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Noise contours around Brussels Airport for the year 2013

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Contents

List of maps

List of tables

List of figures

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 en Thermische Fysica (further referred to as ATF) 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.

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[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 ATF 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)
    - Frequency contours for 60 dB(A) during the night period (23.00 to 07.00)

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 landing runway of at least 800 metres

[4] On July 1, 2013 a fusion took place between Brussels Airport Company nv (BAC) and Brussels Airport Holding nv (BAH). The name was changed into Brussels Airport Company nv (BAC).

1.2 History of noise contour calculations for Brussels Airport

The Laboratorium voor Akoestiek en Thermische Fysica 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 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 2006 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.

[5] Regarding the frequency contours of 60 and 70 dB(A), only the year 2010 was recalculated with 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

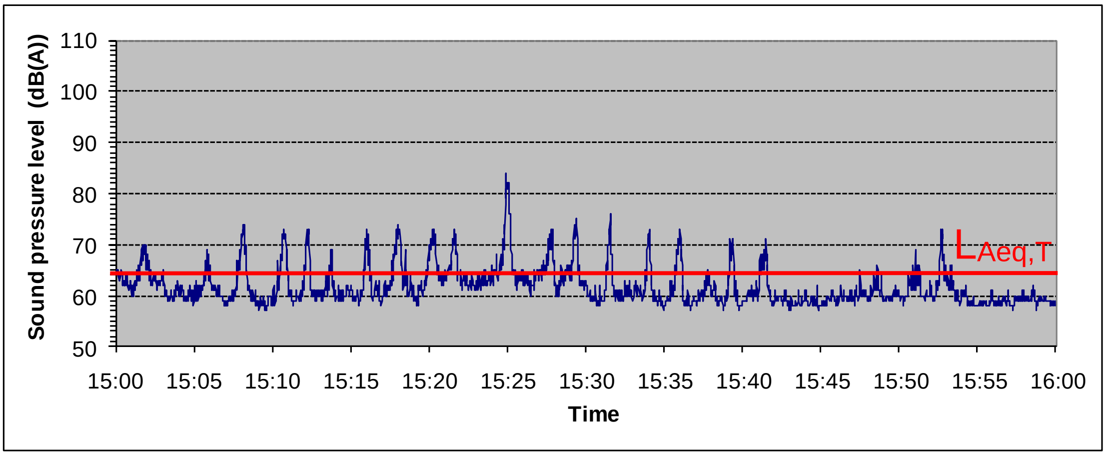
A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

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 rather 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

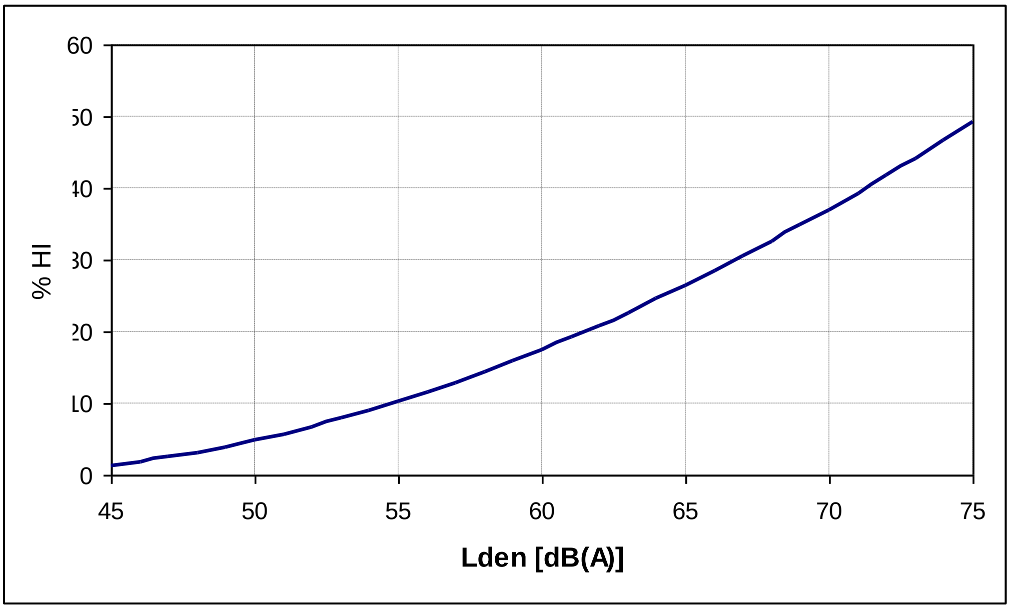
L_{den} noise contours, the day is divided in the way used in VLAREM heading 57, where the evening period runs from 19.00 to 23.00 and the night period from 23.00 to 07.00.

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 transportation noise and annoyance, TNO report PG/VGZ/00.052, July 2000

[8] European Commission, WG2 – Dose/effect, *Position paper on dose response relationships between transportation noise and annoyance*, 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 2013, 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

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

[10] This radar data is available in the NMS of Brussels Airport up to a height of 9000 feet

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.

3.1.3 Meteorological data

For the calculation of the contours for 2013, the actual average meteorological conditions during the year 2013 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 are:

- 4.6 knots headwind on runway 25R during the operational day period (06.00-23.00)
- 3.7 knots headwind on runway 25R during the operational night period (23.00-06.00)
- 3.3 knots headwind on runway 25L
- 5.4 knots headwind on runway 07L
- 5.2 knots headwind on runway 07R
- 4.1 knots headwind on runway 01
- 5.4 knots headwind on runway 19

The average temperature for 2013 that is entered into the computer model (averaged out per movement) is 11.1°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 calculates 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 is exceeded. This result was imported into a GIS system for further processing.

The contour lines were drawn in Arcview. A 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.

[11] 1 nmi (nautical mile) = 1,852 km (kilometer)

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.

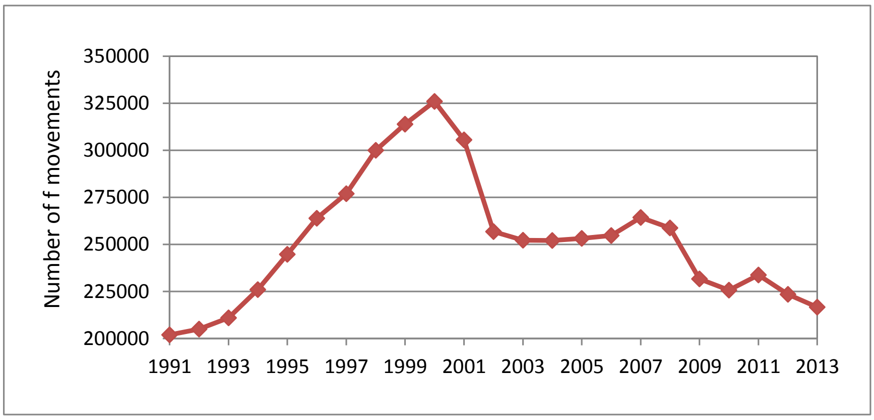
4. Results

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. The fall in the number of movements at Brussels Airport in 2012 (-4.4%) has continued in 2013, amounting to approximately 3.0%, and dropping from 223,431 in 2012 to 216,678 in 2013.

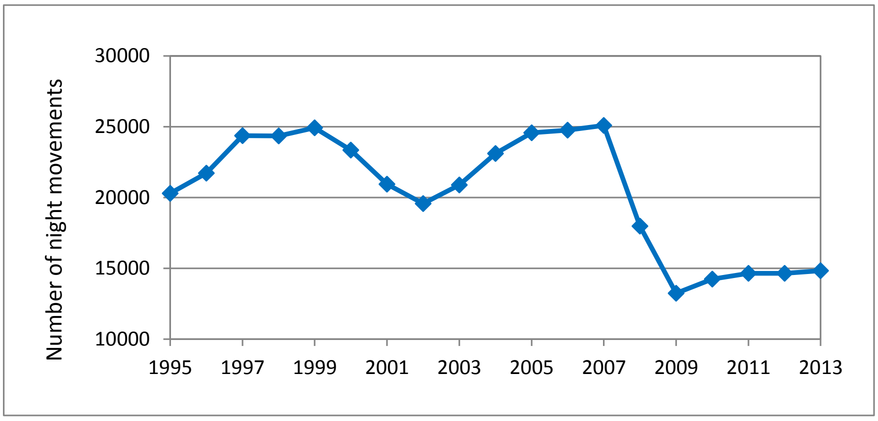
Figure 3 Change in flight traffic at Brussels Airport 1991-2013 (Source: Brussels Airport Company)



The number of night-time movements (23:00-06:00) in 2013 has increased by 1.2% from 14,648 in 2012 till 14,831 in 2013. For 2013, the number of night slots assigned 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) fell by 3.3% from 208,783 in 2012 to 201,847 in 2013.

Figure 4 Change in flight traffic during the night (23.00-06.00) at Brussels Airport 1995-2013 (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 2013 counted in accordance with that breakdown, split into departures and landings, is represented, together with the number of movements in 2012, 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 a drop in the number of movements of approximately 4.0% as compared to 2012, both for landings and departures.

For the evening period (19:00 – 23:00), the number of landings remained approximately equal to that of 2012, but the number of departures diminished by approximately 4.1%.

The number of departures during the night period (23:00 – 07:00) rose by approximately 4.5% as compared to 2012. 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 fell by 2.0%. This is mainly a consequence of a strong decrease (-10.6%) of the number of landings during the morning hour between 06:00 and 07:00.

Table 1 Number of flights (incl. helicopter movements) in 2013 and 2012 and the change of 2013 compared with 2012, according to the division of the day used in VLAREM

period	2012			2013			change compared to 2012		
	departures	arrivals	total	departures	arrivals	total	departures	arrivals	total
day (07.00-19.00)	76.999	74.349	151.348	73.874	71.432	145.306	-4.1%	-3.9%	-4.0%
evening (19.00-23.00)	22.447	24.838	47.285	22.504	23.824	46.328	0.3%	-4.1%	-2.0%
night (23.00-07.00)	12.271	12.527	24.798	11.959	13.085	25.044	-2.5%	4.5%	1.0%
23.00-06.00	*10.442*	*4.206*	*14.648*	*10.323*	*4.508*	*14.831*	*-1.1%*	*7.2%*	*1.2%*
06.00-07.00	*1.829*	*8.321*	*10.150*	*1.636*	*8.577*	*10.213*	*-10.6%*	*3.1%*	*0.6%*

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 2013 are summarised below.

Fleet changes

Just as in the three previous years, during the operational night-time period of 2013, approximately 30% of the departures involved an aircraft of the type B752. In second place there was the aircraft type B733, which was used for 12% of the departures, followed by the A320, with 9%. Also remarkable is the further increased use of A320, B734, B738 and B763 aircrafts. Furthermore, there is a strong decrease of the number of movements with A30B aircrafts, both for departures and arrivals, as a result of a fleet renewal at DHL, which goes along with the replacement of this type of aircraft by the A306 type. As far as the arrivals are concerned, mainly the increase of the number of landings with A319 aircrafts catches the eye. In combination with the similar decrease in 2012, this brings the use of that aircraft back to the level of 2011. There were also less landings with B733 and B734. The evolution of the most frequently used aircraft types is depicted in Table 2.

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 aircraft types

Type	Arrivals			Departures		
(ICAO)	2012	2013	evolution with respect to 2012	2012	2013	evolution with respect to 2012
A30B	248	25	-223 (-90%)	258	27	-231 (-90%)
A306	127	291	164 (129%)	126	292	166 (132%)
A319	856	1055	199 (23%)	403	282	-121 (-30%)
A320	2036	2109	73 (4%)	273	411	138 (51%)
A321	483	393	-90 (-19%)	18	28	10 (56%)
A332	368	349	-19 (-5%)	10	5	-5 (-50%)
A333	766	811	45 (6%)	6	9	3 (50%)
ATP	54	96	42 (78%)	264	263	-1 (0%)
B733	813	532	-281 (-35%)	633	539	-94 (-15%)
B734	681	398	-283 (-42%)	101	155	54 (53%)
B735	126	1	-125 (-99%)	3		-3 (-100%)
B737	372	301	-71 (-19%)	14	7	-7 (-50%)
B738	1025	1133	108 (11%)	107	239	132 (123%)
B744	89	62	-27 (-30%)	18	29	11 (61%)
B752	1164	1240	76 (7%)	1284	1310	26 (2%)
B763	404	368	-36 (-9%)	331	409	78 (24%)
BE20	38	5	-33 (-87%)	38	2	-36 (-95%)
DH8D	84	119	35 (42%)	15	9	-6 (-40%)
EXPL	95	91	-4 (-4%)	50	56	6 (12%)
MD11	35	43	8 (23%)	47	52	5 (11%)
RJ1H	230	248	18 (8%)	28	27	-1 (-4%)
RJ85	52	29	-23 (-44%)	11	1	-10 (-91%)

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 2013 no changes were imposed to this scheme, except for the footnotes (1) and (5) in Table 3 (changes effective as from 19/09/2013).

