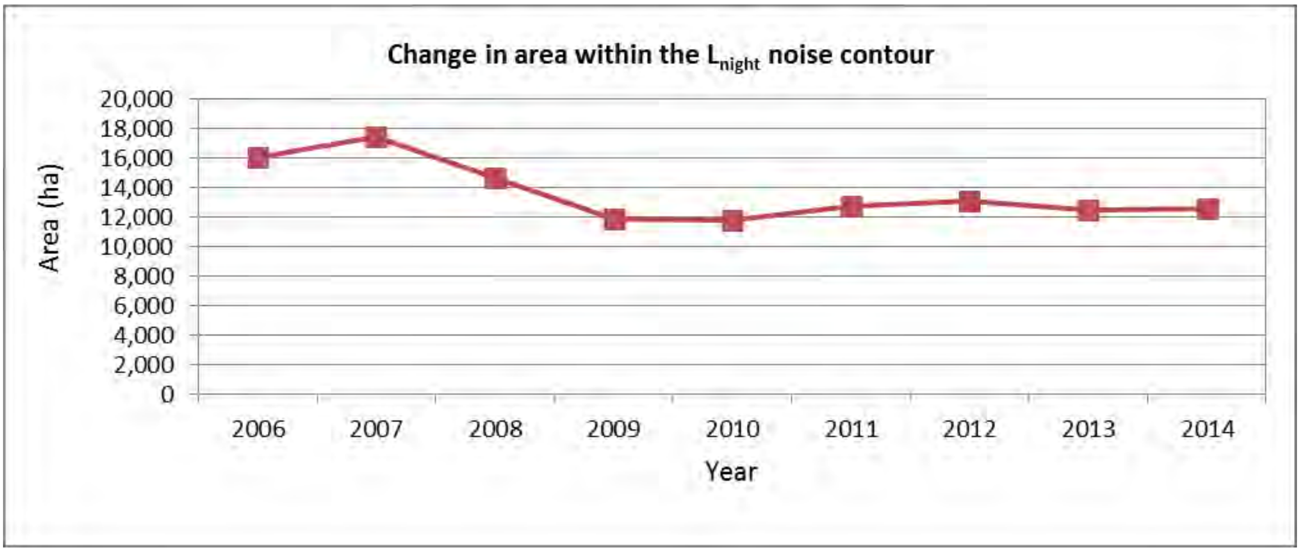


Table 30 Change in the area within the L_{den} contours (2006-2014)

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**	**Totaal**
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**

* Calculated with INM 7.0b

Figure 25 Change in the area within the L_{den} contours (2006-2014)

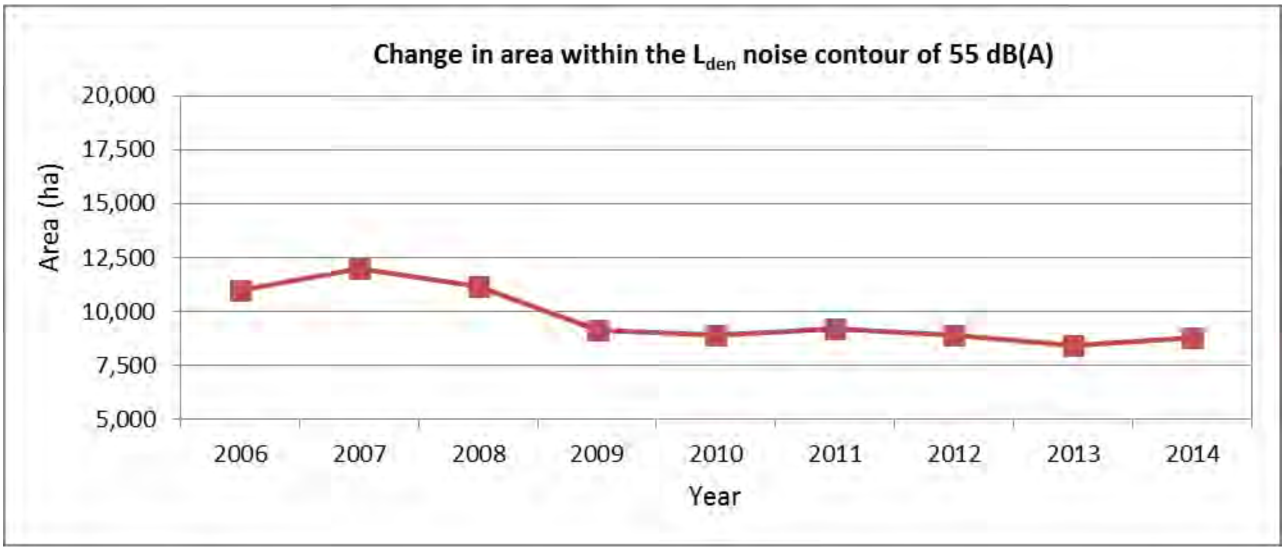


Table 31 Change in the area within the Freq.70,day contours (2010-2014)

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**

* Calculated with INM 7.0b

Figure 26 Change in the area within the Freq.70,day contours (2010-2014)

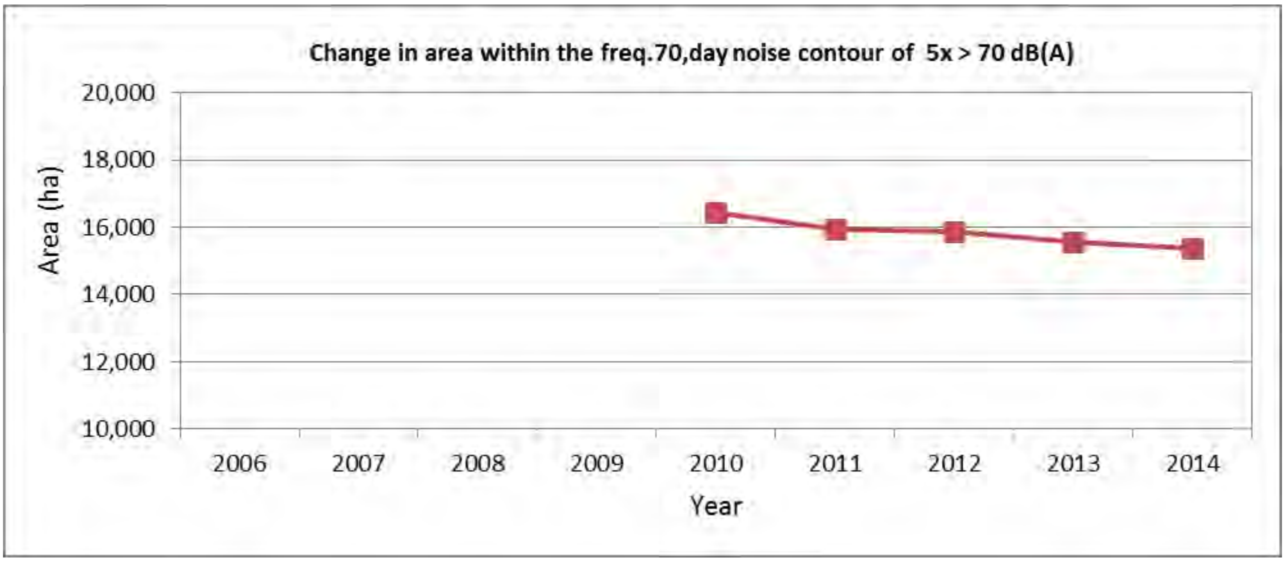


Table 32 Change in the area within the Freq.70,night contours (2010-2014)

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**

* Calculated with INM 7.0b

Figure 27 Change in the area within the Freq.70,night contours (2010-2014)

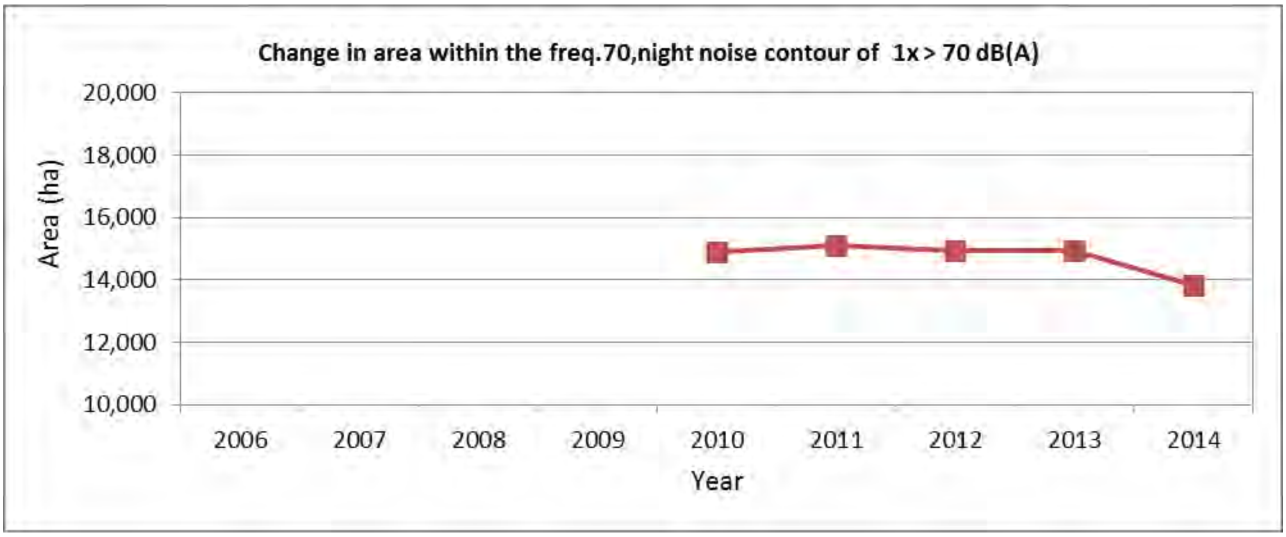


Table 33 Change in the area within the Freq.60,day contours (2010-2014)

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**

* Calculated with INM 7.0b

Figure 28 Change in the area within the Freq.60,day contours (2010-2014)

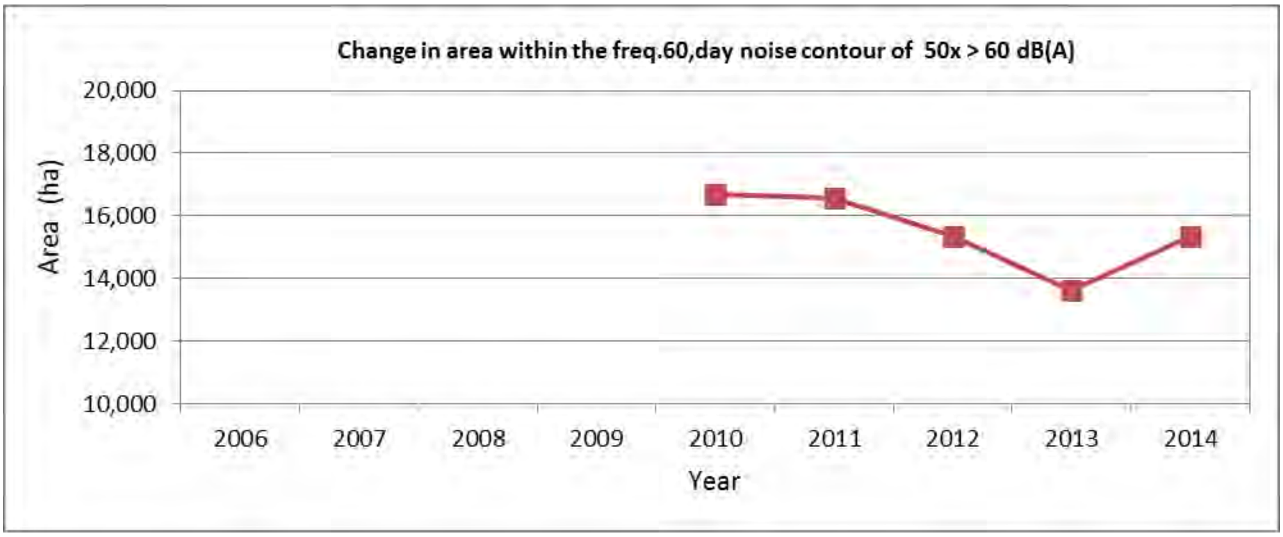
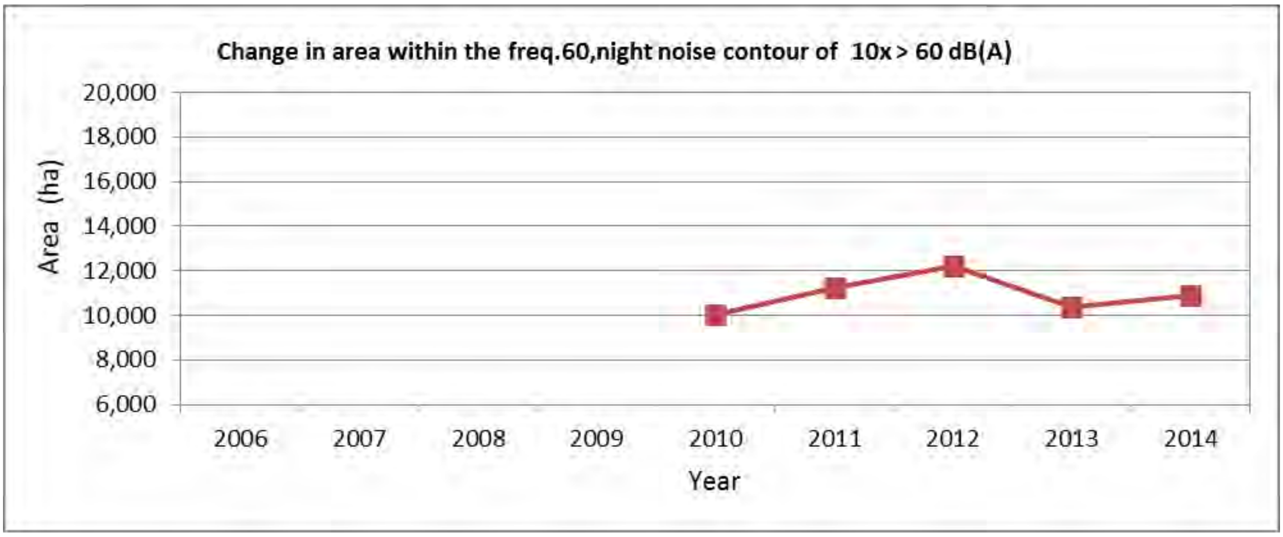


Table 34 Change in the area within the Freq.60,night contours (2010-2014)

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**

* Calculated with INM 7.0b

Figure 29 Change in the area within the Freq.60,night contours (2010-2014)