Table 3 Preferential runway use since 31/07/2010 (local time) (source : AIP 19/09/2013)

		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
(5) Change of terminology: on 19/9/2013 runway 20 was renamed as runway 19 and runway 02 as runway 01

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. Until 18/9/2013, for all runways a maximum crosswind of 15 kt and a maximum tailwind of 7 kt was allowed. Since 19/9/2013, the maximum tailwind for gusts is 12 kt and the maximum crosswind 20 kt when the preferential runway use is in operation. In addition, wind speed limits were also included in the AIP for non-preferential runways, which Belgocontrol needs to reckon with in case of alternative runway use. For gusts, these amount to a maximum tailwind of 5 kt and a maximum crosswind of 20 kt.

During the month of August, runway 25R-07L was out of operation due to maintenance work. Because, among other things, of the weather conditions, most departures and landings were performed on runway 20 (renamed as runway 19 since 19/9/2013) during this time span.

Concerning the flight paths (SIDs), no essential changes were made in the course of 2013.

Operating restrictions

During the year 2013 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 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 $L_{Aeq,24h}$,

[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 upon placement into operation of the new system.

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
NMT01-1	STEENOKKERZEEL	62,7	60,6	2,1
NMT02-2	KORTENBERG	67,8	67,8	0,0
NMT03-2	HUMELGEM-Airside	64,8	63,9	0,9
NMT04-1	NOSSEGEM	63,7	65,8	-2,1
NMT06-1	EVERE	48,8	49,6	-0,8
NMT07-1	STERREBEEK	49,4	50,8	-1,4
NMT08-1	KAMPENHOUT	52,4	53,1	-0,7
NMT09-2	PERK	48,4	45,4	3,0
NMT10-1	NEDER-OVER-HEEMBEEK	52,9	52,4	0,5
NMT11-2	SINT-PIETERS-WOLUWE	52,5	53,7	-1,2
NMT12-1	DUISBURG	46,7	43,1	3,6
NMT13-1	GRIMBERGEN	45,2	38,9	6,3
NMT14-1	WEMMEL	46,3	45,5	0,8
NMT15-3	ZAVENTEM	56,8	48,3	8,5
NMT16-2	VELTEM	55,6	55,9	-0,3
NMT19-3	VILVOORDE	51,2	50,3	0,9
NMT20-2	MACHELEN	53,0	50,9	2,1
NMT21-1	STROMBEEK-BEVER	49,3	48,6	0,7
NMT23-1	STEENOKKERZEEL	65,5	64,0	1,5
NMT24-1	KRAAINEM	53,8	54,6	-0,8
NMT26-2	BRUSSEL	46,4	46,6	-0,2
NMT40-1*	KONINGSLO	50,6	51,3	-0,7
NMT41-1*	GRIMBERGEN	47,2	46,7	0,5
NMT42-2*	DIEGEM	63,0	62,6	0,4
NMT43-2*	ERPS-KWERPS	57,4	56,8	0,6
NMT44-2*	TERVUREN	47,7	47,7	0,0
NMT45-1*	MEISE	44,3	44,0	0,3
NMT46-2*	WEZEMBEEK-OPPEM	55,5	56,7	-1,2
NMT47-3*	WEZEMBEEK-OPPEM	51,1	51,4	-0,3
NMT48-3*	BERTEM	44,9	44,5	0,4

* noise data LNE off-line correlated by the NMS

The measuring stations NMT 1-1, NMT 3-2, 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).

There are a few noticeable outliers, where the model clearly calculates higher levels than the noise levels effectively measured (mainly NMTs 12-1 Duisburg and 13-1 Grimbergen). 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
NMT01-1	STEENOKKERZEEL	63,4	58,7	4,7
NMT02-2	KORTENBERG	63,6	63,6	0,0
NMT03-2	HUMELGEM-Airside	60,1	58,5	1,6
NMT04-1	NOSSEGEM	60,4	63,1	-2,7
NMT06-1	EVERE	43,1	43,8	-0,7
NMT07-1	STERREBEEK	48,8	51,2	-2,4
NMT08-1	KAMPENHOUT	50,8	51,3	-0,5
NMT09-2	PERK	44,8	42,6	2,2
NMT10-1	NEDER-OVER-HEEMBEEK	48,7	48,7	0,0
NMT11-2	SINT-PIETERS-WOLUWE	48,4	49,6	-1,2
NMT12-1	DUISBURG	43,8	42,1	1,7
NMT13-1	GRIMBERGEN	39,9	29,2	10,7
NMT14-1	WEMMEL	42,0	39,8	2,2
NMT15-3	ZAVENTEM	53,8	50,1	3,7
NMT16-2	VELTEM	51,6	51,7	-0,1
NMT19-3	VILVOORDE	47,2	46,8	0,4
NMT20-2	MACHELEN	49,4	47,7	1,7
NMT21-1	STROMBEEK-BEVER	45,2	44,8	0,4
NMT23-1	STEENOKKERZEEL	64,0	62,8	1,2
NMT24-1	KRAAINEM	49,3	50,4	-1,1
NMT26-2	BRUSSEL	42,6	42,8	-0,2
NMT40-1*	KONINGSLO	46,8	47,6	-0,8
NMT41-1*	GRIMBERGEN	43,5	42,8	0,7
NMT42-2*	DIEGEM	57,7	58,2	-0,5
NMT43-2*	ERPS-KWERPS	52,7	52,0	0,7
NMT44-2*	TERVUREN	45,8	47,3	-1,5
NMT45-1*	MEISE	39,3	38,2	1,1
NMT46-2*	WEZEMBEEK-OPPEM	51,1	52,5	-1,4
NMT47-3*	WEZEMBEEK-OPPEM	49,9	51,5	-1,6
NMT48-3*	BERTEM	40,0	39,9	0,1

* 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
NMT01-1	STEENOKKERZEEL	69,6	65,9	3,7
NMT02-2	KORTENBERG	71,8	71,8	0,0
NMT03-2	HUMELGEM-Airside	68,7	67,5	1,2
NMT04-1	NOSSEGEM	68,2	70,6	-2,4
NMT06-1	EVERE	52,2	52,9	-0,7
NMT07-1	STERREBEEK	55,3	57,4	-2,1
NMT08-1	KAMPENHOUT	57,8	58,4	-0,6
NMT09-2	PERK	52,8	50,1	2,7
NMT10-1	NEDER-OVER-HEEMBEEK	56,9	56,5	0,4
NMT11-2	SINT-PIETERS-WOLUWE	56,7	57,9	-1,2
NMT12-1	DUISBURG	51,3	48,6	2,7
NMT13-1	GRIMBERGEN	49,0	41,5	7,6
NMT14-1	WEMMEL	50,1	48,6	1,6
NMT15-3	ZAVENTEM	61,4	55,9	5,5
NMT16-2	VELTEM	59,6	59,9	-0,3
NMT19-3	VILVOORDE	55,5	54,7	0,8
NMT20-2	MACHELEN	57,1	55,5	1,6
NMT21-1	STROMBEEK-BEVER	53,3	52,6	0,7
NMT23-1	STEENOKKERZEEL	71,0	69,7	1,4
NMT24-1	KRAAINEM	57,8	58,8	-1,0
NMT26-2	BRUSSEL	51,0	51,2	-0,2
NMT40-1*	KONINGSLO	54,8	55,4	-0,6
NMT41-1*	GRIMBERGEN	51,4	50,8	0,6
NMT42-2*	DIEGEM	66,6	66,5	0,1
NMT43-2*	ERPS-KWERPS	61,2	60,6	0,7
NMT44-2*	TERVUREN	52,8	53,7	-0,9
NMT45-1*	MEISE	47,8	47,0	0,8
NMT46-2*	WEZEMBEEK-OPPEM	59,5	60,8	-1,3
NMT47-3*	WEZEMBEEK-OPPEM	56,6	57,7	-1,1
NMT48-3*	BERTEM	48,8	48,5	0,2

* 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).

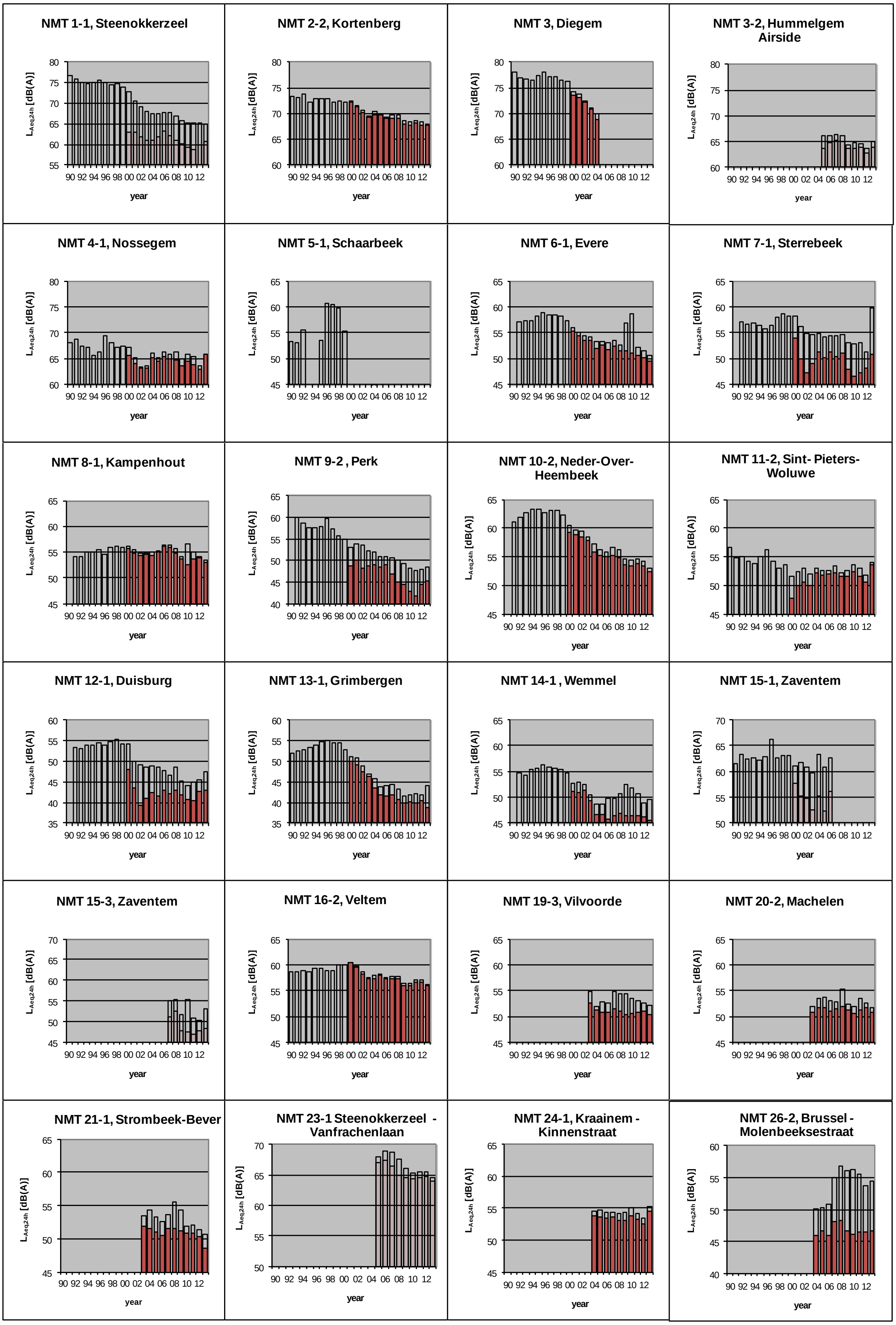
To determine $L_{Aeq,24h}$ levels based on all noise events, we started from the logarithmic average of the measured $L_{Aeq,24h}$ values recorded at the measuring stations. It was observed that outliers within these data clouds have a strong influence in the logarithmic averages, and therefore they 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 2-2, 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 1-1, NMT 3-2, NMT 15-1, NMT 15-3 and NMT 23-1 are less relevant for the reasons set out in 4.2 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 2012 and 2013 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.**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 contour of 55 dB(A) for the years 2012 and 2013 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 67% of departures during the daytime period in 2013. As a result of these movements, the L_{day} noise contours clearly show a flaring departure lobe in the continuation of runway 25R. Runway 19, as the preferential departure runway during the off-peak period at the weekend for departures in an easterly direction by aircraft with an MTOW of less than 200 tonnes, was used in 2013 for 7.7% of the departure movements during the daytime period. The fact that runway 25R was closed for maintenance works in August 2013 was also an important factor in this respect. As the departure routes from this runway turn away in an easterly direction at a height of 700 ft, there is a barely visible bulge in the landing contour of runway 01. As an alternative departure runway, runway 07R accounts for 23.3% of take-offs. These departures produce a northerly and south-westerly widening in relation to the narrow landing lobe of runway 25L, in the area close to the airport. Compared with the take-offs on runway 19, the southerly bulge is less marked as a result of the higher turnaway height. The other runways 07L, 01 and 25L were used to serve only a small minority of take-offs in 2013; 1.2%, 0.5% and 0.0% respectively.