Appendix 5.2. Change in number of inhabitants per contour zone: L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day, freq.70,night, freq.60,day, freq.60,night

Table 35 Change in the number of inhabitants within the L_{day} contours (2006-2014)

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**
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	01jan10	22,998	8,649	2,249	22	2	**33,920**

* Calculated with INM 7.0b

Figure 30 Change in the number of inhabitants within the L_{day} contours (2006-2014)

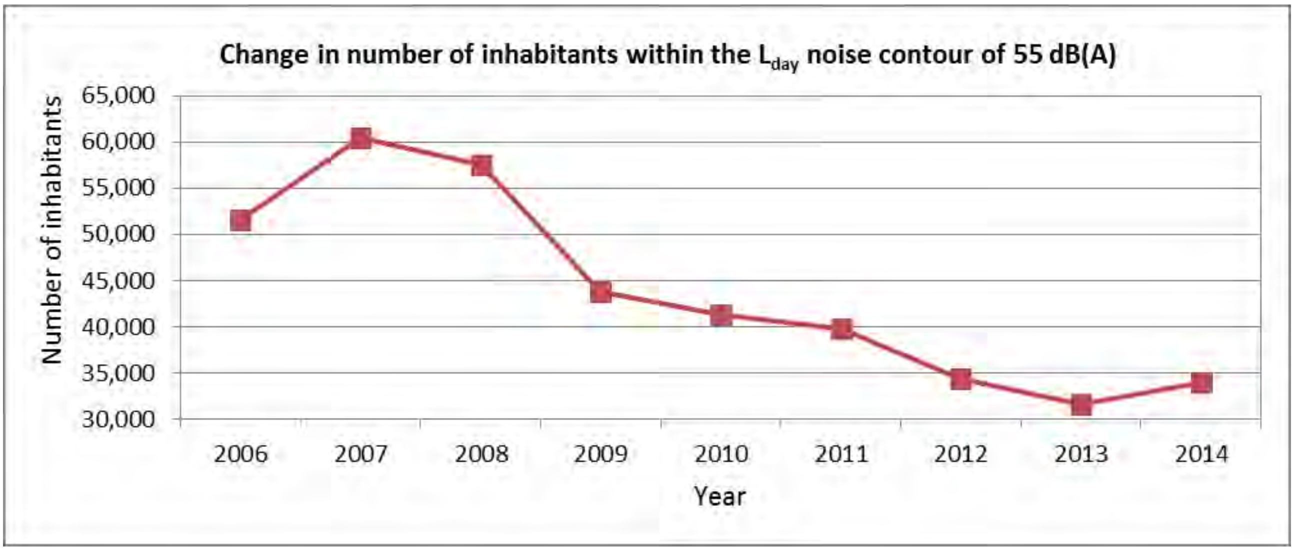


Table 36 Change in the number of inhabitants within the $L_{evening}$ contours (2006-2014)

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**
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	01jan10	187,698	23,913	9,632	2,052	29	0	**223,324**

* Calculated with INM 7.0b

Figure 31 Change in the number of inhabitants within the $L_{evening}$ contours (2006-2014)

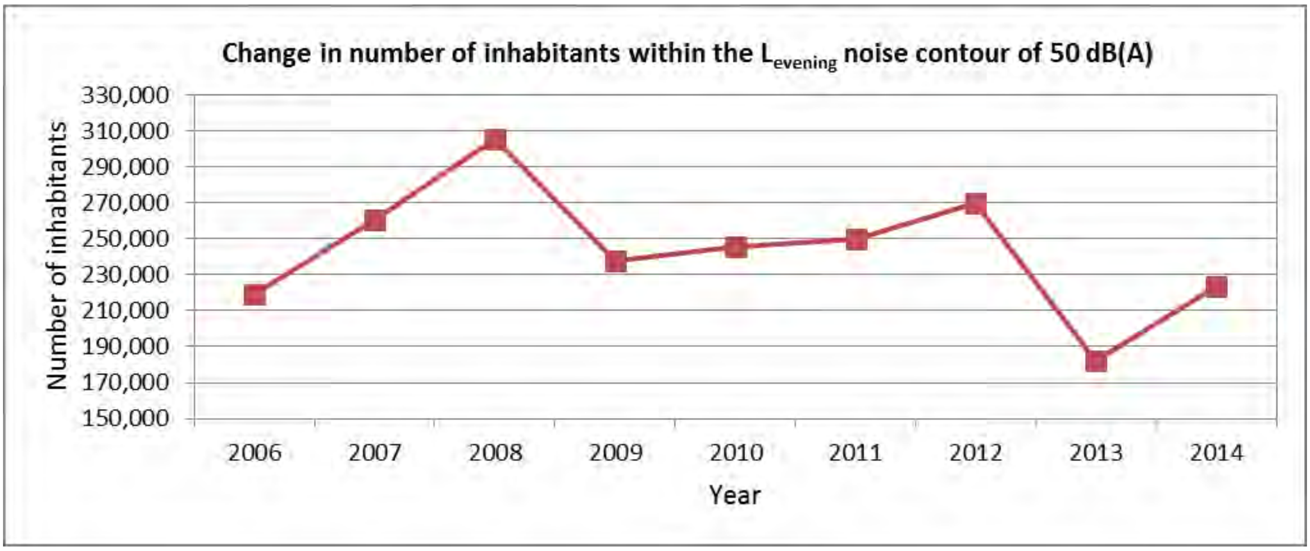


Table 37 Change in the number of inhabitants within the L_{night} contours (2006-2014)

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**
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	01jan10	163,270	24,221	7,889	869	110	3	**196,362**

* Calculated with INM 7.0b

Figure 32 Change in the number of inhabitants within the L_{night} contours (2006-2014)

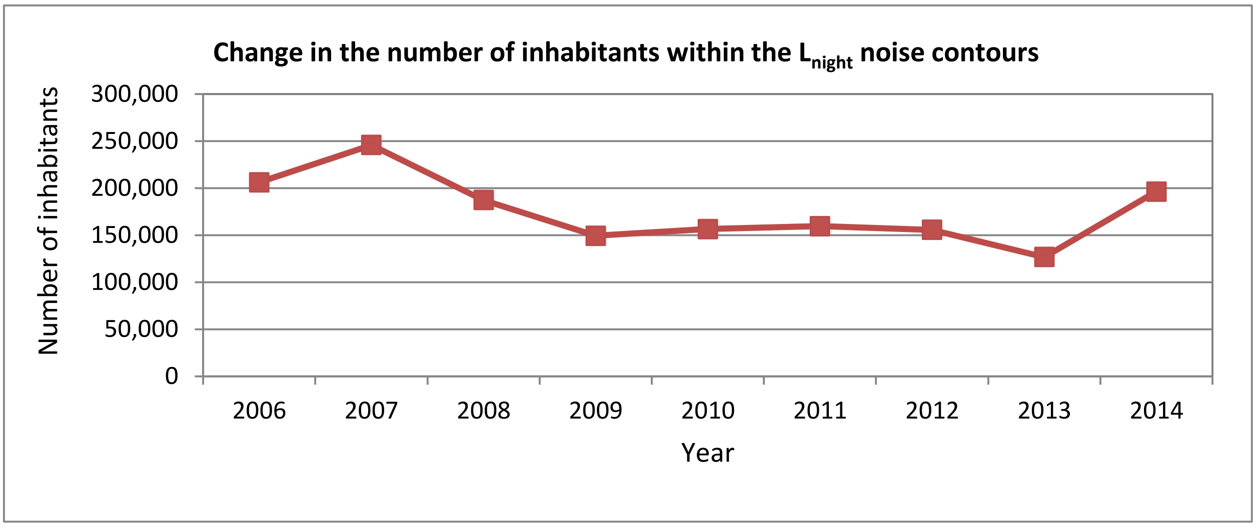


Table 38 Change in the number of inhabitants within the L_{den} contours (2006-2014)

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**	**Totaal**
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**

* Calculated with INM 7.0b

Figure 33 Change in the number of inhabitants within the L_{den} contours (2006-2014)

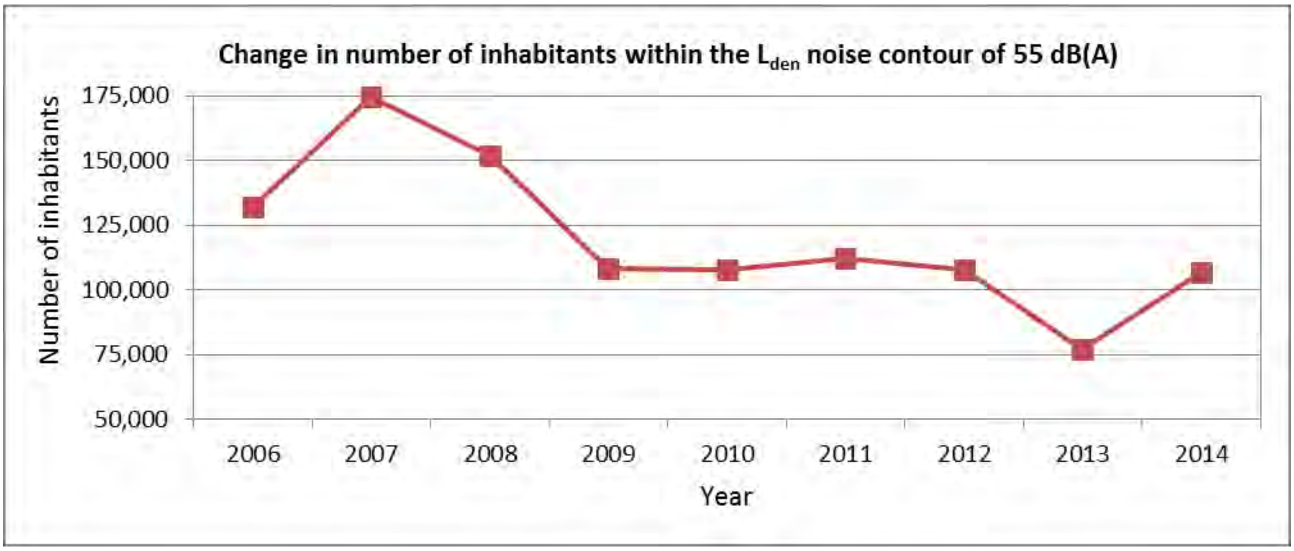


Table 39 Change in the number of inhabitants within the Freq.70,day contours (2010-2014)

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	01jan10	226,319	139,618	47,774	10,655	10,379	**434,746**

* Calculated with INM 7.0b

Figure 34 Change in the number of inhabitants within the Freq.70,day contours (2010-2014)

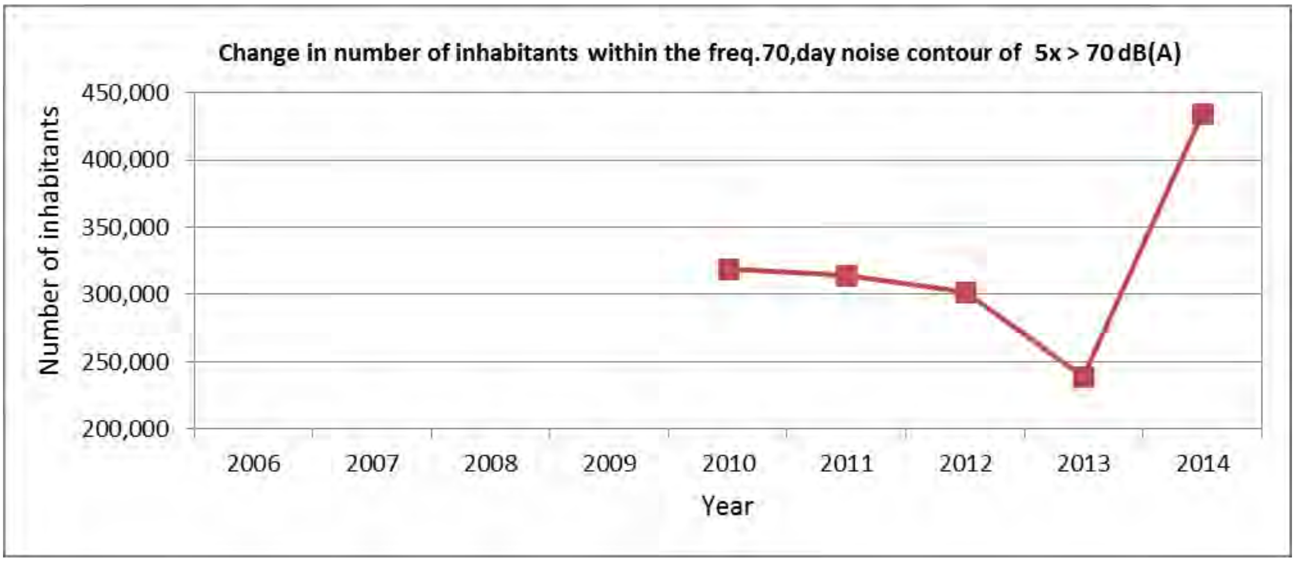


Table 40 Change in the number of inhabitants within the Freq.70,night contours (2010-2014)

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	01jan10	240,106	19,794	13,018	6,333	0	**279,251**

* Calculated with INM 7.0b

Figure 35 Change in the number of inhabitants within the Freq.70,night contours (2010-2014)

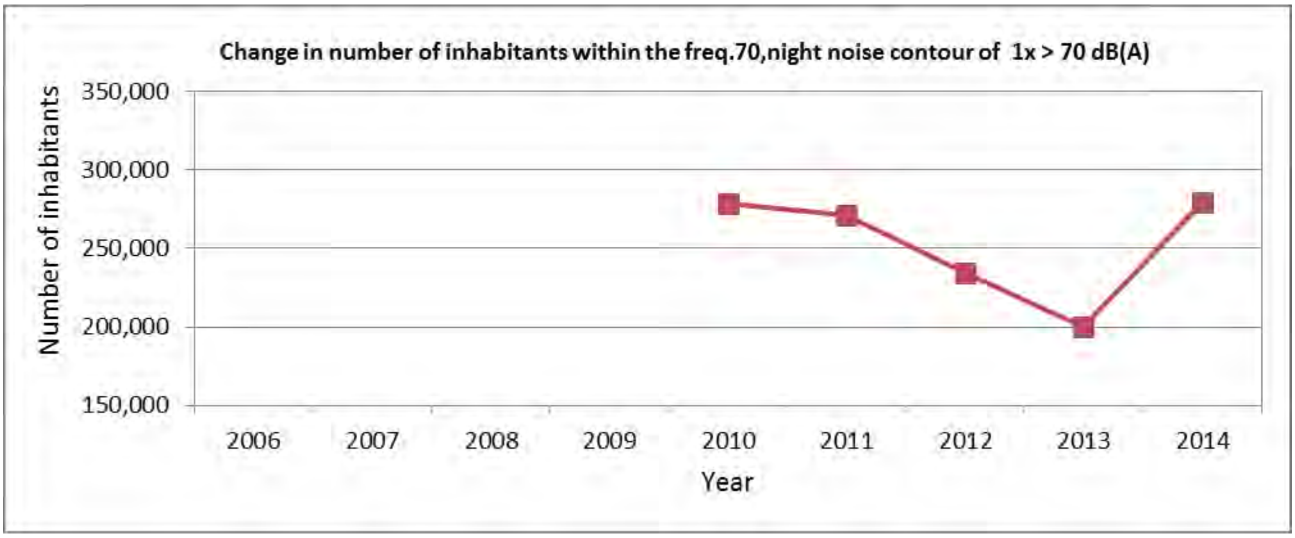


Table 41 Change in the number of inhabitants within the Freq.60,day contours (2010-2014)