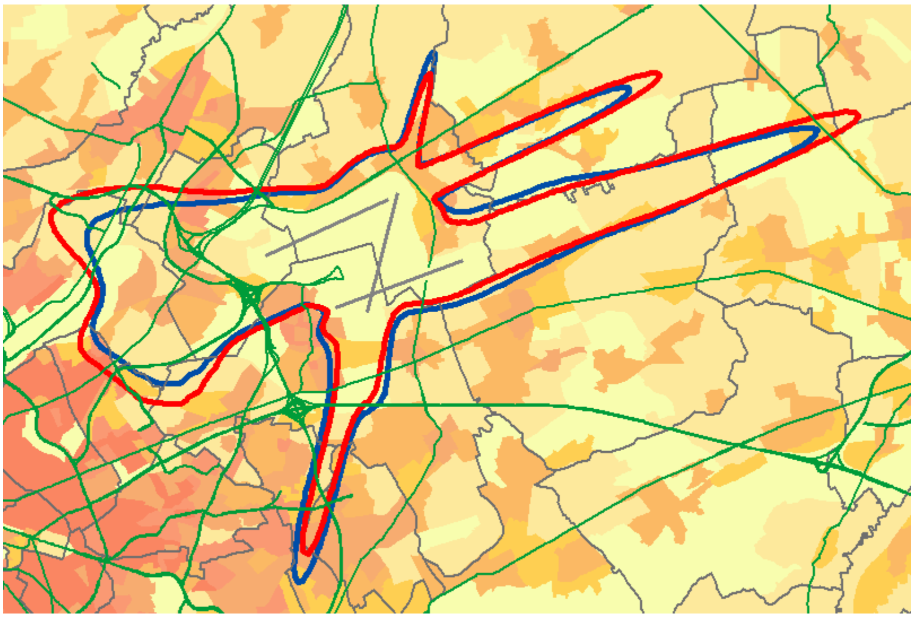
As far as the landings are concerned, the arrival lobe on runways 25L is clearly the largest. This runway handles just under 50% of all arrivals during the daytime period. Slightly less but still very pronounced are the arrival lobes on runways 25R and 01, as a result of the fact that they handle 19.8% and 22.4% respectively of landing traffic. In 2013, 6.8% of landings were handled by runway 19, in the continuation of which there is a clear arrival lobe. In comparison with 2012, the total number of take-offs during the day period fell by 7.8%, from 203 per day in 2012 to 196 per day in 2013. This fall, along with the change in the actual runway use (the use of runway 25R went down from 83% in 2012 to 67% in 2013), caused the flaring departure lobe in the continuation of runway 25R to become smaller. The noise contour remained equal only around the canal area, as a result of the increased use of the canal route since August 2012, instead of the Chabert route. Because of the significant increase in the use of runway 07R for departures (23.3% in 2013 against 11.2% in 2012) the northerly and southerly bulges on the landing contour of runway 25L have increased. The proportion of take-offs from runway 19 rose by 5.2% in 2012 to reach 7.7% in 2013. Even more so than in 2012, the comparatively high use of this runway in 2013 is a result of the maintenance works that were performed to runway 25R-07L in August, which meant that runway 25R was unavailable to be used as a take-off runway. August 2013 saw 4,827 take-offs from runway 19, compared against 2,616 in August 2012. As a consequence, the bulge seen in the landing contour as a result of landings on runway 01 is even more pronounced than it was in 2012.

In comparison with 2012, the total number of landings during the daytime period in 2013 declined by 4%. Regarding the runway use for landings, the increased use of runway 01 (22.4% of the landings in 2013 compared to 11.3% in 2012) stands out especially, and is consistent with the increased use of runway 07R for departure movements. All the more so as the 'departures 07R(/07L/02) - landings 01' configuration is the main alternative configuration when weather conditions do not permit the preferential runway use (mostly due to wind limits being exceeded). The landings on runway 19 increased slightly from 5.2% in 2012 to 6.8% in 2013, with the aforesaid maintenance work on runway 25R once again playing an important role. The extension of the landing contours of runways 01 and 19 reflects these observations.

In particular, the extension of the landing contour of runway 01 reflects the impact of a rise in compliance with the twofold increase of the number of landings on this runway, which is somewhat mitigated by the reduction of the number of flights taking off from runway 25R who turn in a south-easterly direction over this area. The landing contours in the continuation of runways 25R and 25L have diminished as a result of the global reduction of the number of movements during the daytime, and the shift to landings on runway 01. Alongside the reduction of the number of movements and the changes in runway use, the uptake of a more silent aircraft fleet is also a factor in each of these developments. Because of the increased use of runway 19, the landing contour on this runway has become much larger

In 2013, the total surface area within the L_{day} noise contour of 55 dB(A) fell by around 5% compared against 2012 (4,637 ha in 2013 against 4,871 ha in 2012). The number of residents inside this noise contour went down by around 8%, from 34,375 in 2012 to 31,546 in 2013.

Figure 6 L_{day} noise contours of 55 dB(A) around Brussels Airport for 2012 (red) and 2013 (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 contour of 50 dB(A) for 2012 and 2013 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, there are an average of 16.3 take-offs an hour, i.e. the same number as during the daytime period. However, in the evenings, there are fewer landings than during the day (15.4 per hour between 19:00 and 23:00 compared against 16.9 per hour between 07:00 and 19:00). Runway use for take-offs as well as landings during the evening period was very similar to that during the daytime period, except for a number of aspects. For the departures from runway 25R during the evening period slightly more routes are used in a northerly direction (5.0 movements per hour during the evening against 4.8 during the day), to the detriment of routes in an easterly direction (5.5 movements per hour during the evening against 5.6 during the evening). Also, runways 07R and 07L saw a slight rise in the number of take-offs than during the day. Runway 19 was used less during the evening than during the day, for departures and landings alike. Minor differences in runway use between the evening and daytime periods also come to the fore in a comparison between the 55 dB(A) contours.

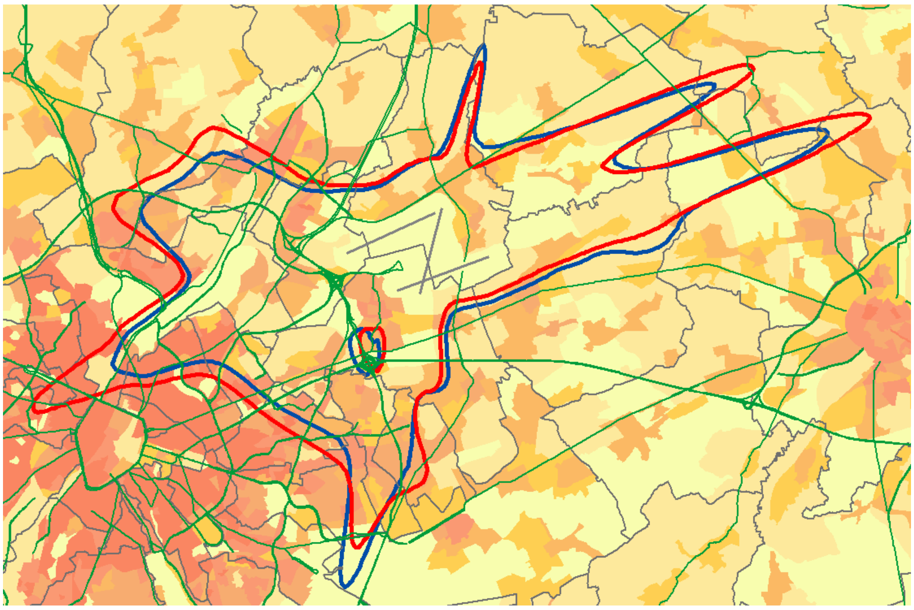
Same as during the daytime, during the evening period, the departure route from runway 25R straight ahead, climbing to an altitude of 4,000 feet is used only by heavy 4-engine aircraft (B744 and B742 especially), which climb much less quickly than light twin-engine aircraft. However, in the evenings, this type of flights is much more frequent than during the day (around 2.5 as many per hour), resulting in a pronounced departure lobe of runway 25R in the straight ahead direction.

The number of take-offs during the evening period fell from 67.9 per evening period in 2012 to 65.3 per evening period in 2013. Compared with 2012, a number of trends are similar to those of the day contours. There is a clear shrinkage of the contours that result from the reduction of the take-off movements on runway 25R and of the landings on 25R and 25L. The departure lobe of runway 25R in the straight ahead direction has significantly diminished. The latter is chiefly to be attributed to the reduction by half in relation to 2012 of the number of heavy 4-engine aircraft with an easterly destination that take-off straight ahead to climb to an altitude of 4000 ft before taking a different course (199 movements of aircraft with a MTOW > 136 tonnes in 2013 against 499 in 2012). Because of the strong rise in the use of runway 07R in 2013 compared against 2012, the bulge on the landing contour of runway 25L in a southerly direction has become clearly noticeable.

The total number of landings in 2013 during the evening period (on average 61.7 per evening period) remained virtually unchanged compared against 2012 (on average 61.3 per evening period). Same as during the daytime, runways 01 and 19 were used much more frequently in 2013, nearly doubling the number of landings on runway 01. This matches the changes in the noise contours.

The total surface area within the $L_{evening}$-noise contour of 50 dB(A) declined from 12,237 ha in 2012 to 11,222 ha in 2013, a decrease by approximately 8%. Because the contour shifted from what are only densely populated areas in the northern and north-western parts of the Brussels Capital Region, the number of residents living inside this noise contour went down by 32%, from 269,635 in 2012 to reach 182,247 in 2013.

Figure 7 L $_{evening}$ noise contours of 50 dB(A) around Brussels Airport for 2012 (red) and 2013 (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 contour of 45 dB(A) for 2012 and 2013 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. 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. Instead, these flights from runway 25R follow a route which turns to the right (see ring route CIV1C). However, when runways 25R and 19 are used together, it is invariably runway 19 that is used for departures in an easterly direction for planes with MTOW<200 tonnes. The smaller aircrafts heading for the Chièvres beacon that take off from runway 25R use the canal route (CIV7D) during the operational nighttime period, whilst the larger aircraft follow the ring route.

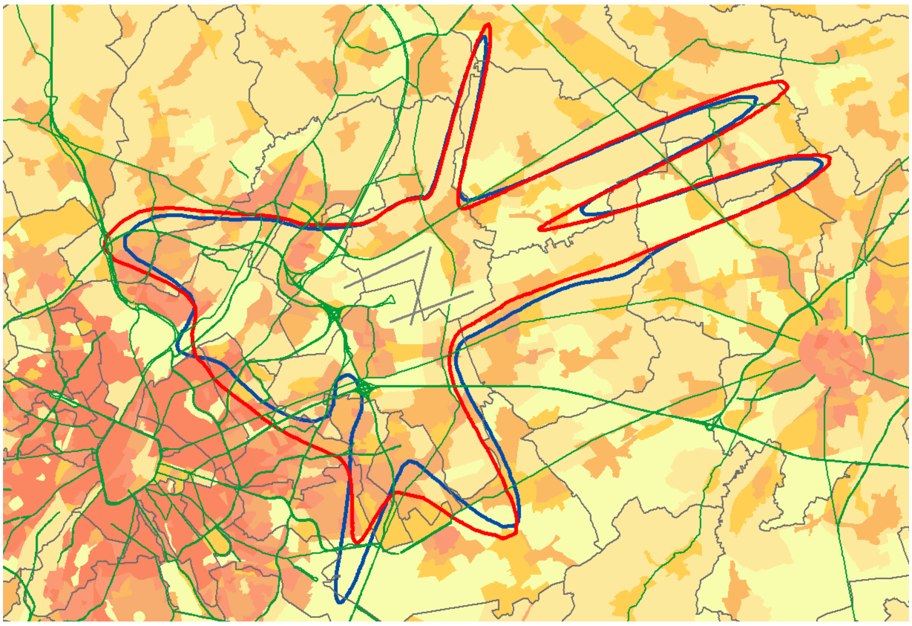
Due to the presence of the hour between 06:00 and 07:00 in the L$_{night}$ parameter, approximately 60% of all departures in this evaluation period take place from runway 25R (two thirds of the departures between 23:00 and 07:00 actually occur in the hour between 06:00 and 07:00; see Table 1). In spite of the fact that the routes involving a short left-hand turn to the south from runway 25R are not used during the operational nighttime period, there is a distinct departure lobe for the L$_{night}$-noise contours in the southerly direction (as a result of the departures between 06:00 and 07:00), which is comparable in size to the departure lobe of runway 25R in a northerly direction. Furthermore, the departure lobe in a southeasterly direction from runway 19 is also clearly visible (19.3% of all departures). Of the nighttime departures, 14.0% take place from runway 07R, which produces a southeasterly bulge in the 25L landing contour. As far as landings are concerned, the bulk of these are handled by runways 25R and 25L (jointly 72.2%). Other clear landing contours can be seen in the extension of runways 01 (18.2% of landings) and 19 (9.3% of landings).

Compared against 2012, the total number of departure movements in 2013 during the night period from 23:00 to 07:00 rose by 4.5%. As a result of the shift of flights from the Chabert route to the canal route since August 2012, which made itself felt to the full in 2013, there is a slight increase of the departure lobe around the canal area. In addition, there is a major shift away of take-offs from 25R (59.3% of departures in 2013 compared against 73.5% in 2012) to 07R (14.0% of departures in 2013 against 5.4% in 2012) and 07L (4.5% of departures in 2013 against 1.7% in 2012), which is producing a southerly widening of the 25L landing contour and a slight expansion of the contour in the sector between the landing contours of runways 19 and 25R.

The overall number of landings during the night time period fell by 2.5% (from 4.2 landings per hour in 2012 to 4.1 landings per hour in 2013). Combined with the changed runway use, this is mainly visible in a shrinkage of the 25R landing contour, which was used for 34.7% of nighttime landings. The changes in the other landing contours are also seen to emulate the shifts in runway use: in 2012 a lot more landings took place on runway 01 compared against 2012 (an 8.3% increase to reach 18.2% of landings).

Due to these developments, the surface area within the L_{night} noise contour of 45 dB(A) diminished by 5%, from 13,118 ha in 2012 to 12,501 ha in 2013. The number of residents living inside this noise contour fell by 19%, from 155,655 in 2012 to 126,754 in 2013, mainly as the result of a shrinkage of the contour in the north-western part of the Brussels Capital Region.

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).

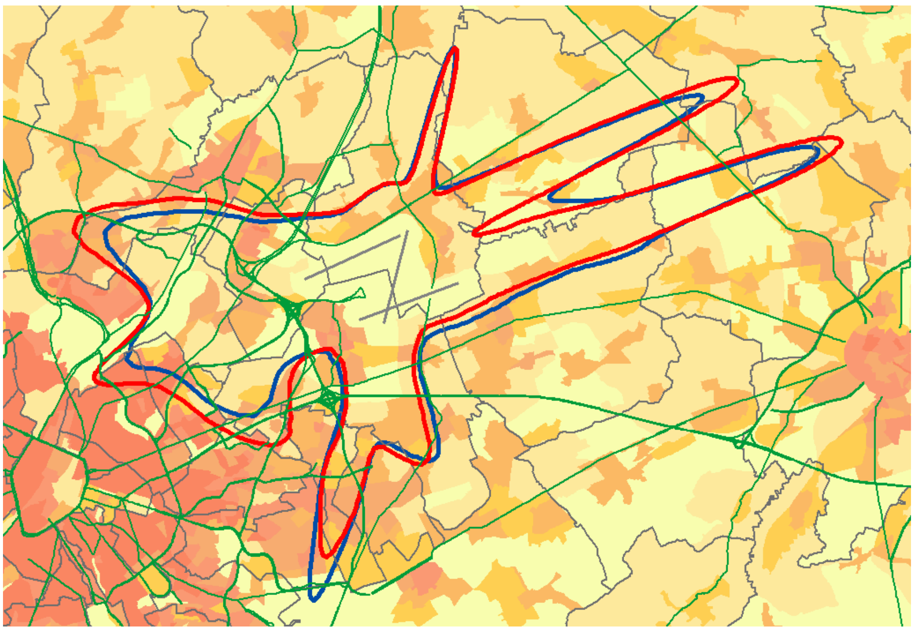
As each of the three time periods contributes to the weighted L_{den} average, the observations put forward in the previous paragraphs in respect of the L_{day}, $L_{evening}$ and L_{night} noise contours are seen to pop up again in the L_{den} noise contours. The changes in the L_{den} noise contour of 55 dB(A) for 2012 and 2013 are also shown in Figure 9.

What is striking is the significant shrinkage of the contours that are dominated by the take-off movements of runway 25R. The only sector where no reduction is seen is in the extended line of this runway by the canal area, as a result of the more frequent use of the canal route by aircraft taking off from runway 25R. The effect on the contours of the substitution of the Chabert route by the canal route (since August 2012) only made itself felt for a few months in 2012, only to come into its own in 2013 in full force. As far as the effect of take-offs on the contours is concerned, there is a minor widening of the global increase of the number of departures in a south(east)ward direction from runways 19 (a 6.3% rise to 8.6% of departures) and 07R (a 10.8% rise to 22.4% of departures). The other departure lobes shrunk in 2013.

With regard to the landings, there is chiefly question of an increase on runway 01 (a twofold increase of the relative contribution from 11.3% in 2012 to 22.5% in 2013). Runways 25L and 25R showed a decline of the contribution to the landings.

The total surface area within the 55 dB(A) diminished by around 6%, from 8,905 ha in 2012 to 8,415 ha in 2013. The number of affected residents fell by 28%, from 107,680 in 2012 to 77,229 in 2013.

Figure 9 L_{den} noise contours of 55 dB(A) around Brussels Airport for 2012 (red) and 20132 (blue)



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

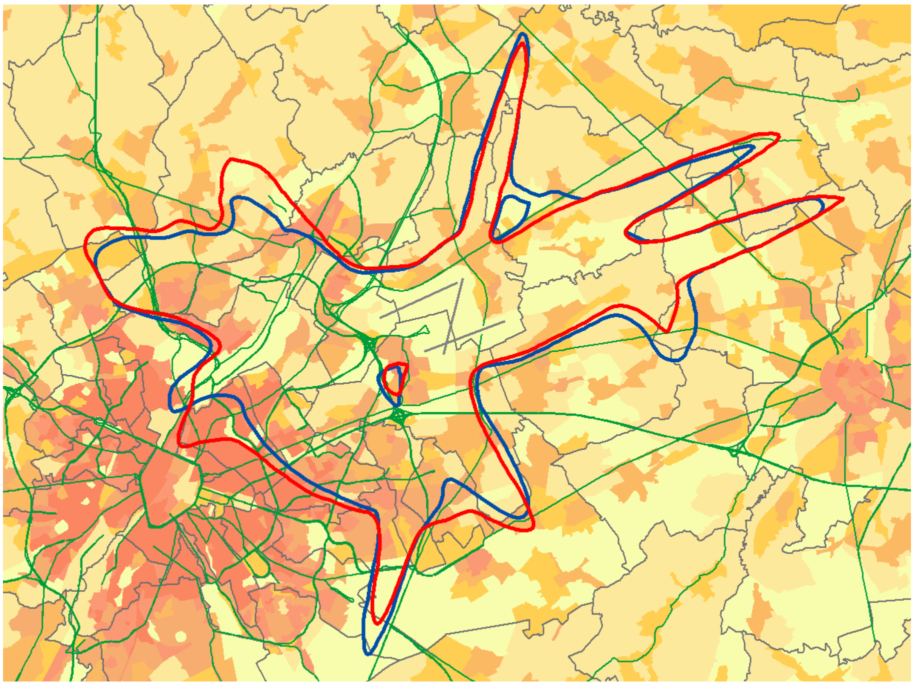
The freq.70,day contours were calculated for an evaluation period that consists of the evaluation periods of L_{day} and $L_{evening}$ combined. The observations discussed above for these parameters therefore recur in the freq.70,day contours to a certain extent. The change in the freq.70,day noise contour of 5X above 70 dB(A) for 2012 and 2013 is also shown in Figure 10.

Compared against 2012, what is noticeable for 2013 is the continued shift of the departure lobe in a northerly direction straight on from runway 25R as a result of the substitution of the Chabert route by the canal route in August 2012. In addition, there is an increase in the size of the departure lobe in a northerly direction, turning away from runway 07L and in a southerly direction turning away from runway 07R. The departure lobe of runway 19 slightly shifted to the east.

With regard to the landings, there is a diminishment of the contour surface areas, except for runways 19 and 01.

The total surface area within the 5x above the 70 dB(A) contour consequently remained approximately unchanged (15,926 ha in 2012 compared against 15,877 ha in 2013). The number of affected residents fell by approximately 21%, 302,136 in 2012 to 239,376 in 2013.

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



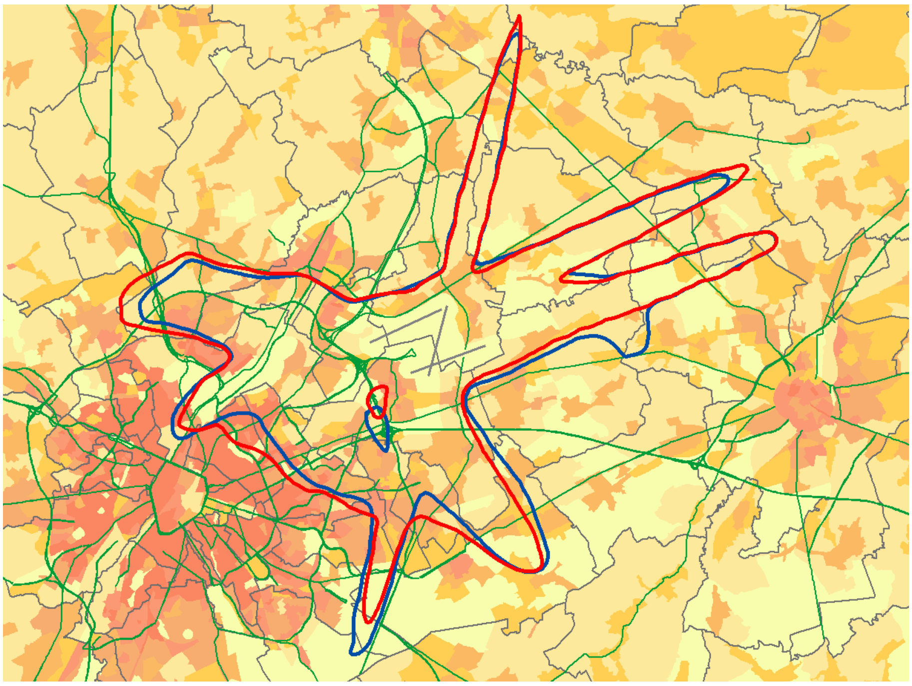
4.4.6 Freq.70,night contours (night 23.00-07.00)

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 contour of 1x above 70 dB(A) for 2012 and 2013 is also shown in Figure 11.

The 1x above the 70 dB(A) range too shows a northerly shift of the centrepoint of the departure lobe of runway 25R, as a result of the substitution of the Chabert route by the canal route mid-2012. Because of the increase in the number of take-offs from runway 07R compared against 2012, the bulge on the landing contour that had vanished in 2012, has returned to being visible in 2013. In addition, the departure lobes have shrunk in a westerly direction. Because of the increased use of runway 01 for nighttime landings (18.2% in 2013 against 8.3% in 2012), the landing contour has extended in length somewhat.

Standing at 14,944 ha in 2013, the total surface area within the 1x above the 70 dB(A) contour remained virtually unchanged from 2012 (14,938 ha). However, the number of affected residents fell by 15%, from 234,110 in 2012 to 199,913 in 2013, due to the fact that a contour shrinkage in a densely populated area was not offset by a contour expansion in a sparsely populated area.