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	01jan10	273,603	22,036	10,282	17,121	**323,042**

* Calculated with INM 7.0b

Figure 36 Change in the number of inhabitants within the Freq.60,day contours (2010-2014)

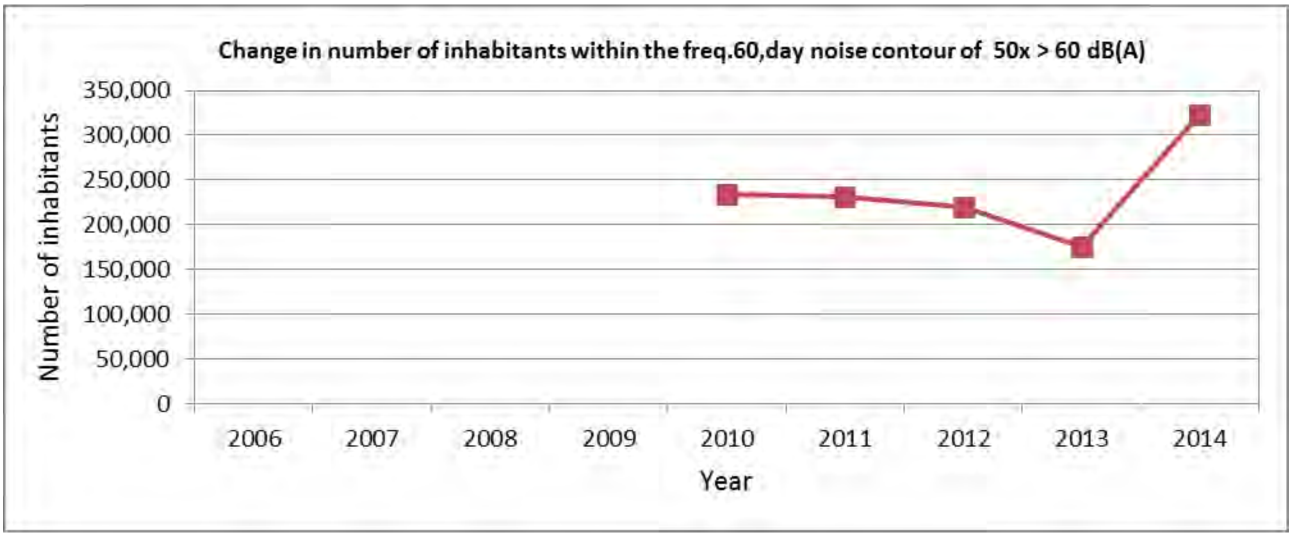
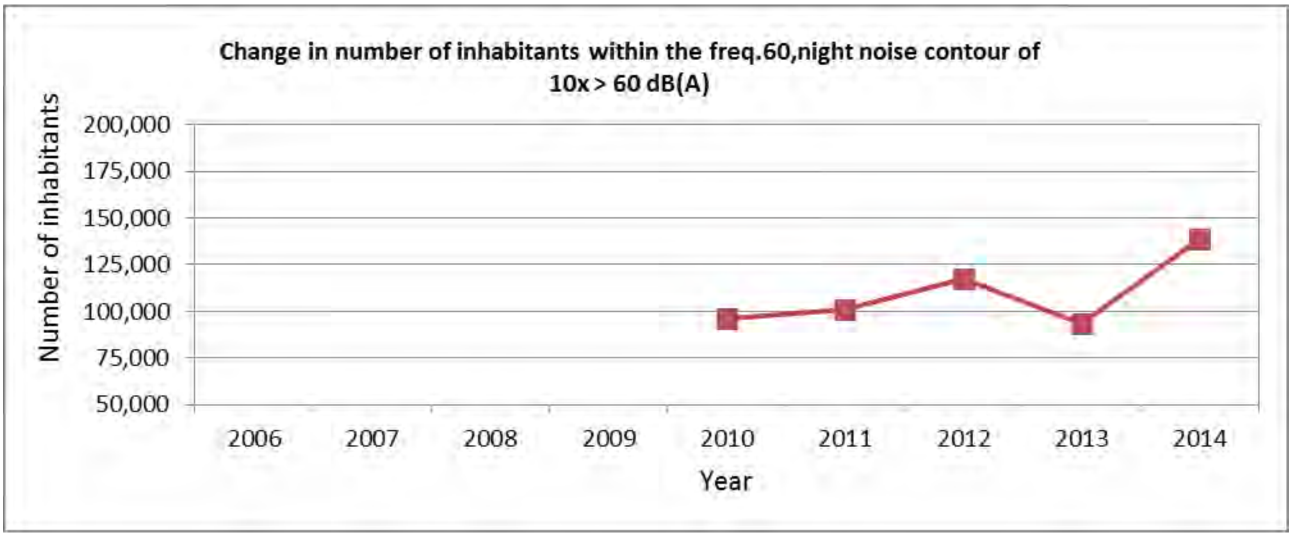


Table 42 Change in the number of inhabitants within the Freq.60,night contours (2010-2014)

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	01jan10	79,725	27,741	18,637	12,317	**138,420**

* Calculated with INM 7.0b

Figure 37 Change in the number of inhabitants within the Freq.60,night contours (2010-2014)



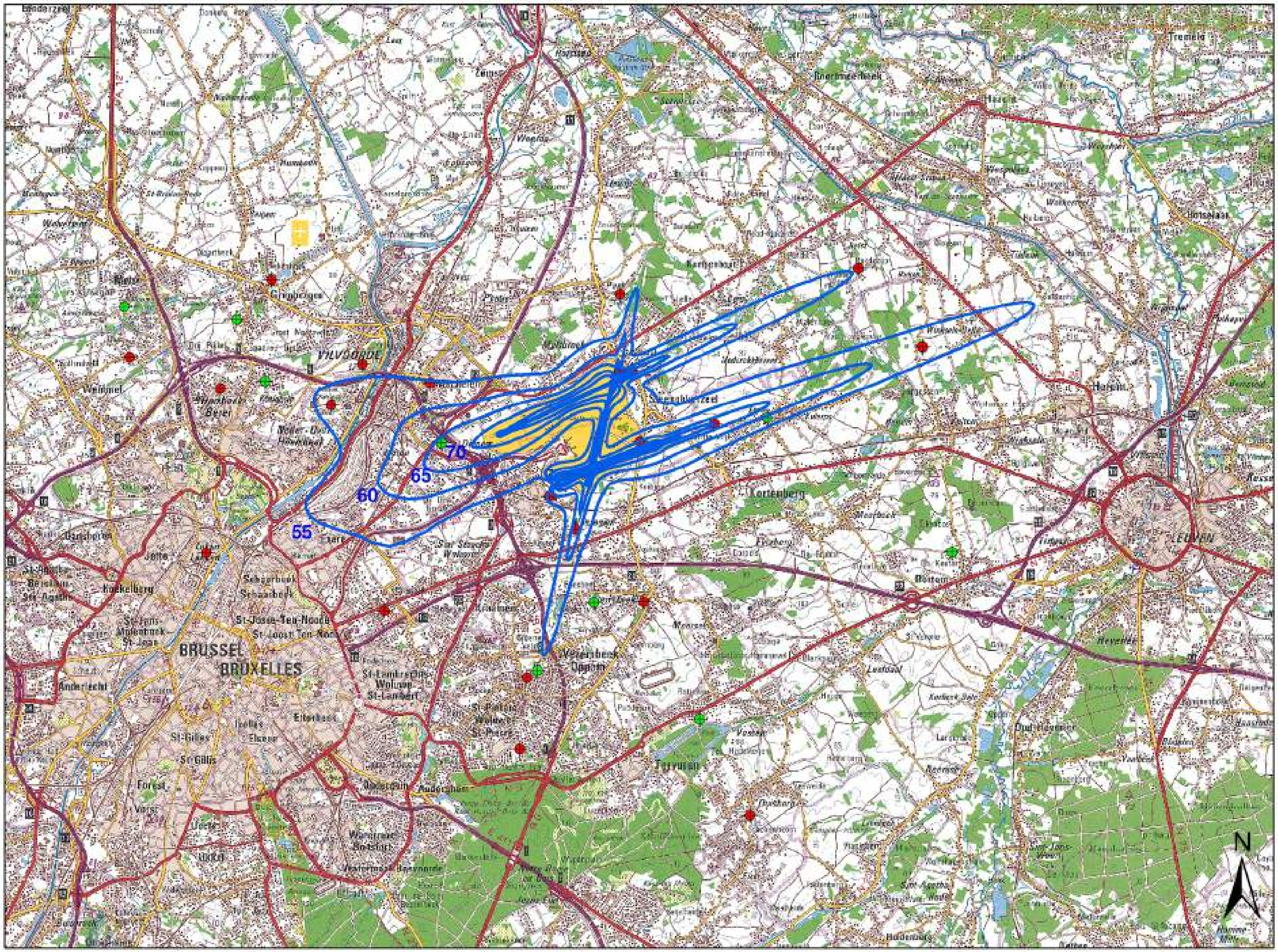
Appendix 6. Noise contours for the year 2014 on a topographical map

- L_{day} noise contours for 2014, background topographical map
- $L_{evening}$ – noise contours for 2014, background topographical map
- L_{night} noise contours for 2014, background topographical map
- L_{den} noise contours for 2014, background topographical map
- Freq.70,day – noise contours for 2014, background topographical map
- Freq.70,night – noise contours for 2014, background topographical map
- Freq.60,day – noise contours for 2014, background topographical map
- Freq.60,night – noise contours for 2014, background topographical map

L_{day} noise contours for 2014

day 07.00 - 19.00

Noise contours
around Brussels Airport
on a
topographic map



Legend

L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,000 4,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

KU Leuven
LABORATORIUM VOOR AKOESTIEK
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B-3001 Leuven (Heverlee)

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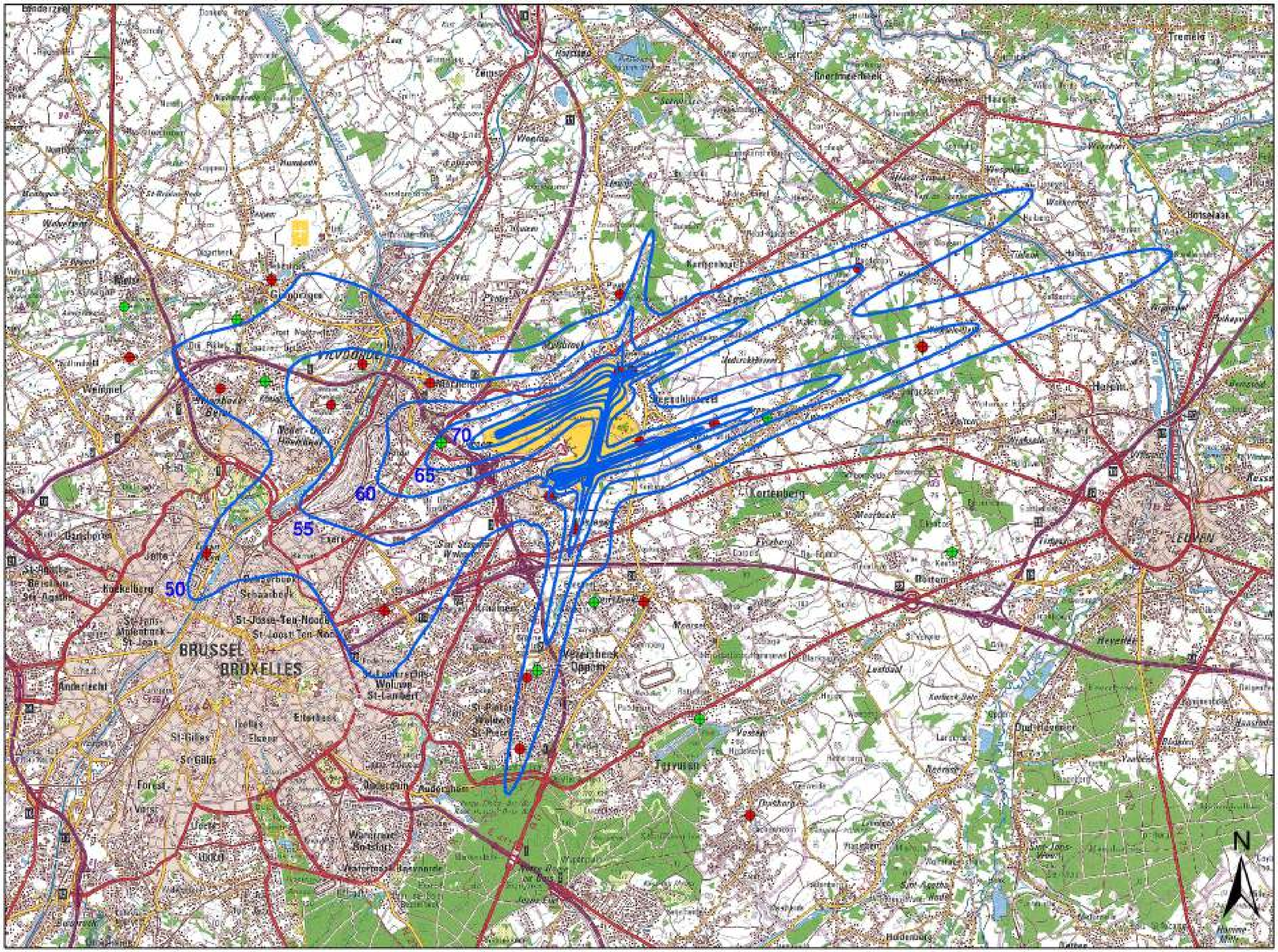
$L_{evening}$ noise contours for 2014

evening 19.00 - 23.00

Noise contours around Brussels Airport on a topographic map



Legend

$L_{evening}$ noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,000 4,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