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



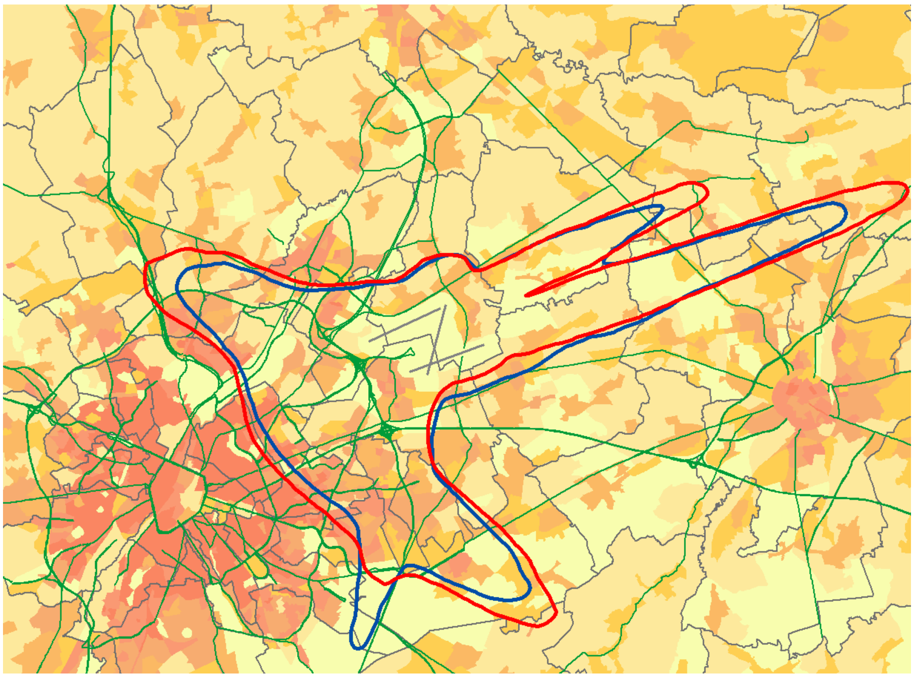
4.4.7 Freq.60,day – contours (day 07.00-23.00)

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 change in the freq.60, day noise contour of 50x above 60 dB(A) for 2012 and 2013 is also shown in Figure 12. In terms of shape, this noise contour has remained entirely comparable, but has significantly diminished in most areas, except for the increases as a result of the higher number of landings on runway 01 and the higher number of take-offs from runway 07R.

The total surface area within the 50x above the 60 dB(A) contour during the daytime period fell by approximately 11% from 15,337 ha in 2012 to 13,632 in 2013. This caused the population within this contour line to decline by approximately 21% from 220,312 in 2012 to 174,921 in 2013.

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

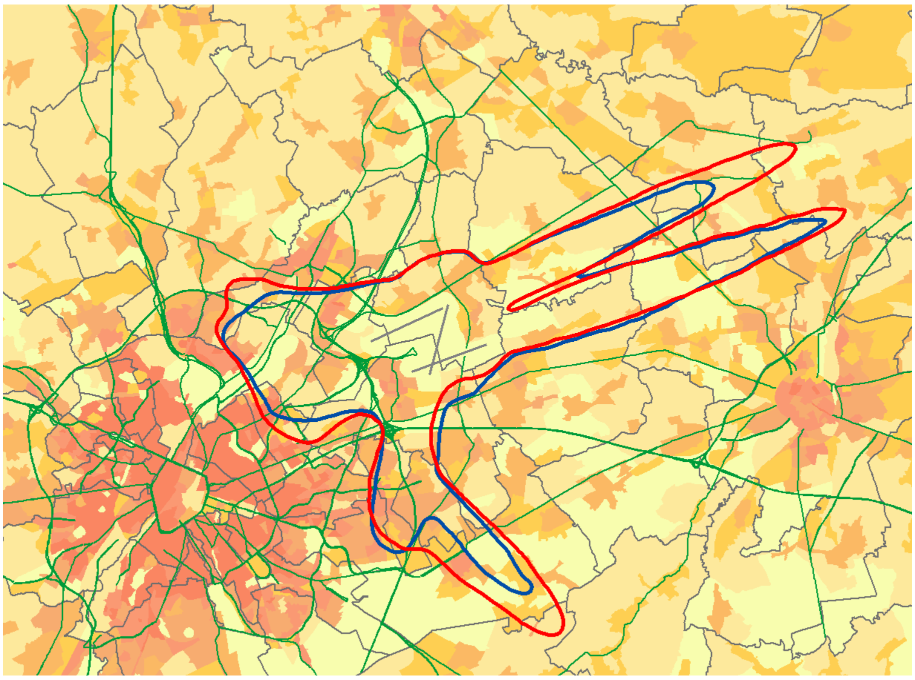


4.4.8 Freq.60,night contours (night 23.00-07.00)

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 from runway 19 with a turn to the east. The change in the freq.60,night noise contour of 10x above 60 dB(A) for 2012 and 2013 is also shown in Figure 13. Other than for the slight expansion of the contour surface area in the vicinity of runway 07R and alongside the extended line of runway 19, the contours have shrunk.

The total surface area within the 10x above 60 dB(A) contour fell by 15% from 12,236 ha in 2012 to 10,369 ha in 2013. This causes the number of residents living inside this contour to diminish by 20% from 117,284 in 2012 to 93,438 in 2013.

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

The number of people potentially highly inconvenienced per L_{den} contour zone and per municipality was established based on the dose-response ratio set out in the VLAREM regulations (see 2.2).

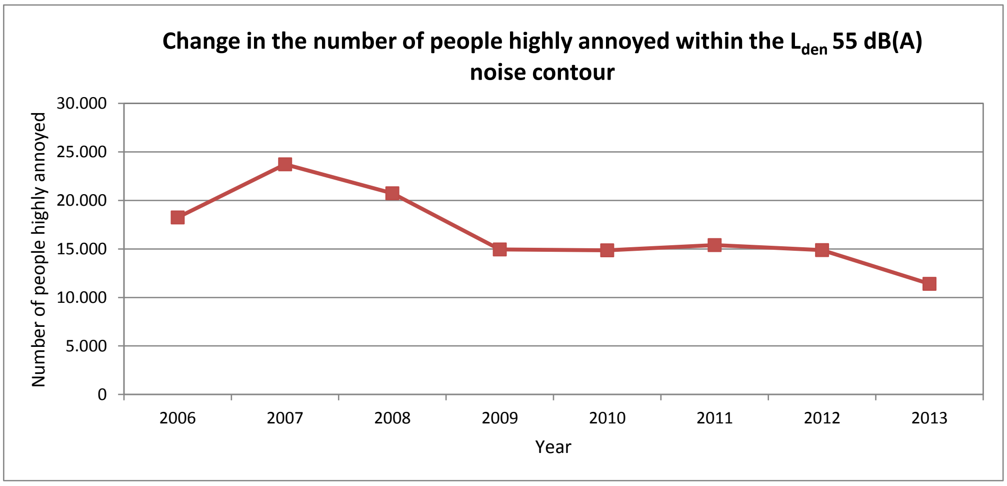
For 2013, the total number of people potentially highly inconvenienced living inside the L_{den} 55 dB(A) contour was 11,399. This represents a decline of around 23% compared against 2012, when 14,886 people were potentially highly inconvenienced, as a result of the significantly shrunk noise contours in the majority of directions. Especially the shrinking of the departure lobes from runway 25R from densely populated areas in the northwest of the Brussels Capital Region has acted to greatly reduce the number of people in that area who are potentially highly inconvenienced.

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

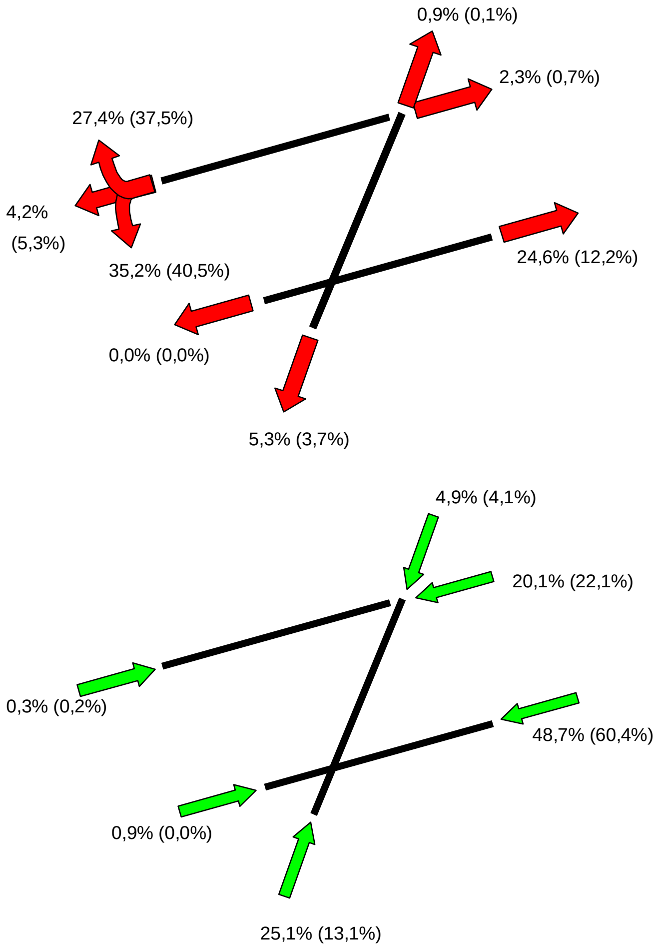
Figure 14 Change in the number of people highly inconvenienced within the L_{den} 55 dB(A) noise contour



Appendix 1. Runway use in 2013 (compared with 2012)

The runway use was derived from the Central Database (CDB) of Brussels Airport Company.

In Figure 16 up to and including



Runway	2012	2013
01	16	218
07L	180	532
07R	3.009	5.548
19	904	1.193
25L	5	12
25R	20.724	16.321

Runway	2012	2013
01	2.914	5.614
07L	57	68
07R	2	210
19	923	1.106
25L	13.465	10.877
25R	5.086	4.629

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 2013. As a comparison, the statistics for the year 2012 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 immediately after take-off, aircraft which turn south immediately after take-off, and those which first fly straight in a westerly direction after take-off. This latter group also contains flights that only 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 2012 and 2013.

In Figure 15 the nomenclature of the runways is shown. The past terminology for runways 20 and 02 was modified on 19/9/2013 to runways 19 and 01 respectively.

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

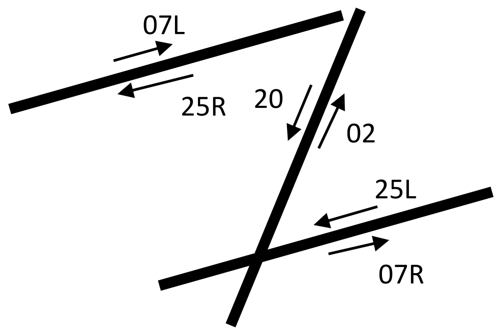
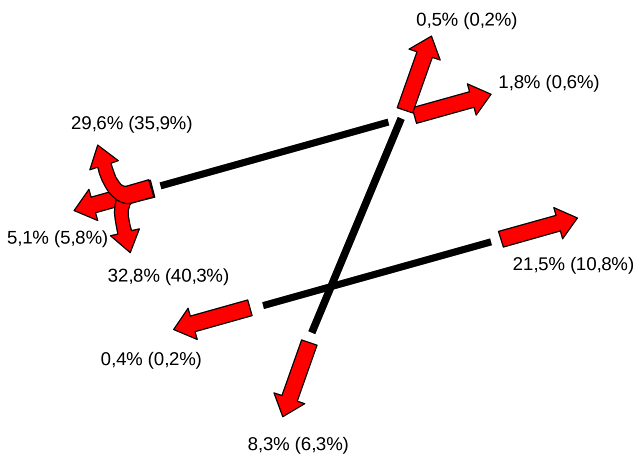
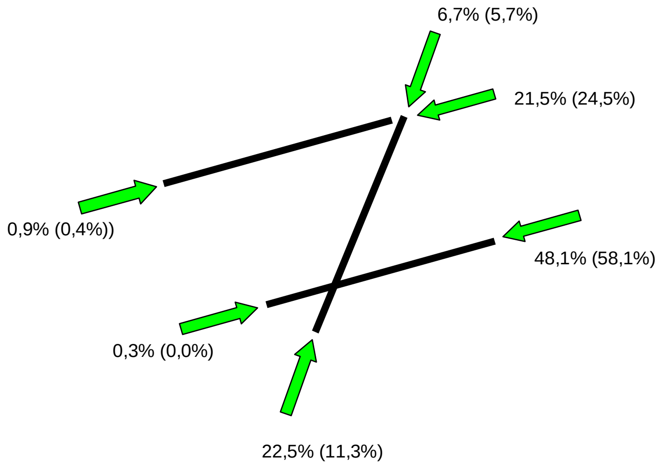


Figure 16 The runway use of the total number of departures and landings in 2013 (and 2012)

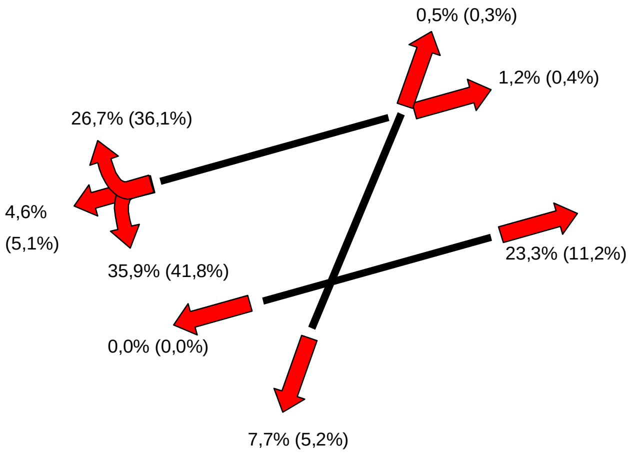


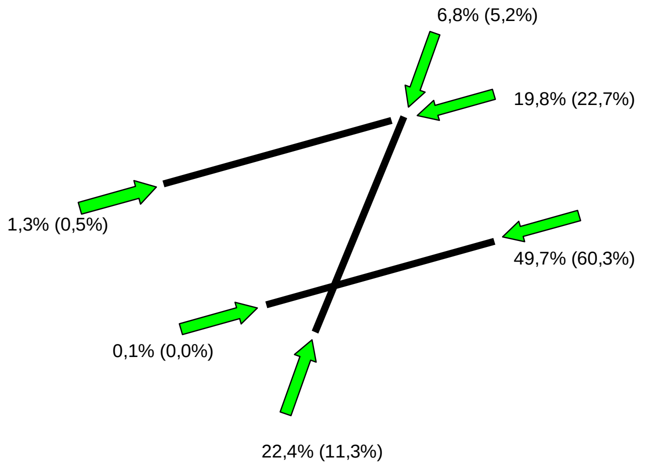


Runway	2012	2013
01	251	617
07L	692	2023
07R	11.893	23.030
19	7.033	8.910
25L	189	397
25R	91.656	73.364

Runway	2012	2013
01	12.550	24.163
07L	453	1.006
07R	11	316
19	6.281	7.229
25L	64.363	51.710
25R	28.059	23.912

Figure 17 The runway use of the total number of departures and arrivals in 2013 (and 2012) during the day (07.00-19.00)

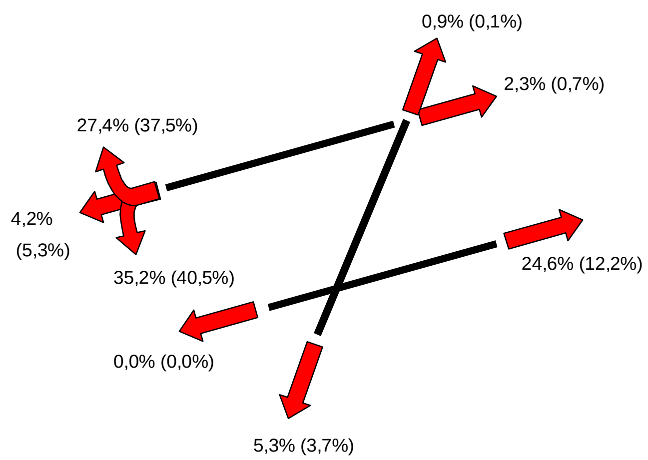


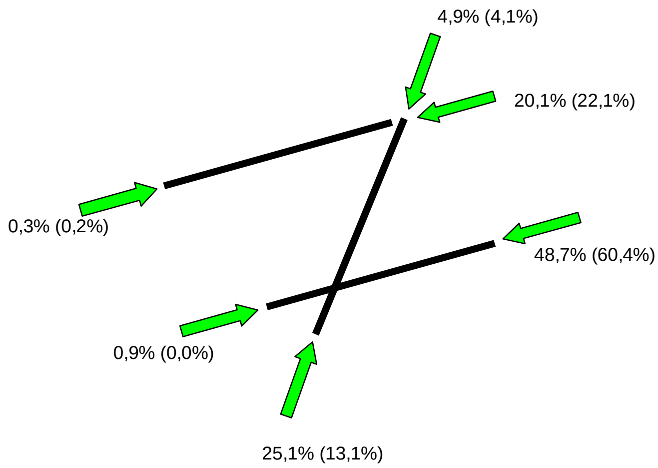


Runway	2012	2013
01	235	379
07L	299	913
07R	8.210	15.700
19	3.867	5.254
25L	23	36
25R	61.715	49.150

Runway	2012	2013
01	8.619	16.389
07L	392	924
07R	8	73
19	3.986	5.022
25L	46.061	36.390
25R	17.933	15.075

Figure 18 The runway use of the total number of departures and arrivals in 2013 (and 2012) during the evening (19.00-23.00)

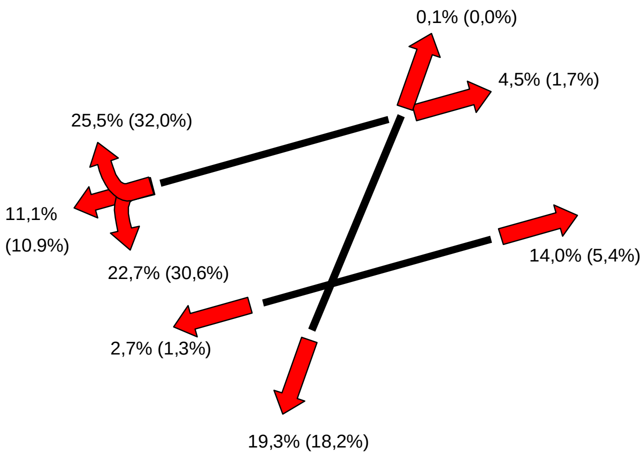


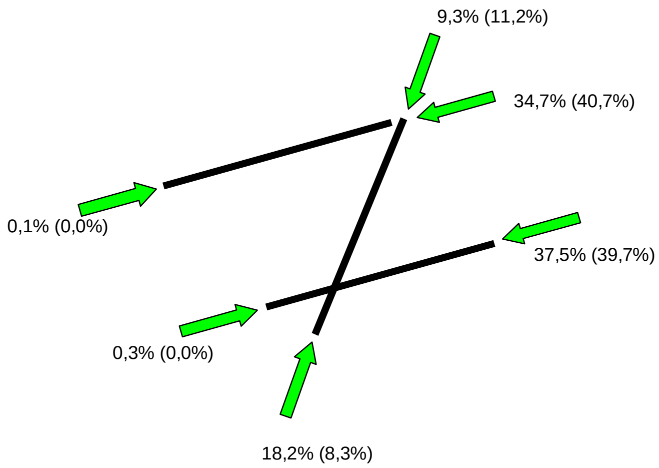


Runway	2012	2013
01	16	218
07L	180	532
07R	3.009	5.548
19	904	1.193
25L	5	12
25R	20.724	16.321

Runway	2012	2013
01	2.914	5.614
07L	57	68
07R	2	210
19	923	1.106
25L	13.465	10.877
25R	5.086	4.629

Figure 19 The runway use of the total number of take-offs and landings in 2013 (and 2012) during the night (23.00-07.00)



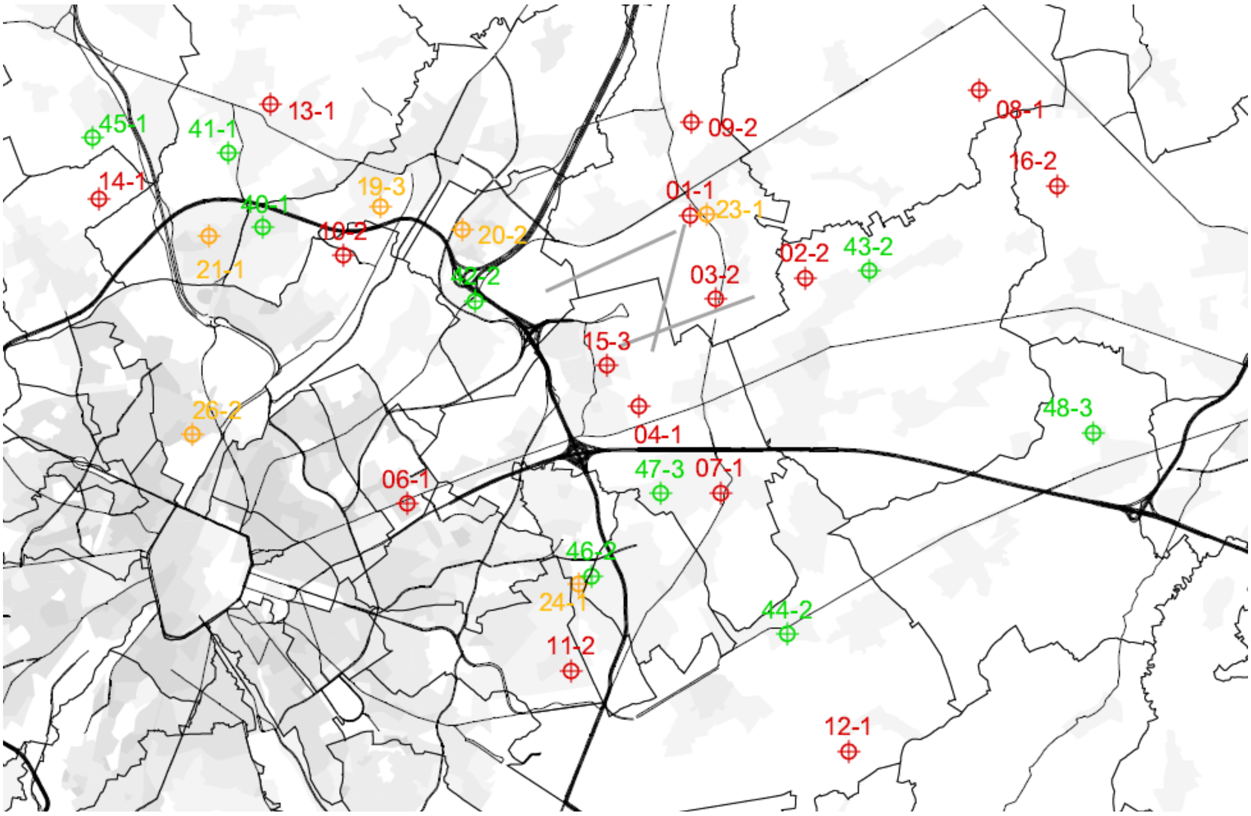


Runway	2012	2013
01	0	20
07L	213	578
07R	674	1.782
19	2.262	2.463
25L	161	349
25R	9.217	7.893

Runway	2012	2013
01	1.017	2.160
07L	4	14
07R	1	33
19	1.372	1.101
25L	4.837	4.443
25R	5.040	4.208

Appendix 2. Location of the noise monitoring terminals

Figure 20 Location of the noise monitoring terminals (situation as of 31/12/2013)



(source background: population map, density 1/1/2008)

Table 8 List of the noise monitoring terminals around Brussels Airport

NMT	Owner	Type	Location
1-1	Brussels Airport Company	Fixed	Steenokkerzeel
2-2	Brussels Airport Company	Fixed	Kortenberg
3-2	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. SIDs

For the most frequently-flown SIDs, where a large geographical spread is present, the various aircraft types are subdivided into groups before determining average INM routes according to the procedure set out below.

Based on the noise measurements of the monitoring network during the year 2013, the 20 most important aircraft types were identified which made a substantial contribution to the measured equivalent sound pressure levels at one or more measuring stations. The remaining aircraft types are always considered together.

Per SID, for each of the 20 aircraft types, and for the collection of remaining aircraft types, an average route was determined using the INM-link program. Based on the location of these average routes, it was decided which aircraft types are considered in one group. For these groups, an average INM route with a spread was determined using the INM tool.

If, for one of the 20 aircraft types for a given SID, fewer than 30 movements were carried out annually, then for the analysis of this SID, this aircraft type was considered jointly with the general group.

The 20 main aircraft types for 2013 are: A319, A320, RJ1H, B738, DH8D, E190, A321, A333, B763, E145, B737, A332, F70, B752, B733, E170, B734, F100, CRJ9, B744.

This division into different groups was carried out for a number of SIDs of runway 25R concerning daytime flights[13](06.00-23.00) (CIV1C, NIK2C, DEN3C, HEL3C, SPI2C and S0P3C) and for SID SOP2J from runway 07R. These SIDs were considered together with all other SIDs which proceed in a completely similar way in the initial period of the flight. This means that SID SOP3C was considered jointly with the SIDs ROUSY3C and PITES3C, that SID SPI2C was considered with SID LNO2C and that SID SOP2J was considered with the SIDs CIV5J, ROUSY3J and PITES4J.

The result of this procedure is shown in the table below. For each of the above-mentioned SIDs, the INM SID used is shown per aircraft type and for the group of 'other aircraft types'. The aircraft types (from the list of 20 main aircraft types) where fewer than 30 movements were carried out on the relevant SID are included in the former group. This latter are shown in the table in italics each time.

[13] During the night period (06.00-23.00) aircraft take off on runway 25R from the head of the runway as close as possible to the noise barriers. For this reason, the departure routes from runway 25R are modelled separately in the INM model for the operational day and night period.