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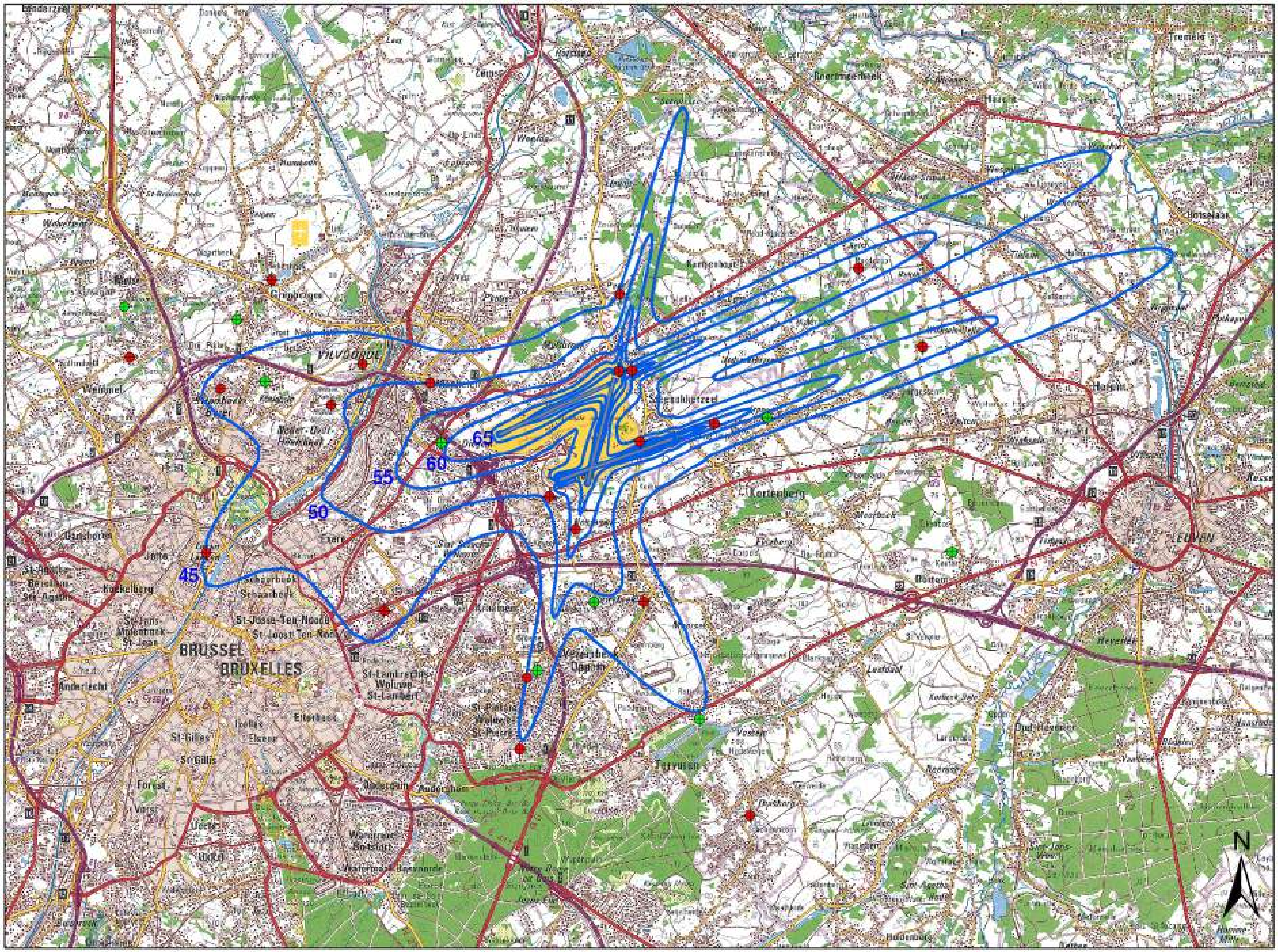
L_{night} noise contours for 2014

night 23.00 - 07.00

Noise contours around Brussels Airport on a topographic map



Legend

L_{night} noise contours of 45, 50, 55, 60, 65 and70 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,000 4,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

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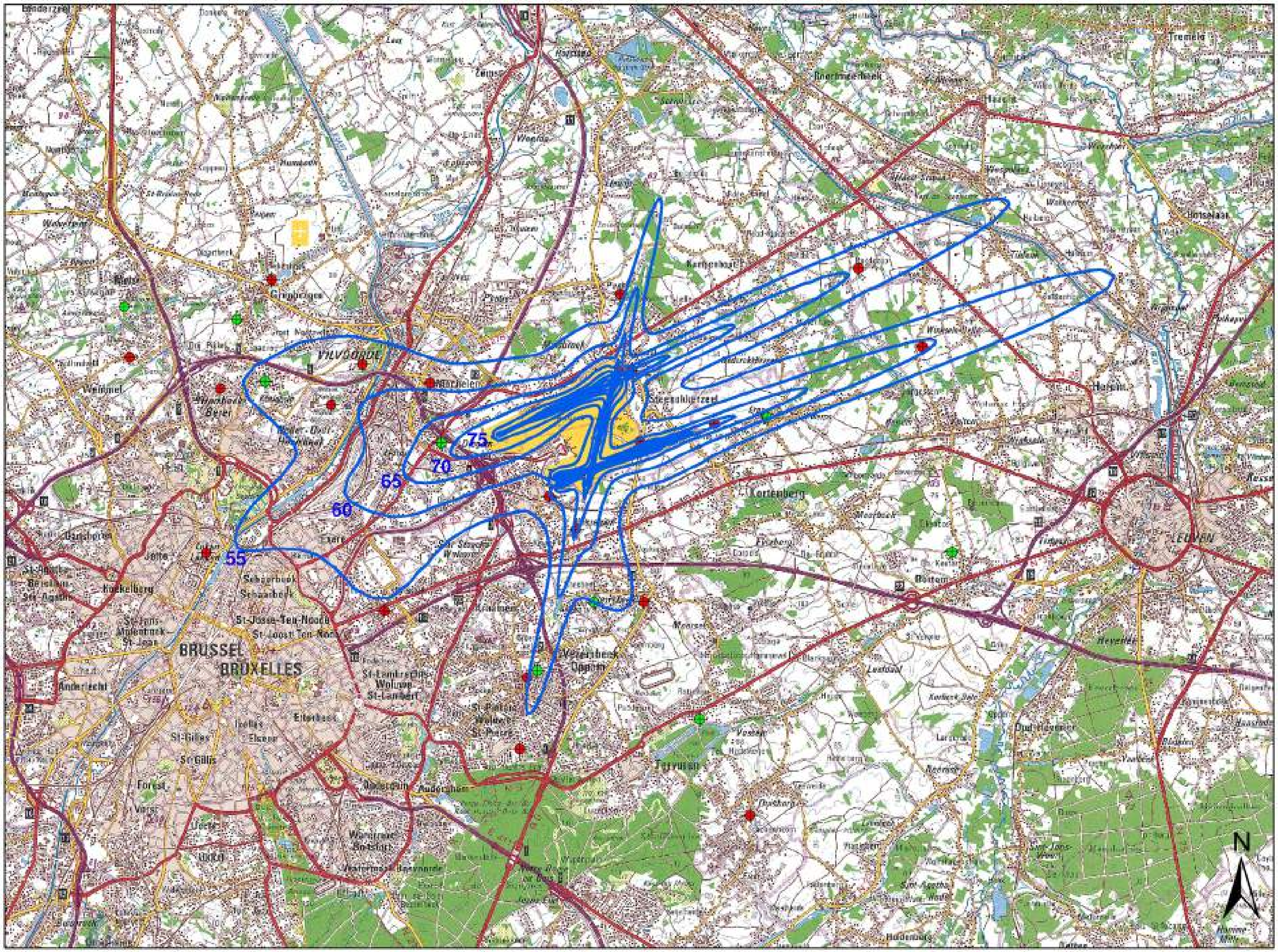
L_{den} noise contours for 2014

day 07.00 - 19.00 - evening 19.00 - 23.00 - night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
topographic map



Legend

L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,000 4,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

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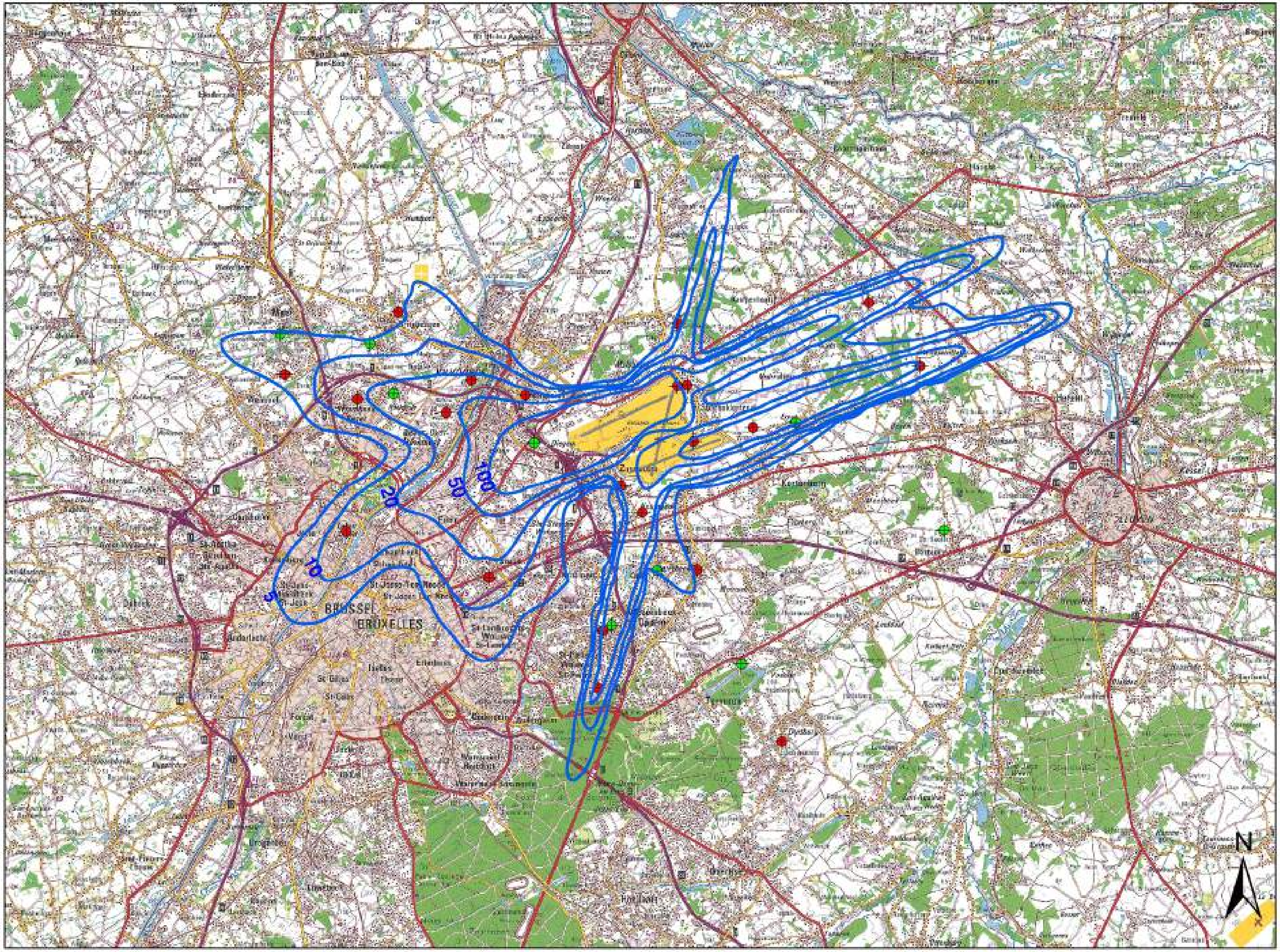
Freq.70,day noise contours for 2014

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
topographic map



Legend

Freq.70,day noise contours of 5x, 10x, 20x, 50x en 100x for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,500 5,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

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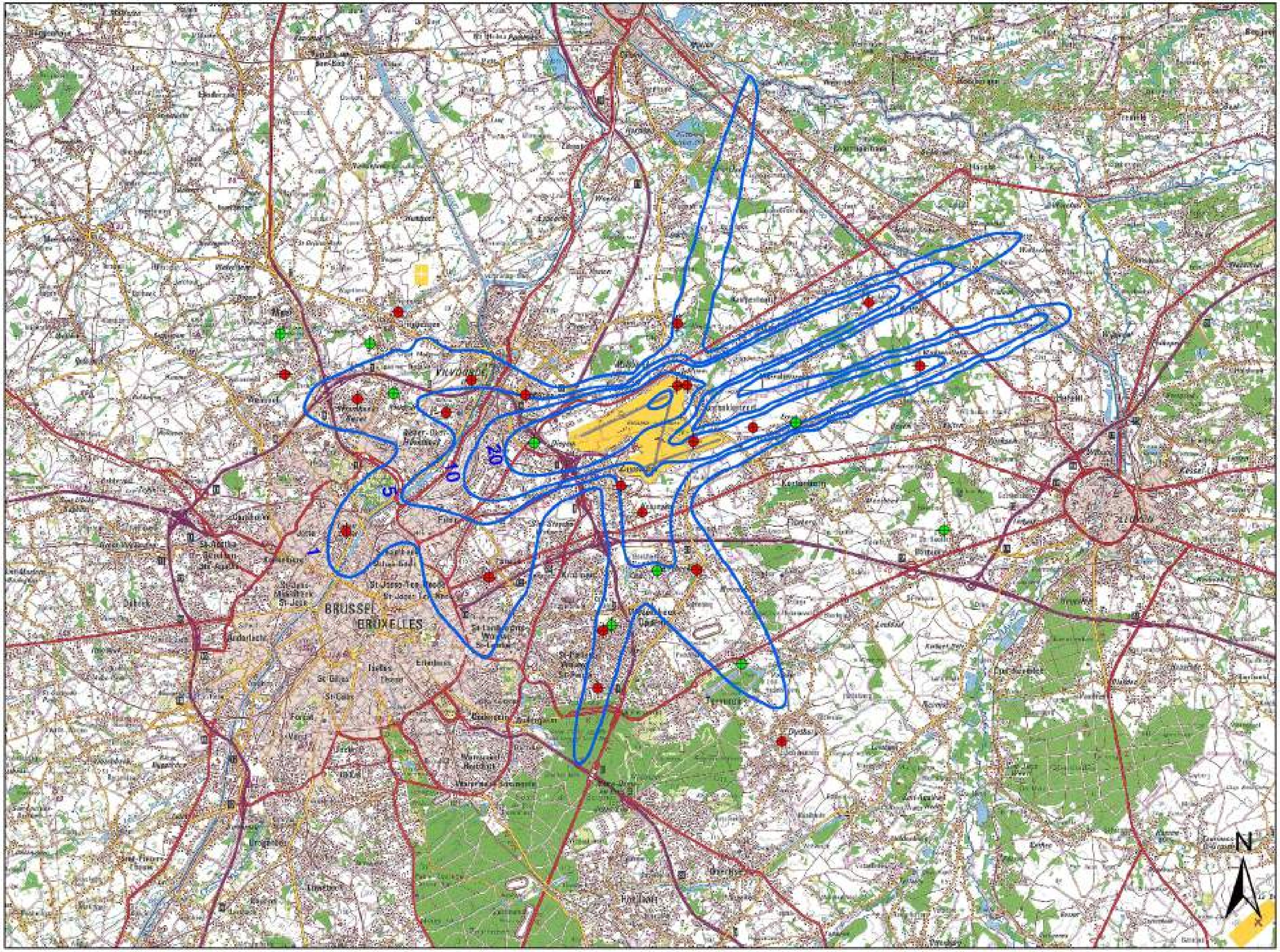
Freq.70, night noise contours for 2014

naight 23.00 - 07.00

Noise contours around Brussels Airport on a topographic map



Legend

Freq.70,night noise contours of 1x, 5x, 10x, 20x en 50x for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,500 5,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

KU Leuven
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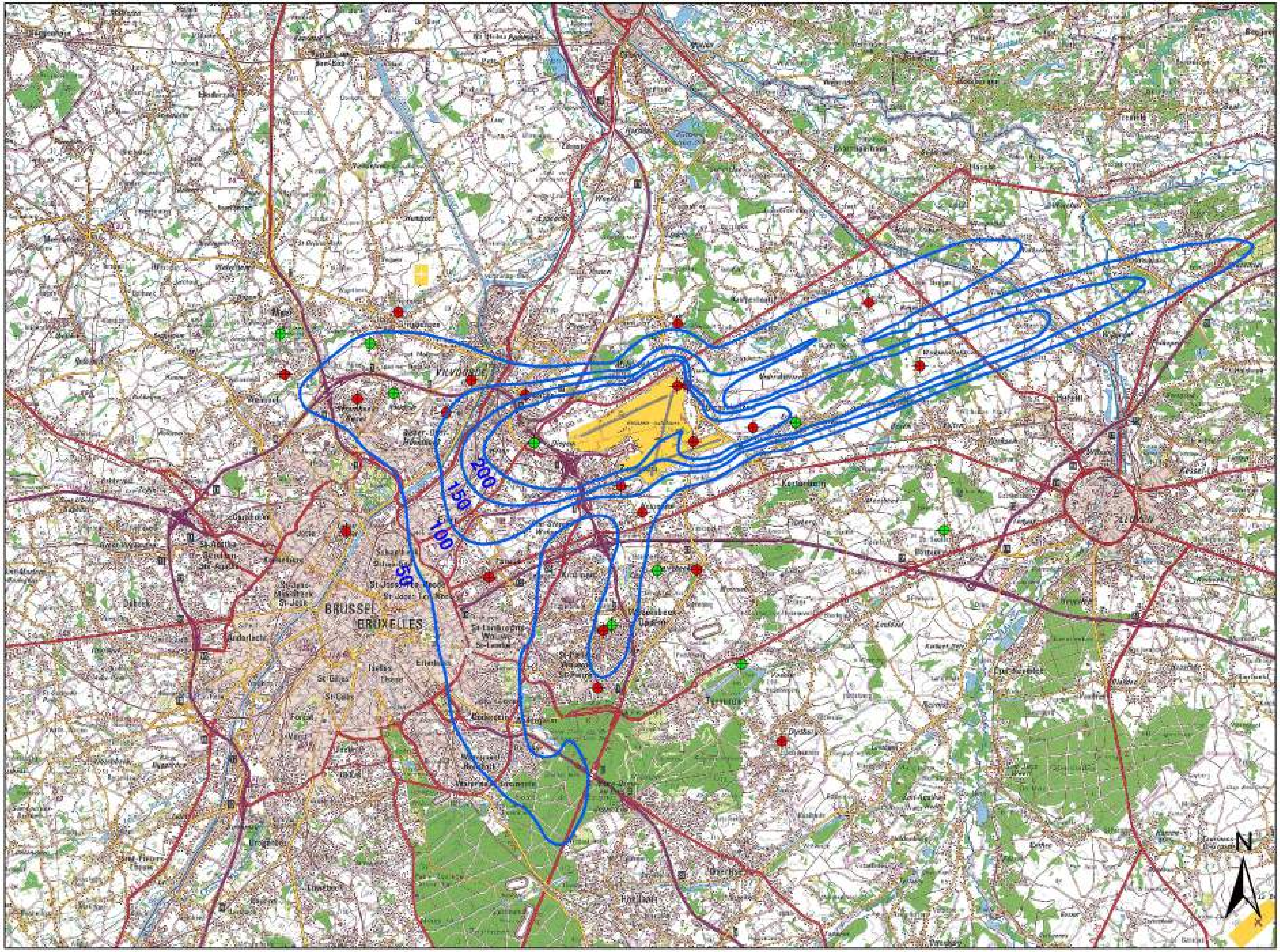
Freq.60,day noise contours for 2014

day 07.00 - 23.00

Noise contours around Brussels Airport on a topographic map



Legend

Freq.60,day noise contours of 50x, 100x, 150x en 200x for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,500 5,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

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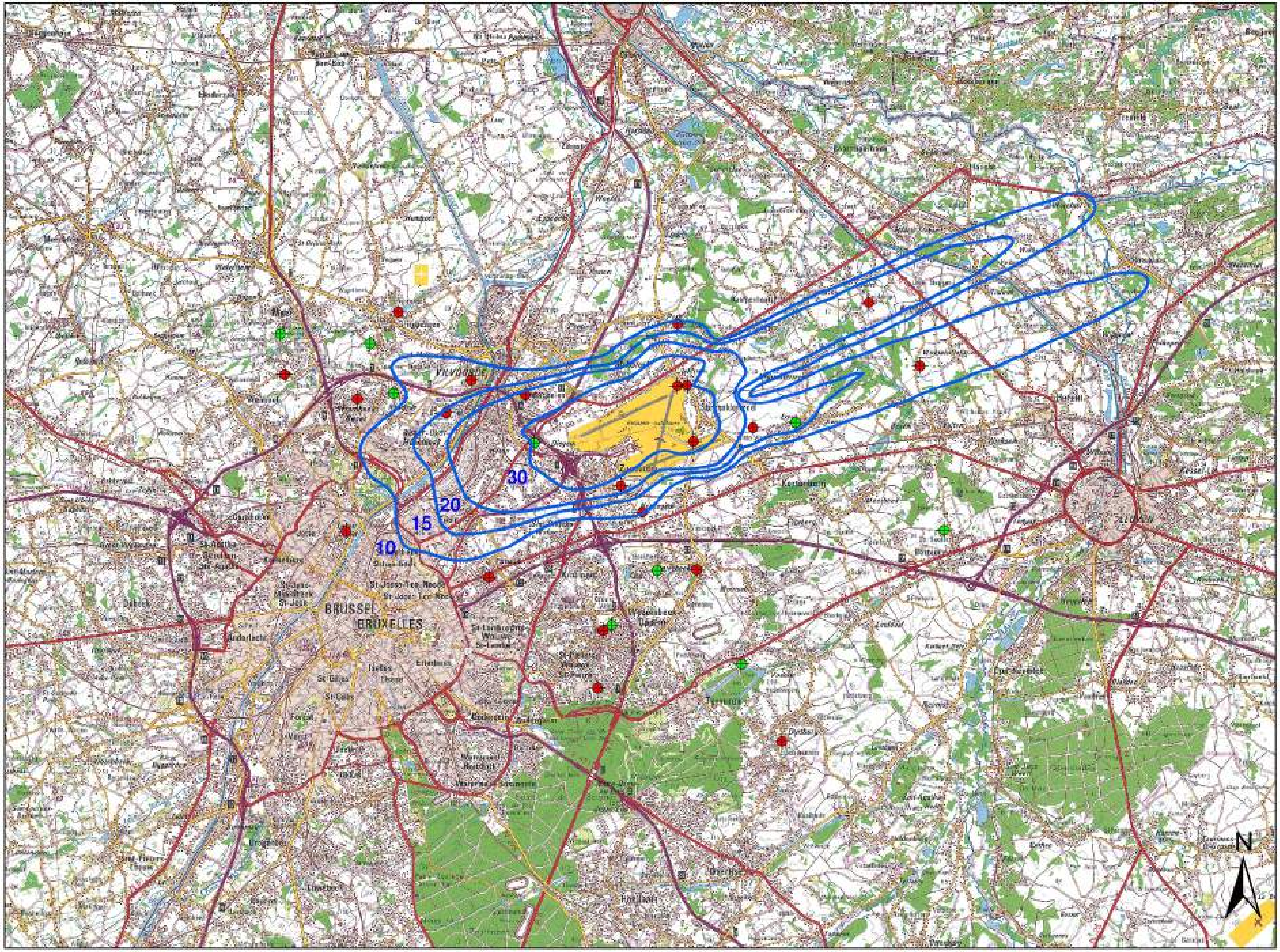
Freq.60,night noise contours for 2014

night 23.00 - 07.00

Noise contours around Brussels Airport on a topographic map



Legend

Freq.60,night noise contours of 10x, 15x, 20x en 30x for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,500 5,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 : 100.000 (OC GIS-Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

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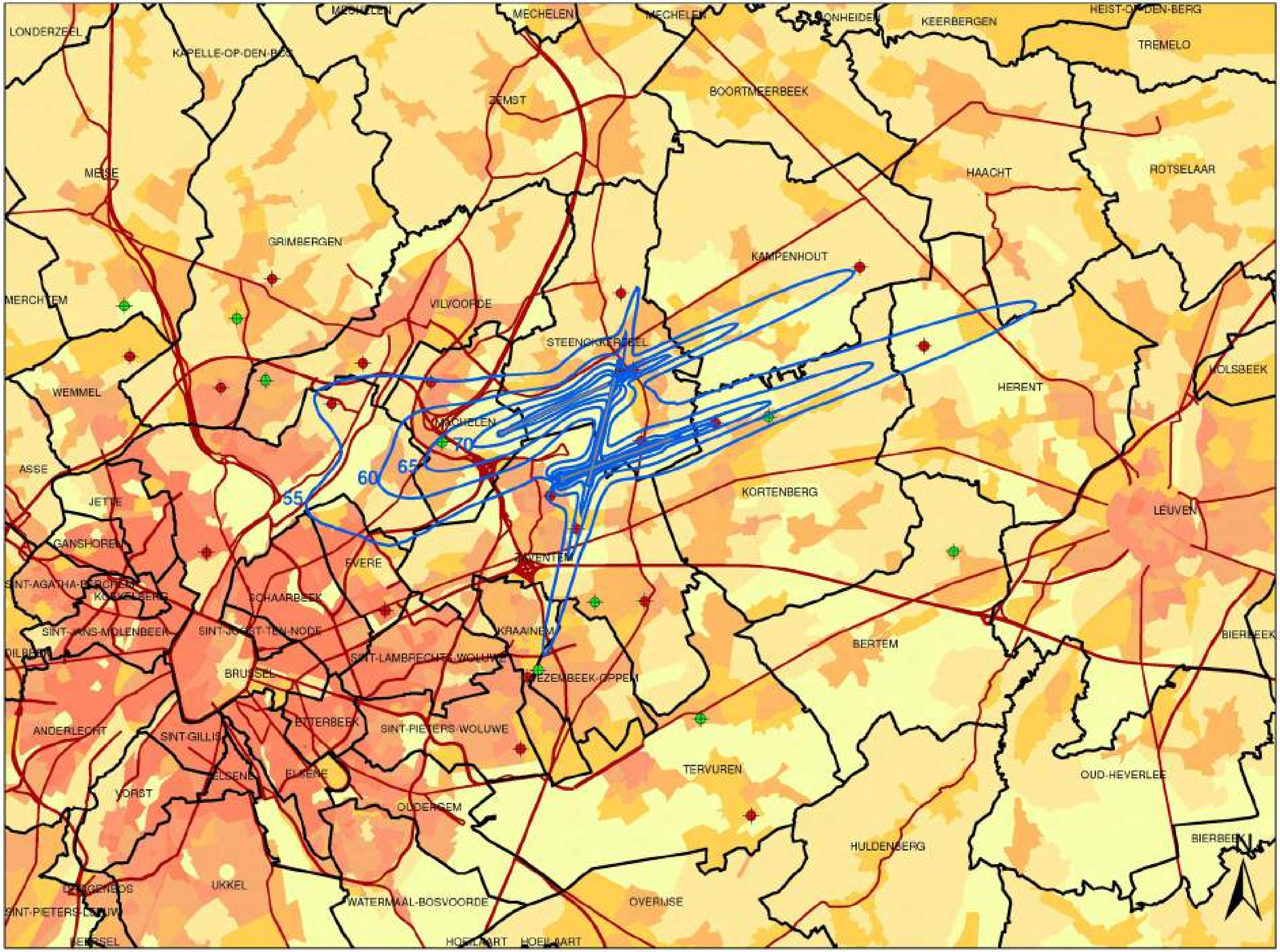
Appendix 7. Noise contours for the year 2014 on a population map

- L_{day} noise contours for 2014, background population map 2010
- $L_{evening}$ noise contours for 2014, background population map 2010
- L_{night} noise contours for 2014, background population map 2010
- $L_{den\ noise}$ contours for 2014, background population map 2010
- Freq.70,day noise contours for 2014, background population map 2010
- Freq.70,night noise contours for 2014, background population map 2010
- Freq.60,day noise contours for 2014, background population map 2010
- Freq.60,night noise contours for 2014, background population map 2010