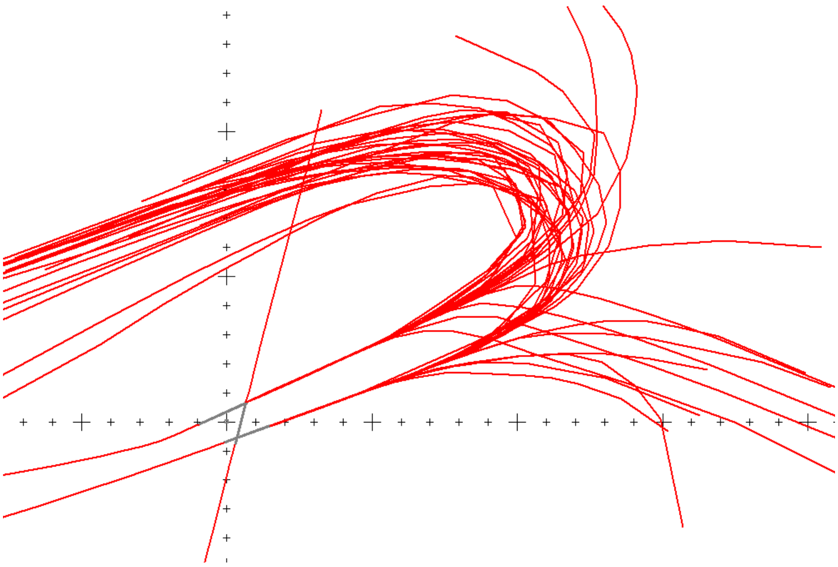
Table 9 Grouping of aircraft types for the most commonly-flown SIDs for determining the average INM routes

	SID						
Type	**CIV1C**	**DEN3C**	**HEL4C**	**NIK2C**	**SOP2J**	**SOP3C**	**SPI2C**
A306	*G1_CIV1C*	*G1_DEN3C*	G2_HEL4C	*G1_NIK2C*	*G1_SOP2J*	G1_SOP3C	*G1_SPI2C*
A319	G1_CIV1C	G1_DEN3C	G2_HEL4C	G2_NIK2C	G1_SOP2J	G2_SOP3C	G1_SPI2C
A320	G1_CIV1C	G1_DEN3C	G2_HEL4C	G2_NIK2C	G1_SOP2J	G1_SOP3C	G1_SPI2C
A321	G1_CIV1C	G1_DEN3C	G1_HEL4C	G1_NIK2C	G1_SOP2J	G3_SOP3C	G3_SPI2C
A332	G2_CIV1C	G2_DEN3C	*G1_HEL4C*	G3_NIK2C	G1_SOP2J	G4_SOP3C	G2_SPI2C
A333	G2_CIV1C	*G1_DEN3C*	G1_HEL4C	*G1_NIK2C*	G1_SOP2J	G4_SOP3C	G1_SPI2C
B733	G3_CIV1C	*G1_DEN3C*	*G1_HEL4C*	*G2_NIK2C*	G1_SOP2J	G1_SOP3C	G1_SPI2C
B734	*G1_CIV1C*	*G1_DEN3C*	*G1_HEL4C*	*G1_NIK2C*	G1_SOP2J	G3_SOP3C	G3_SPI2C
B737	G1_CIV1C	*G1_DEN3C*	*G1_HEL4C*	G1_NIK2C	G1_SOP2J	G4_SOP3C	*G1_SPI2C*
B738	G1_CIV1C	*G1_DEN3C*	*G1_HEL4C*	G1_NIK2C	G1_SOP2J	G1_SOP3C	G1_SPI2C
B744	*G1_CIV1C*	*G4_DEN3C*	G1_HEL4C	*G3_NIK2C*	G1_SOP2J	*G1_SOP3C*	*G1_SPI2C*
B752	*G1_CIV1C*	G2_DEN3C	*G4_HEL4C*	*G1_NIK2C*	G1_SOP2J	G1_SOP3C	*G1_SPI2C*
B763	G2_CIV1C	G2_DEN3C	G1_HEL4C	*G1_NIK2C*	G2_SOP2J	G3_SOP3C	*G1_SPI2C*
B772	*G1_CIV1C*	G4_DEN3C	G1_HEL4C	*G1_NIK2C*	*G1_SOP2J*	*G1_SOP3C*	*G1_SPI2C*
C130	G4_CIV1C	*G1_DEN3C*	*G1_HEL4C*	*G1_NIK2C*	*G1_SOP2J*	*G1_SOP3C*	*G1_SPI2C*
DH8D	G1_CIV1C	*G1_DEN3C*	G1_HEL4C	G1_NIK2C	G1_SOP2J	G1_SOP3C	G1_SPI2C
E190	G3_CIV1C	*G1_DEN3C*	G3_HEL4C	G2_NIK2C	G1_SOP2J	G2_SOP3C	G1_SPI2C
F100	G1_CIV1C	*G1_DEN3C*	G1_HEL4C	*G1_NIK2C*	G1_SOP2J	G1_SOP3C	*G1_SPI2C*
MD11	*G1_CIV1C*	*G1_DEN3C*	*G1_HEL4C*	*G1_NIK2C*	*G1_SOP2J*	G3_SOP3C	*G1_SPI2C*
RJ1H	G2_CIV1C	G3_DEN3C	G2_HEL4C	G3_NIK2C	G2_SOP2J	G4_SOP3C	G2_SPI2C

Appendix 3.2. Arrival routes

The 60 dB(A) level is, in itself, so low that the frequency contours for 60 dB(A) being exceeded are soon far away from the airport. This means that for landings the modelling of the landing routes on 1 line with only 2 sub-tracks cannot be used. Before intercepting the ILS, the flights can come from almost any direction. For the modelling, for runways 25L and 25R, we divided the range of landing routes per angle of approximately 10°. Per segment of the arc, an average route was defined with two sub-tracks and a percentage breakdown across the various routes. These average routes are shown in Figure21. Despite this extra modelling of the landing routes, it remains the case for the 60 dB(A) frequency contours that the length of the landing contours is so large that the INM standard vertical landing profile, which takes account of a constant landing angle of 3° for most aircraft can deviate from the actual landing profile.

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



Appendix 4. Results of contour calculations 2013

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 2013

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	495	68	0	0	0	563
EVERE	6	0	0	0	0	6
HERENT	152	0	0	0	0	152
KAMPENHOUT	241	18	0	0	0	258
KORTENBERG	449	216	43	3	0	711
KRAAINEM	102	0	0	0	0	102
MACHELEN	329	284	161	38	8	819
STEENOKKERZEEL	453	330	191	109	89	1171
VILVOORDE	12	0	0	0	0	12
WEZEMBEEK-OPPEM	78	0	0	0	0	78
ZAVENTEM	462	190	60	27	24	763
Grand total	***2779***	***1106***	***455***	***176***	***121***	***4637***

Table 11 Area per $L_{evening}$ contour zone and per municipality for the year 2013

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	719	438	59	0	0	0	1216
EVERE	289	77	0	0	0	0	366
GRIMBERGEN	97	0	0	0	0	0	97
HAACHT	140	0	0	0	0	0	140
HERENT	382	55	0	0	0	0	436
KAMPENHOUT	999	246	23	0	0	0	1269
KORTENBERG	567	456	153	25	0	0	1201
KRAAINEM	394	72	0	0	0	0	466
LEUVEN	1	0	0	0	0	0	1
MACHELEN	253	354	269	139	33	11	1048
OUDERGEM	0	0	0	0	0	0	0
SCHAARBEEK	224	0	0	0	0	0	224
SINT-LAMBRECHTS-WOLUWE	167	0	0	0	0	0	167
SINT-PIETERS-WOLUWE	210	0	0	0	0	0	210
STEENOKKERZEEL	440	478	332	187	104	73	1540
TERVUREN	96	0	0	0	0	0	96
VILVOORDE	561	13	0	0	0	0	574
WEZEMBEEK-OPPEM	164	66	0	0	0	0	230
ZAVENTEM	1201	414	158	51	24	21	1848
ZEMST	0	0	0	0	0	0	0
Grand total	***6998***	***2668***	***994***	***401***	***161***	***104***	***11222***

Table 12 Area per L_{night} contour zone and per municipality for the year 2013

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	25	0	0	0	0	0	25
BRUSSELS	744	321	9	0	0	0	1074
EVERE	241	0	0	0	0	0	241
GRIMBERGEN	224	0	0	0	0	0	224
HAACHT	447	0	0	0	0	0	447
HERENT	485	126	0	0	0	0	611
KAMPENHOUT	1042	336	72	0	0	0	1449
KORTENBERG	515	423	177	1	0	0	1116
KRAAINEM	273	66	0	0	0	0	339
LEUVEN	108	0	0	0	0	0	108
MACHELEN	275	384	380	23	9	0	1071
OUDERGEM	6	0	0	0	0	0	6
SCHAARBEEK	11	0	0	0	0	0	11
SINT-LAMBRECHTS-WOLUWE	9	0	0	0	0	0	9
SINT-PIETERS-WOLUWE	186	0	0	0	0	0	186
STEENOKKERZEEL	444	494	541	118	100	0	1697
TERVUREN	392	0	0	0	0	0	392
VILVOORDE	508	14	0	0	0	0	522
WEZEMBEEK-OPPEM	319	69	0	0	0	0	388
ZAVENTEM	1514	624	346	30	21	0	2535
ZEMST	50	0	0	0	0	0	50
Grand total	***7817***	***2857***	***1525***	***172***	***130***	***0***	***12501***

Table 13 Area per L_{den} contour zone and per municipality for the year 2013

Area (ha)	L_{den} - contour zone in dB(A) (d. 07h-19h, av. 19h-23h, n. 23h-07h)					
Gemeente	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
BRUSSELS	692	211	2	0	0	905
EVERE	194	0	0	0	0	194
HAACHT	128	0	0	0	0	128
HERENT	352	18	0	0	0	370
KAMPENHOUT	839	158	15	0	0	1012
KORTENBERG	466	358	93	14	0	931
KRAAINEM	193	31	0	0	0	224
MACHELEN	318	328	234	77	22	979
SCHAARBEEK	11	0	0	0	0	11
SINT-PIETERS-WOLUWE	111	0	0	0	0	111
STEENOKKERZEEL	478	435	282	162	157	1514
TERVUREN	10	0	0	0	0	10
VILVOORDE	251	0	0	0	0	251
WEZEMBEEK-OPPEM	149	12	0	0	0	161
ZAVENTEM	958	430	141	46	37	1612
ZEMST	2	0	0	0	0	2
Grand total	***5152***	***1981***	***767***	***299***	***216***	***8415***

Table 14 Area per freq.70,day contour zone and per municipality for the year 2013

Area (ha)	Freq.70,day contour zone (day 07.00-23.00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Totaal**
BERTEM	19				0	19
BOORTMEERBEEK	129	5			0	135
BRUSSELS	438	207	519	273	28	1466
EVERE	121	253	137		0	511
GRIMBERGEN	743	373			0	1116
HAACHT	153	77	48		0	278
HERENT	341	117	186	101	0	744
KAMPENHOUT	549	566	528	103	1	1854
KORTENBERG	259	235	239	262	350	1344
KRAAINEM	19	225	154	48	0	470
LEUVEN	42	4			0	47
MACHELEN	63	80	208	182	482	1016
MEISE	29				0	29
OUDERGEM	74	0			0	74
SCHAARBEEK	125				0	125
SINT-LAMBRECHTS-WOLUWE	172	270	4		0	446
SINT-PIETERS-WOLUWE	87	91	96		0	275
STEENOKKERZEEL	147	285	251	382	559	1633
TERVUREN	105	87	1		0	193
VILVOORDE	172	339	200		0	712
WATERMAAL-BOSVOORDE	8				0	8
WEMMEL	149				0	149
WEZEMBEEK-OPPEM	192	44	96	39	0	372
ZAVENTEM	478	611	487	489	82	2453
ZEMST	45	45			0	89
Grand total	***4660***	***3915***	***3154***	***1879***	***1503***	***15557***

Table 15 Area per freq.70,night contour zone and per municipality for the year 2013

Area (ha)	Freq.70,night contour zone (night 23.00-07.00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
BOORTMEERBEEK	260				260
BRUSSELS	797	506	139		1443
EVERE	405				405
GRIMBERGEN	635				635
HAACHT	299	98			397
HERENT	331	218	60		608
KAMPENHOUT	918	427	203		1547
KORTENBERG	508	246	458		1212
KRAAINEM	326	121			456
LEUVEN	50				50
MACHELEN	219	199	290	299	1007
MECHELEN	56				56
OUDERGEM	90				90
SCHAARBEEK	64				64
SINT-LAMBRECHTS-WOLUWE	297				297
SINT-PIETERS-WOLUWE	227	2			229
STEENOKKERZEEL	462	233	562	378	1635
TERVUREN	811				811
VILVOORDE	523	75			598
WATERMAAL-BOSVOORDE	23				23
WEZEMBEEK-OPPEM	268	102			371
ZAVENTEM	1410	595	511	46	2646
ZEMST	104				104
Grand total	***9083***	***2821***	***2223***	***723***	***14944***