L_{day} noise contours for 2014

day 07.00 - 19.00

Noise contours
around Brussels Airport
on a
population map



Legend

L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning
(OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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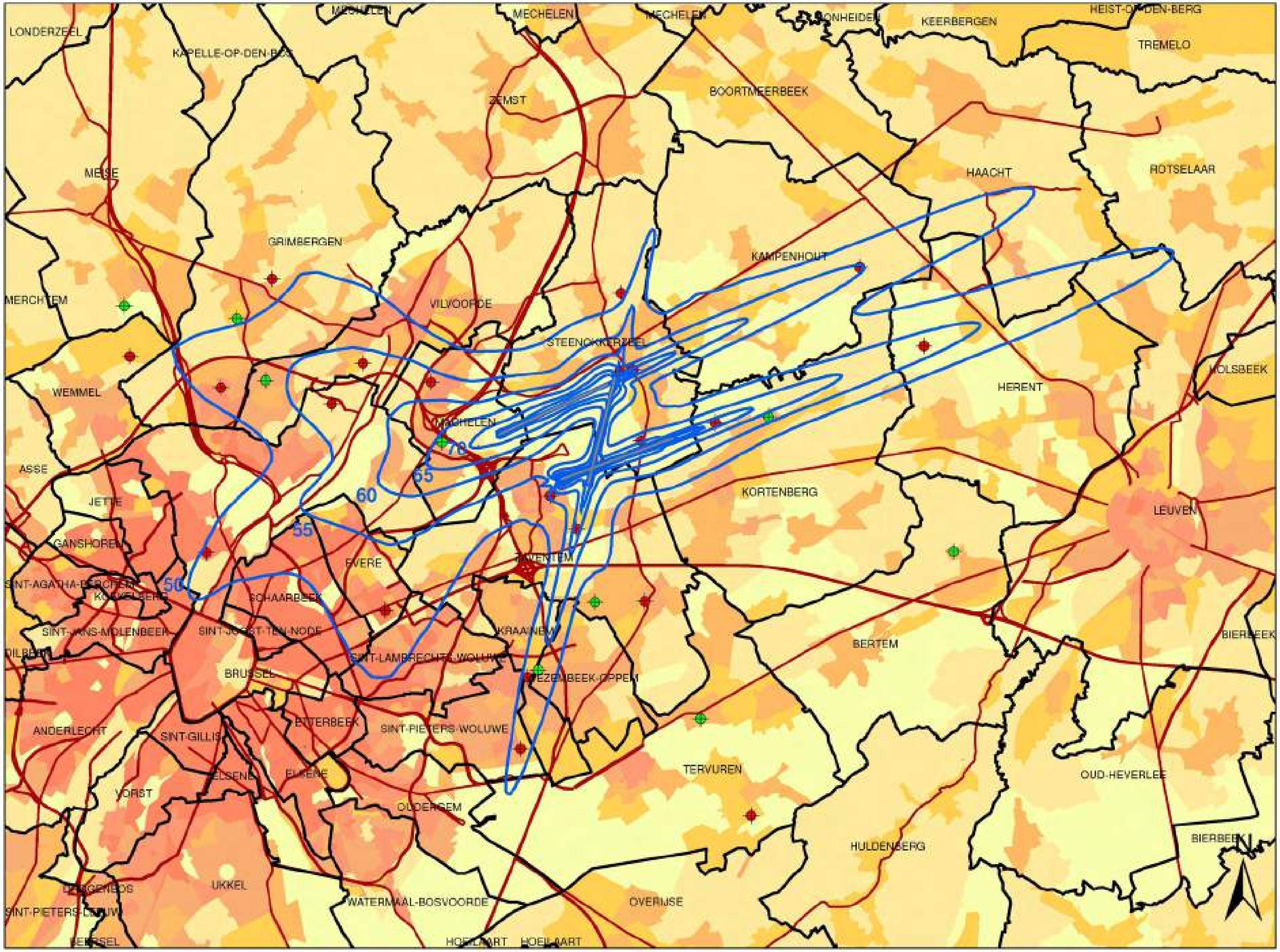
$L_{evening}$ noise contours for 2014

evening 19.00 - 23.00

Noise contours around Brussels Airport on a population map



Legend

$L_{evening}$ noise contours of 50, 55, 60, 65, 70 and 75 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data : National Institute of Statistics (2010)

Statistical sector : AHROM - afdeling ruimtelijke planning (OC - GIS Vlaanderen)

Noise contours : Calculated by ATF with the calculation model INM 7.0b

Street maps : Streetmap - Teleatlas

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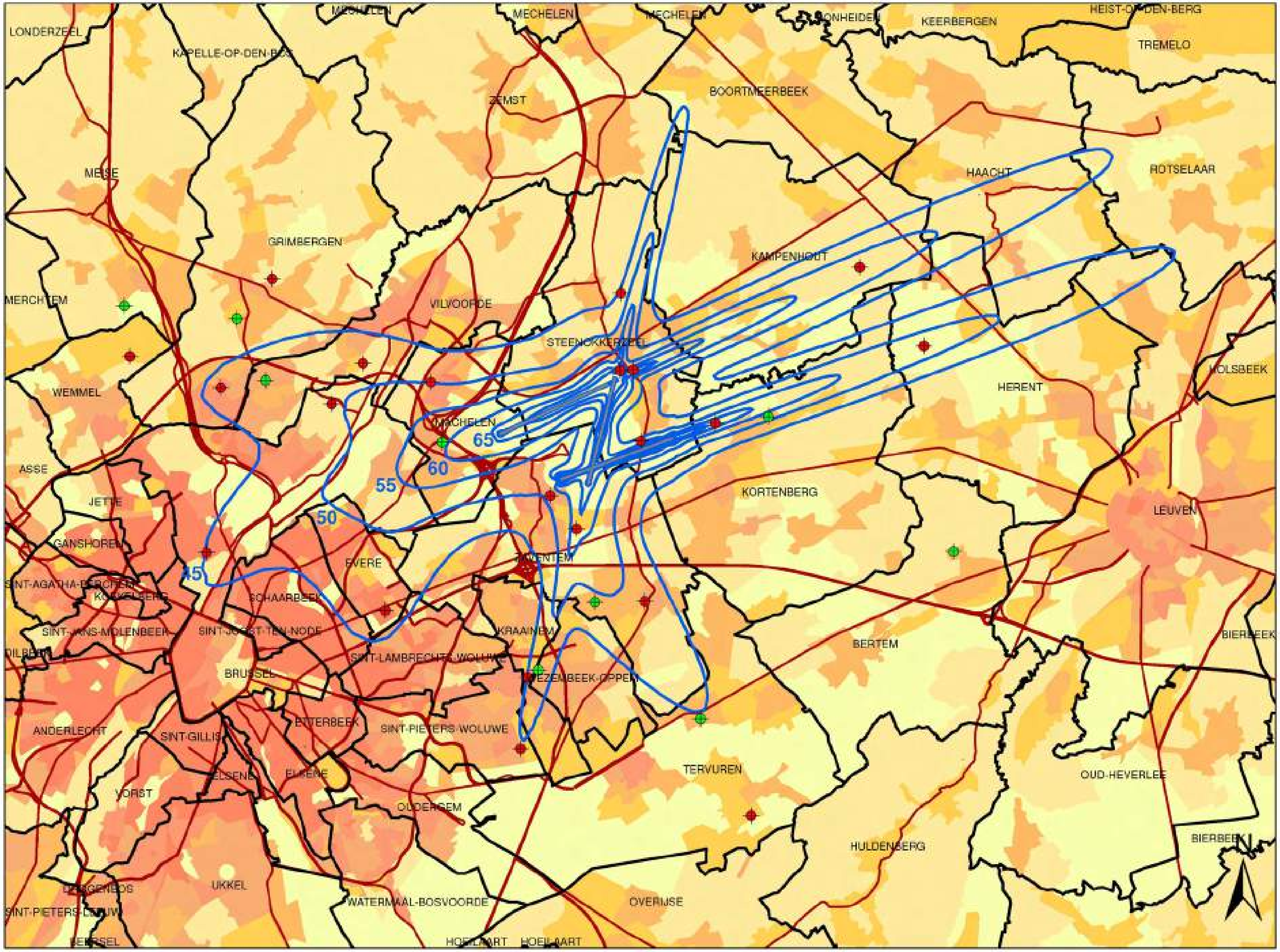
L_{night} noise contours for 2014

night 23.00 - 07.00

Noise contours around Brussels Airport on a population map



Legend

L_{night} noise contours of 45, 50, 55, 60, 65, 70 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data :
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Street maps :
Streetmap - Teleatlas

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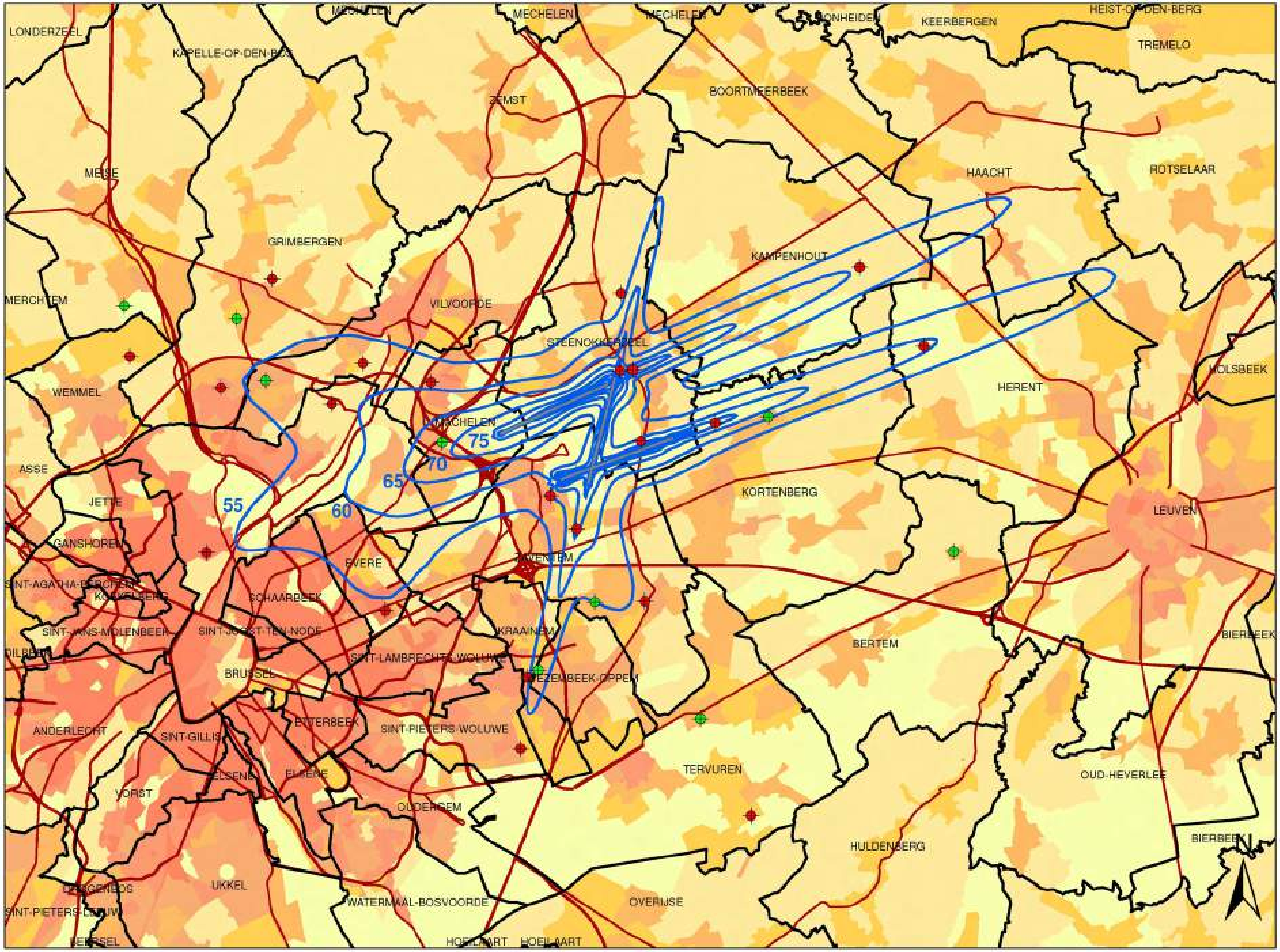
L_{den} noise contours for 2014

day 07.00 - 19.00 - evening 19.00 - 23.00 - night 23.00 - 07.00

Noise contours around Brussels Airport on a population map



Legend

L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

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Freq.70,day noise contours for 2014

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
population map

Legend

Freq.70,day noise contours of 5x, 10x, 20x, 50x, and 100x for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,500 5,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
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Noise contours :
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Freq.70,night noise contours for 2014

night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
population map

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
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Noise contours :
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Street maps :
Streetmap - Teleatlas

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Freq.60,day noise contours for 2014

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
population map

Legend

Freq.60,day noise contours of 50x, 100x,150x and 200x for 2014

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,500 5,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning (OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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Freq.60,night noise contours for 2014

night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
population map

Legend

Freq.60,night noise contours of 10x, 15x, 20x and 30x for 2014

Meetposten

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,500 5,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
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(OC - GIS Vlaanderen)

Noise contours :
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the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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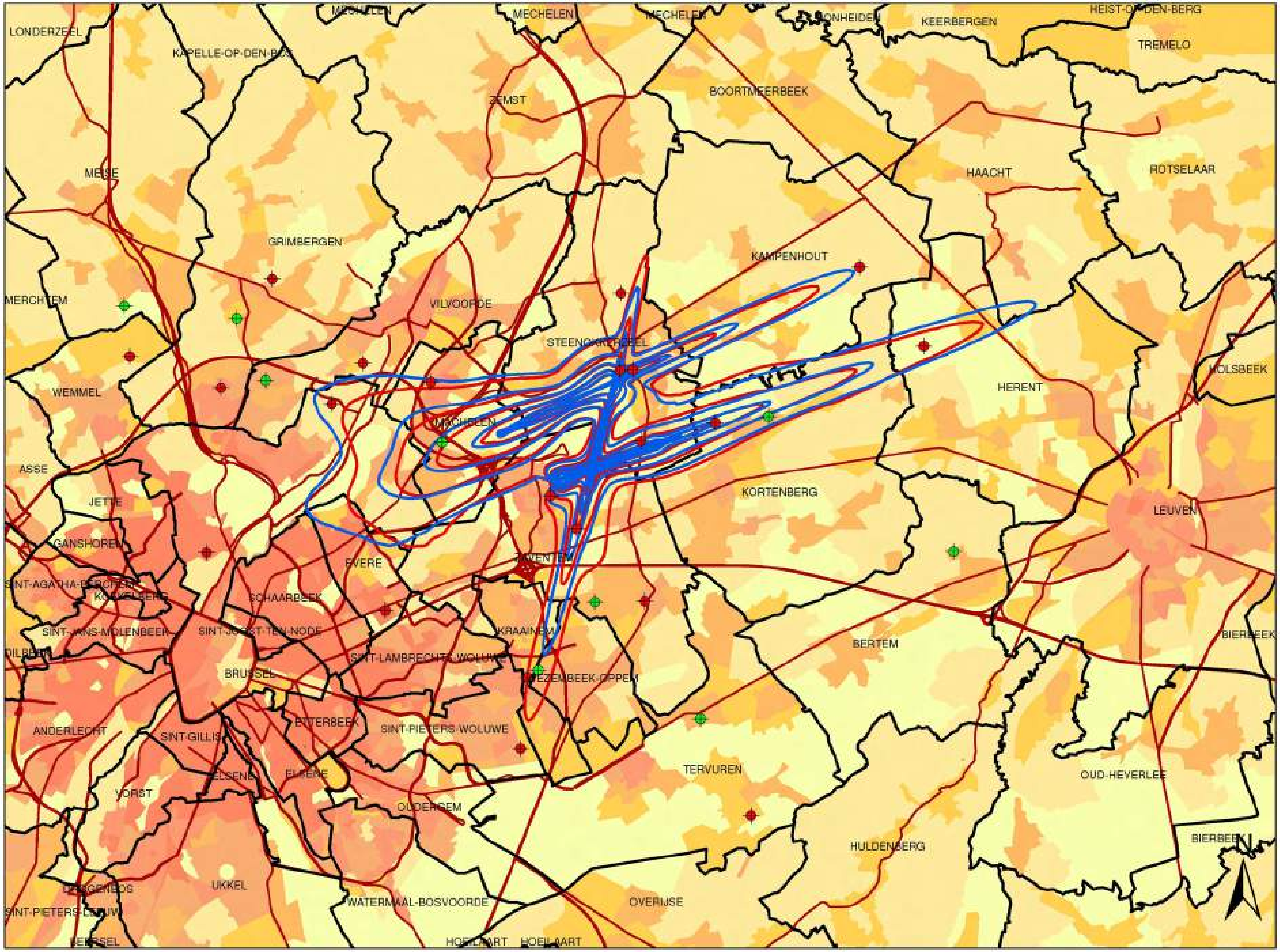
Appendix 8. Noise contour maps: change 2013-2014

- L_{day} noise contours for 2013 and 2014, background population map 2010
- L_{night} noise contours for 2013 and 2014, background population map 2010
- $L_{evening}$ noise contours for 2013 and 2014, background population map 2010
- L_{den} noise contours for 2013 and 2014, background population map 2010
- Freq.70,day noise contours for 2013 and 2014, background population map 2010
- Freq.70,night noise contours for 2013 and 2014, background population map 2010
- Freq.60,day noise contours for 2013 and 2014, background population map 2010
- Freq.60,night noise contours for 2013 and 2014, background population map 2010

Evolution of the L_{day} noise contours for 2013 and 2014

day 07.00 - 19.00

Noise contours
around Brussels Airport
on a
population map



Legend

L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014

L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning
(OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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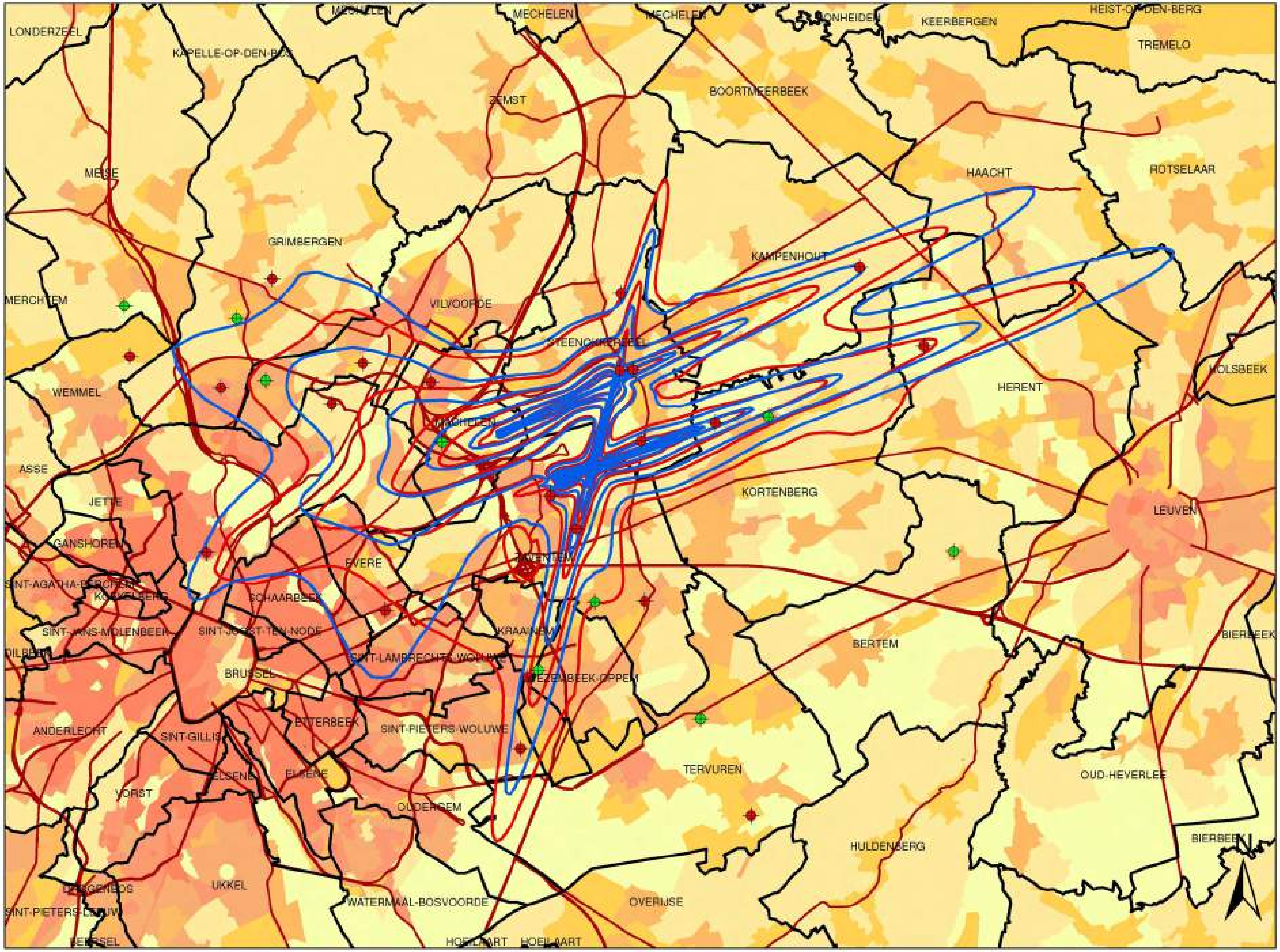
Evolution of the $L_{evening}$ noise contours for 2013 and 2014

evening 19.00 - 23.00

Noise contours
around Brussels Airport
on a
population map



Legend

$L_{evening}$ noise contours of 50, 55, 60, 65, 70 and 75 dB(A) for 2014

$L_{evening}$ noise contours of 50, 55, 60, 65, 70 and 75 dB(A) for 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning
(OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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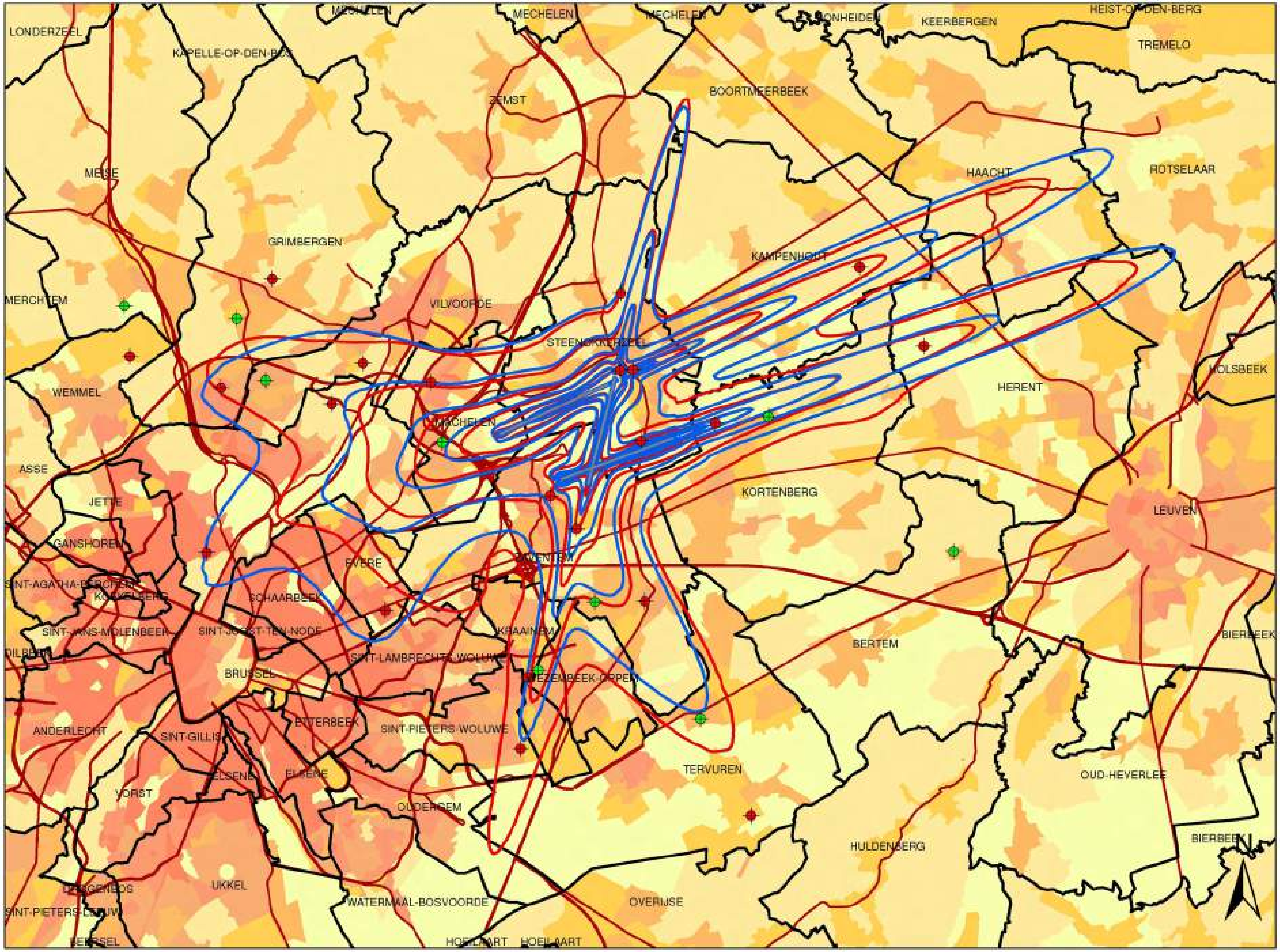
Evolution of the L_{night} noise contours for 2013 and 2014

night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
population map



Legend

L_{night} noise contours of 45, 50, 55, 60, 65 and 70 dB(A) for 2014

L_{night} noise contours of 45, 50, 55, 60, 65 and 70 dB(A) for 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning
(OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with
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Street maps :
Streetmap - Teleatlas

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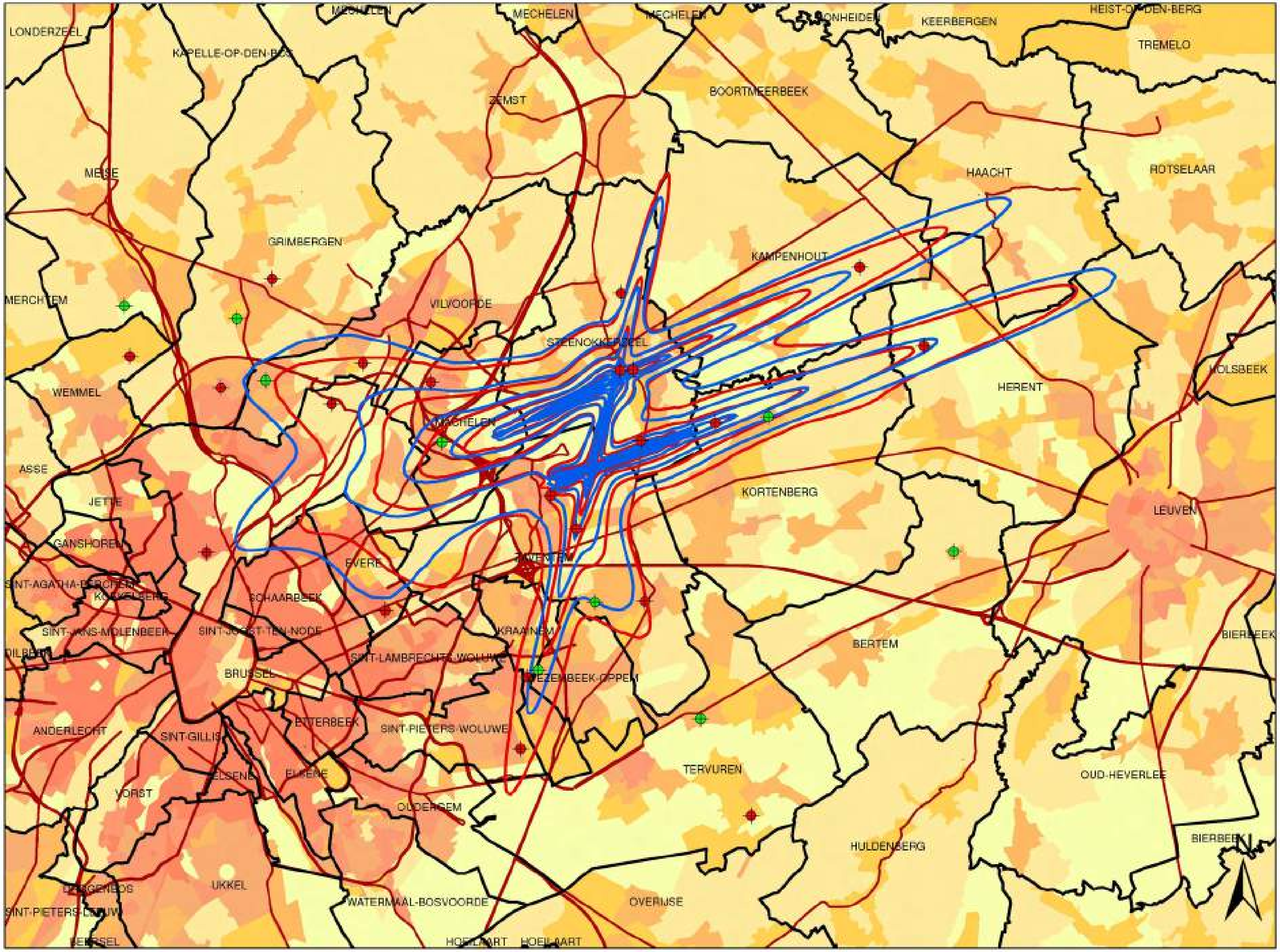
Evolution of the L_{DEN} noise contours for 2013 and 2014

day 07.00 - 19.00 - evening 19.00 - 23.00 - night 23.00 - 07.00

Noise contours around Brussels Airport on a population map



Legend

- L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2014
- L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport
- Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,000 4,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning (OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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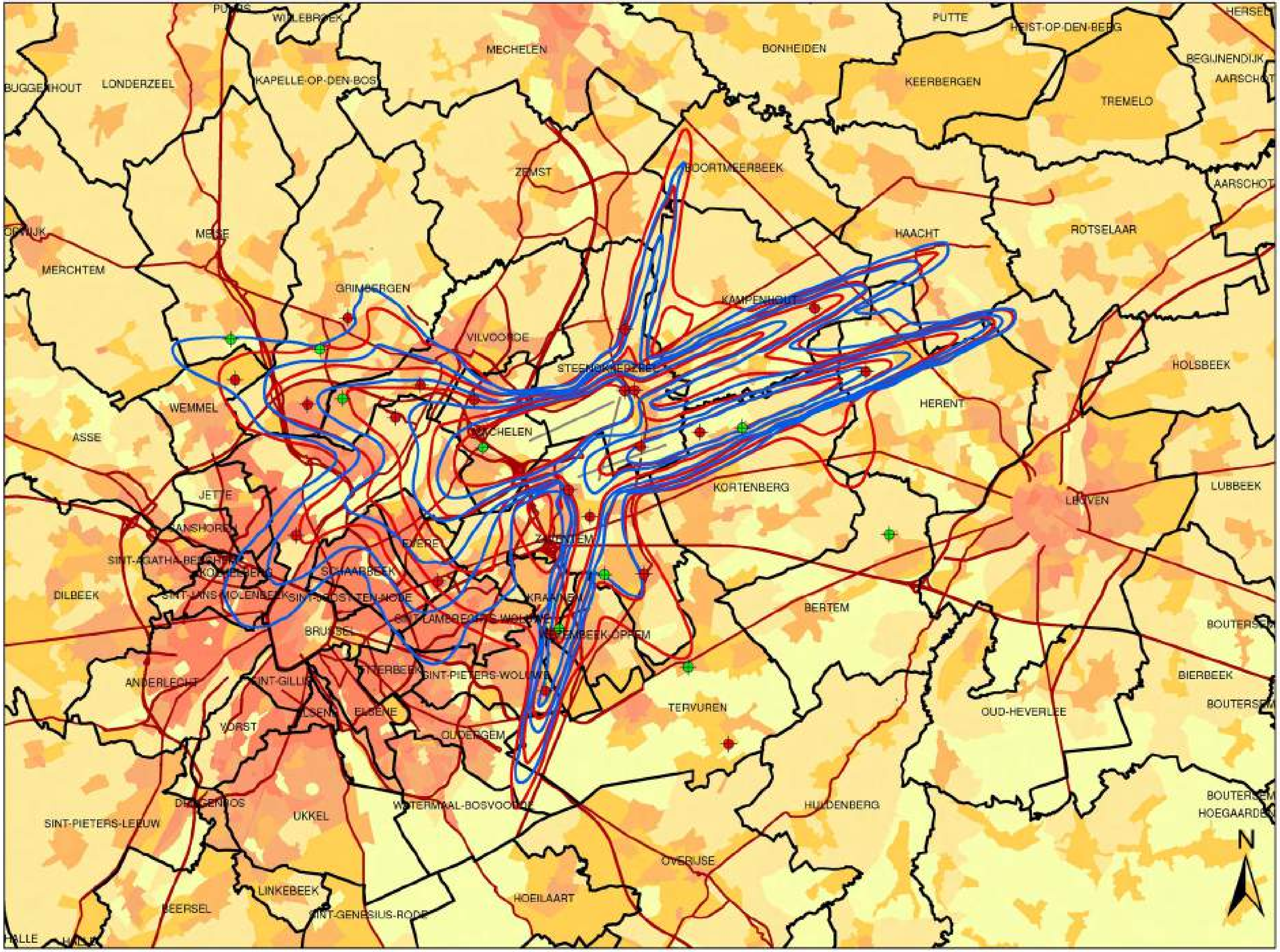
Evolution of the freq.70,day - noise contours for 2013 and 2014

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
population map



Legende

Freq.70,day - noise contours of 5x, 10x, 20x, 50x and100x for 2014

Freq.70,day - noise contours of 5x, 10x, 20x, 50x and100x for 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,500 5,000 Meters

Sources

Population data :
National Institute of Statistics (2010)

Statistical sector :
AHROM - afdeling ruimtelijke planning
(OC - GIS Vlaanderen)

Noise contours :
Calculated by ATF with
the calculation model INM 7.0b

Street maps :
Streetmap - Teleatlas

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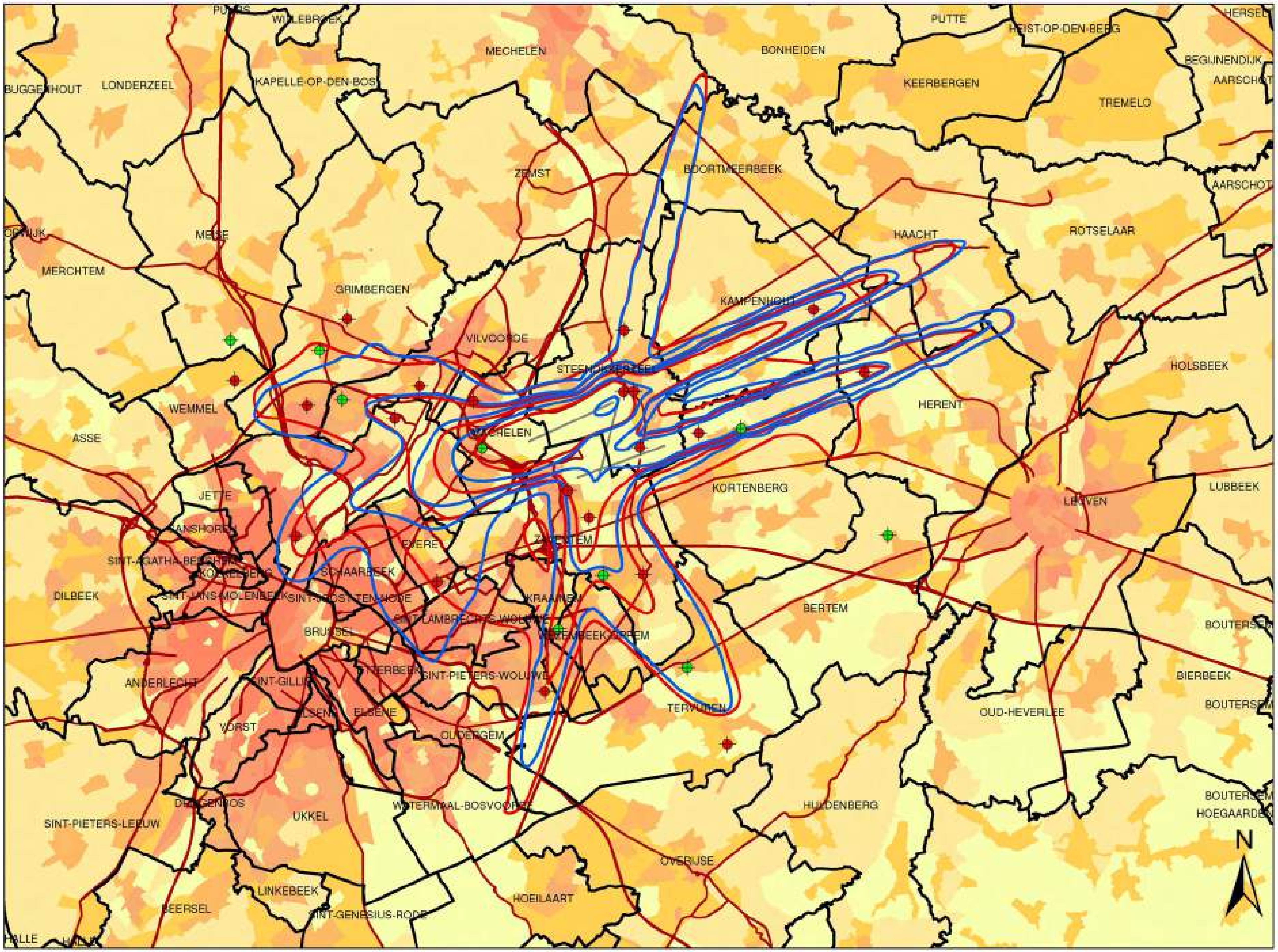
Evolution of the freq.70,night - noise contours for 2013 and 2014

night 23.00 - 07.00

Noise contours around Brussels Airport on a population map



Legend

Freq.70,night - noise contours of 1x 5x, 10x, 20x and 50x for 2014

Freq.70,night - noise contours of 1x 5x, 10x, 20 and 50x for 2013

Noise Monitoring Terminals

LNE

Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

< 0.5
0.5 - 4.5
4.5 - 14.5
14.5 - 26.5
26.5 - 56.5
56.5 - 99.5
>= 99.5

0 2,500 5,000 Meters

Sources

Population data : National Institute of Statistics (2010)

Statistical sector : AHROM - afdeling ruimtelijke planning (OC - GIS Vlaanderen)

Noise contours : Calculated by ATF with the calculation model INM 7.0b

Street maps : Streetmap - Teleatlas

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Evolution of the freq.60,day - noise contours for 2013 and 2014

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
population map

Legend

- Freq.60,day noise contours of 50x, 100x, 150x en 200x for 2014
- Freq.60,day noise contours of 50x, 100x, 150x en 200x for 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport
- Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
- 0.5 - 4.5
- 4.5 - 14.5
- 14.5 - 26.5
- 26.5 - 56.5
- 56.5 - 99.5
- >= 99.5

0 2,500 5,000 Meters

Sources

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Evolution of the freq.60,night - noise contours for 2013 and 2014

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Noise contours
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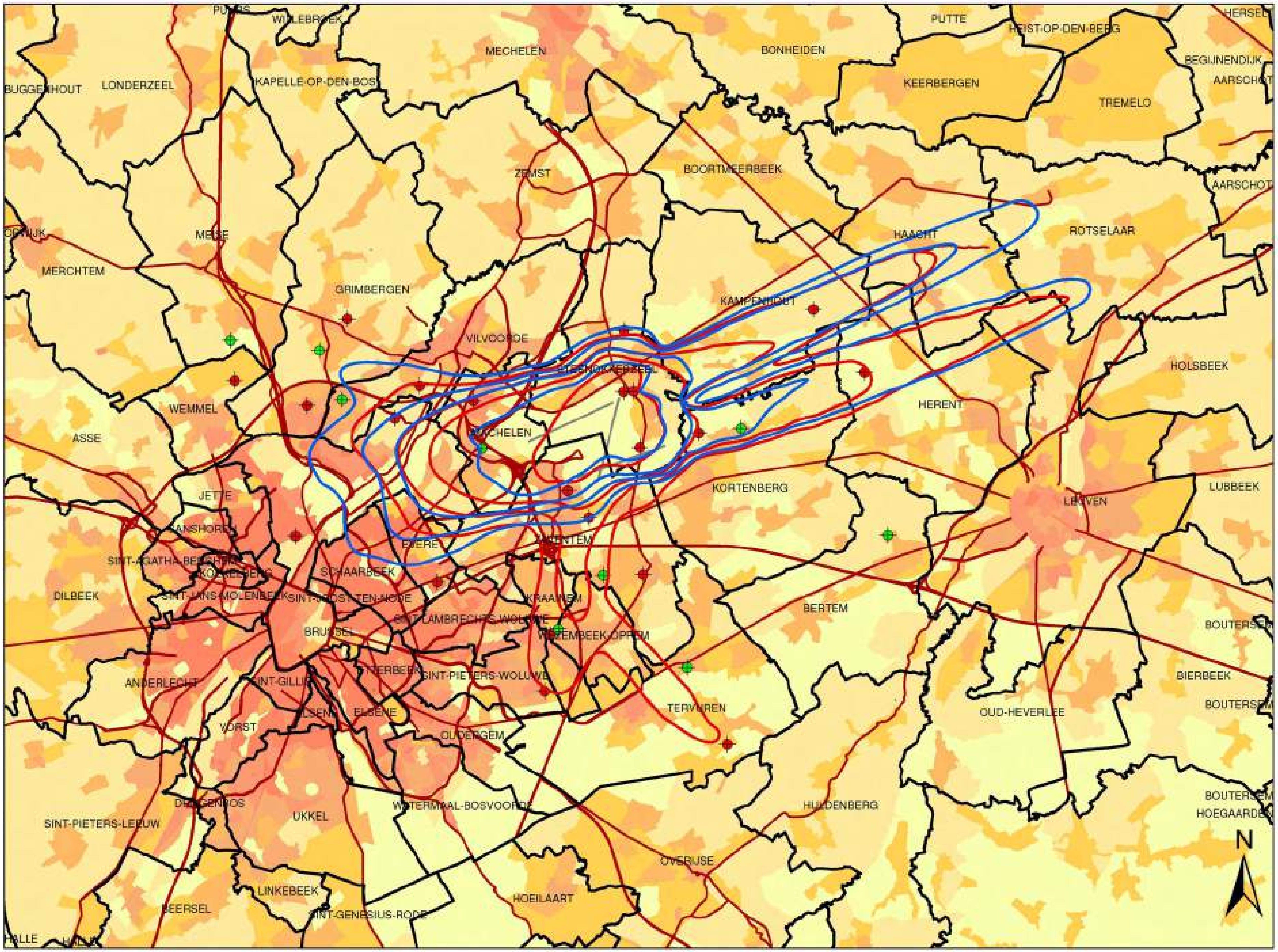
population map



Legend

Freq.60,night - noise contours of 10x, 15x, 20x and30x for 2014

Freq.60,night - noise contours of 10x, 15x, 20x and30x for 2013

Noise Monitoring Terminals

LNE

Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

< 0.5
0.5 - 4.5
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0 2,500 5,000 Meters

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