Table 16 Area per freq.60,day contour zone and per municipality for the year 2013

Area (ha)	Freq.60,day contour zone (day 07.00-23.00)				
Municipality	50-100	100-150	150-200	>200	Total
BRUSSELS	475	385	139		999
EVERE	397	0			397
GRIMBERGEN	344				344
HAACHT	115	136			251
HERENT	280	388	93		762
KAMPENHOUT	1116	102	17		1235
KORTENBERG	435	232	604	26	1298
KRAAINEM	291				576
LEUVEN	255	5			259
MACHELEN	162	185	662	56	1065
OUDERGEM	88				88
ROTSELAAR	149				149
SINT-LAMBRECHTS-WOLUWE	386				386
SINT-PIETERS-WOLUWE	268				354
STEENOKKERZEEL	262	249	347	671	1529
TERVUREN	951				951
VILVOORDE	489	0			490
WATERMAAL-BOSVOORDE	16				16
WEZEMBEEK-OPPEM	446				650
ZAVENTEM	1081	274	191	220	1835
Grand total	***8005***	***1958***	***2053***	***972***	***13632***

Table 17 Area per freq.60,night contour zone and per municipality for the year 2013

Area (ha)	Freq.60,night contour zone (night 23.00-07.00)				
Municipality	10-15	15-20	20-30	>30	Total
BRUSSELS	480	340	164		984
EVERE	104				104
HAACHT	376				376
HERENT	601	107			708
KAMPENHOUT	971	370	14		1355
KORTENBERG	266	728	56		1050
KRAAINEM	293	70			364
LEUVEN	168				168
MACHELEN	112	160	763	22	1057
ROTSELAAR	9				9
SINT-LAMBRECHTS-WOLUWE	0				0
SINT-PIETERS-WOLUWE	105				105
STEENOKKERZEEL	162	121	585	746	1615
TERVUREN	334				334
VILVOORDE	154	6			160
WEZEMBEEK-OPPEM	452	82			533
ZAVENTEM	495	383	306	262	1447
Grand total	***5083***	***2367***	***1888***	***1031***	***10369***

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 2013

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	3363	1121	0	0	0	4485
EVERE	389	0	0	0	0	389
HERENT	219	0	0	0	0	219
KAMPENHOUT	622	118	0	0	0	740
KORTENBERG	2001	540	17	1	0	2560
KRAAINEM	1588	0	0	0	0	1588
MACHELEN	4087	3675	1034	1	0	8796
STEENOKKERZEEL	4062	1339	166	5	2	5574
VILVOORDE	35	0	0	0	0	35
WEZEMBEEK-OPPEM	1650	0	0	0	0	1650
ZAVENTEM	4719	689	100	0	0	5509
Grand total	***22737***	***7482***	***1318***	***7***	***2***	***31546***

Table 19 Number of inhabitants per $L_{evening}$ contour zone and per municipality for the year 2013

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	8774	3469	961	0	0	0	13203
EVERE	19154	4041	0	0	0	0	23196
GRIMBERGEN	3111	0	0	0	0	0	3111
HAACHT	241	0	0	0	0	0	241
HERENT	987	19	0	0	0	0	1006
KAMPENHOUT	3883	724	135	0	0	0	4742
KORTENBERG	3636	1725	286	10	0	0	5656
KRAAINEM	11387	807	0	0	0	0	12194
LEUVEN	2	0	0	0	0	0	2
MACHELEN	3643	4523	3386	820	3	0	12374
SCHAARBEEK	43551	0	0	0	0	0	43551
SINT-LAMBRECHTS-WOLUWE	5497	0	0	0	0	0	5497
SINT-PIETERS-WOLUWE	8405	0	0	0	0	0	8405
STEENOKKERZEEL	2993	4417	1225	168	4	1	8808
TERVUREN	3	0	0	0	0	0	3
VILVOORDE	11672	36	0	0	0	0	11708
WEZEMBEEK-OPPEM	4060	1369	0	0	0	0	5429
ZAVENTEM	17866	4757	440	56	0	0	23119
ZEMST	0	0	0	0	0	0	0
Grand total	***148866***	***25888***	***6432***	***1054***	***7***	***1***	***182247***

Table 20 Number of inhabitants per L_{night} contour zone and per municipality for the year 2013

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	10	0	0	0	0	0	10
BRUSSELS	6412	3826	40	0	0	0	10277
EVERE	11903	0	0	0	0	0	11903
GRIMBERGEN	5153	0	0	0	0	0	5153
HAACHT	990	0	0	0	0	0	990
HERENT	1267	125	0	0	0	0	1393
KAMPENHOUT	3459	1058	289	0	0	0	4805
KORTENBERG	3370	1529	305	1	0	0	5204
KRAAINEM	7920	612	0	0	0	0	8532
LEUVEN	257	0	0	0	0	0	257
MACHELEN	3622	5302	3630	0	0	0	12554
OUDERGEM	1	0	0	0	0	0	1
SCHAARBEEK	662	0	0	0	0	0	662
SINT-LAMBRECHTS-WOLUWE	301	0	0	0	0	0	301
SINT-PIETERS-WOLUWE	6804	0	0	0	0	0	6804
STEENOKKERZEEL	2584	4450	1927	51	3	0	9016
TERVUREN	2948	0	0	0	0	0	2948
VILVOORDE	9241	41	0	0	0	0	9282
WEZEMBEEK-OPPEM	6749	1410	0	0	0	0	8158
ZAVENTEM	17423	10054	961	0	0	0	28439
ZEMST	66	0	0	0	0	0	66
Grand total	***91140***	***28407***	***7152***	***51***	***3***	***0***	***126754***

Table 21 Number of inhabitants per L_{den} contour zone and per municipality for the year 2013

Number of inhabitants	L_{den} - contour zone in dB(A) (d. 07h-19h, av. 19h-23h, n. 23h-07h)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
BRUSSELS	2256	3162	9	0	0	5427
EVERE	10357	0	0	0	0	10357
HAACHT	218	0	0	0	0	218
HERENT	861	6	0	0	0	867
KAMPENHOUT	2491	502	111	0	0	3104
KORTENBERG	2763	1089	109	6	0	3966
KRAAINEM	4713	80	0	0	0	4793
MACHELEN	4265	4425	2726	39	0	11454
SCHAARBEEK	739	0	0	0	0	739
SINT-PIETERS-WOLUWE	3595	0	0	0	0	3595
STEENOKKERZEEL	3668	3377	738	140	5	7927
TERVUREN	0	0	0	0	0	0
VILVOORDE	2876	0	0	0	0	2876
WEZEMBEEK-OPPEM	3269	182	0	0	0	3451
ZAVENTEM	14442	3693	303	13	0	18450
ZEMST	2	0	0	0	0	2
Grand total	***56516***	***16517***	***3994***	***197***	***5***	***77229***

Table 22 Number of inhabitants per freq.70,day contour zone and per municipality for the year 2013

Number of inhabitants	Freq.70,day contour zone (day 07.00-23.00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Totaal**
BERTEM	10				0	10
BOORTMEERBEEK	930	1			0	931
BRUSSELS	19908	4925	1360	3359	226	29778
EVERE	11944	18422	5437		0	35803
GRIMBERGEN	8397	11053			0	19450
HAACHT	187	140	87		0	414
HERENT	1497	292	656	35	0	2479
KAMPENHOUT	2246	1646	1718	289	1	6164
KORTENBERG	1253	1502	1570	1172	946	6442
KRAAINEM	376	7337	3909	194	0	12257
LEUVEN	86	9			0	95
MACHELEN	829	1827	2707	2319	4317	11999
MEISE	358				0	358
OUDERGEM	8	0			0	8
SCHAARBEEK	16979				0	16979
SINT-LAMBRECHTS-WOLUWE	9203	12496	14		0	21713
SINT-PIETERS-WOLUWE	4067	4369	2896		0	11332
STEENOKKERZEEL	813	1537	2699	2692	593	8507
TERVUREN	345	3	0		0	348
VILVOORDE	6487	7383	2718		0	16588
WATERMAAL-BOSVOORDE	0				0	0
WEMMEL	1051				0	1051
WEZEMBEEK-OPPEM	4010	1097	2158	806	0	8070
ZAVENTEM	3847	10646	5116	3360	471	28481
ZEMST	60	59			0	119
Grand total	***94888***	***84745***	***33045***	***14225***	***6554***	***239376***

Table 23 Number of inhabitants per freq.70,night contour zone and per municipality for the year 2013

Number of inhabitants	Freq.70,night contour zone (night 23.00-07.00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
BOORTMEERBEEK	2095				2095
BRUSSELS	20271	1814	2752		24836
EVERE	25484				25484
GRIMBERGEN	12768				12768
HAACHT	725	157			882
HERENT	896	662	21		1578
KAMPENHOUT	2872	1369	719		4960
KORTENBERG	3171	1117	1431		5720
KRAAINEM	9791	2013			11964
LEUVEN	101				101
MACHELEN	3231	2944	4340	1306	11822
MECHELEN	196				196
OUDERGEM	10				10
SCHAARBEEK	11488				11488
SINT-LAMBRECHTS-WOLUWE	13808				13808
SINT-PIETERS-WOLUWE	8929	24			8953
STEENOKKERZEEL	2635	2556	3103	363	8657
TERVUREN	5356				5356
VILVOORDE	11226	386			11613
WATERMAAL-BOSVOORDE	0				0
WEZEMBEEK-OPPEM	5582	2030			7613
ZAVENTEM	17927	7912	3510	104	29870
ZEMST	139				139
Grand total	***158701***	***22985***	***15876***	***1774***	***199913***

Table 24 Number of inhabitants per freq.60,day contour zone and per municipality for the year 2013

Number of inhabitants	Freq.60,day contour zone (day 07.00-23.00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
BRUSSELS	5596	1619	2773		9989
EVERE	25493	2			25495
GRIMBERGEN	4726				4726
HAACHT	278	249			527
HERENT	612	1108	32		1753
KAMPENHOUT	3936	48	7		3991
KORTENBERG	3643	1104	2244	12	7003
KRAAINEM	6336				13259
LEUVEN	946	10			956
MACHELEN	2249	2565	7748	19	12581
OUDERGEM	10				10
ROTSELAAR	351				351
SINT-LAMBRECHTS-WOLUWE	18608				18608
SINT-PIETERS-WOLUWE	9894				14075
STEENOKKERZEEL	1921	1853	2723	1964	8462
TERVUREN	8867				8867
VILVOORDE	8733	1			8734
WATERMAAL-BOSVOORDE	0				0
WEZEMBEEK-OPPEM	8361				13249
ZAVENTEM	13397	4318	2729	1608	22287
Grand total	***123956***	***12877***	***18257***	***3603***	***174921***

Table 25 Number of inhabitants per freq.60,night contour zone and per municipality for the year 2013

Number of inhabitants	Freq.60,night contour zone (night 23.00-07.00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
BRUSSELS	5757	1178	2993		9928
EVERE	6553				6553
HAACHT	623				623
HERENT	1488	44			1532
KAMPENHOUT	3281	1442	40		4763
KORTENBERG	1229	2811	28		4069
KRAAINEM	8696	361			9057
LEUVEN	434				434
MACHELEN	1431	2290	8725	6	12452
ROTSELAAR	26				26
SINT-LAMBRECHTS-WOLUWE	1				1
SINT-PIETERS-WOLUWE	5118				5118
STEENOKKERZEEL	1184	925	2950	4052	9111
TERVUREN	1665				1665
VILVOORDE	1395	16			1410
WEZEMBEEK-OPPEM	9463	1636			11099
ZAVENTEM	3807	3976	5531	2282	15596
Grand total	***52151***	***14679***	***20269***	***6340***	***93438***

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 2013

Number of people potentially highly annoyed	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	304	621	2	0	0	**928**
EVERE	1142	0	0	0	0	**1142**
HAACHT	24	0	0	0	0	**24**
HERENT	106	1	0	0	0	**107**
KAMPENHOUT	301	99	30	0	0	**430**
KORTENBERG	352	219	30	2	0	**603**
KRAAINEM	575	14	0	0	0	**589**
MACHELEN	563	911	790	15	0	**2278**
SCHAARBEEK	76	0	0	0	0	**76**
SINT-PIETERS-WOLUWE	390	0	0	0	0	**390**
STEENOKKERZEEL	500	684	213	56	3	**1455**
TERVUREN	0	0	0	0	0	**0**
VILVOORDE	302	0	0	0	0	**302**
WEZEMBEEK-OPPEM	424	33	0	0	0	**457**
ZAVENTEM	1805	718	90	5	0	**2618**
ZEMST	0	0	0	0	0	**0**
Grand total	***6864***	***3300***	***1155***	***77***	***3***	***11399***

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 (2006-2013)

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**

* Calculated with INM 7.0b

Figure 22 Change in the area within the L_{day} contours (2006-2013)

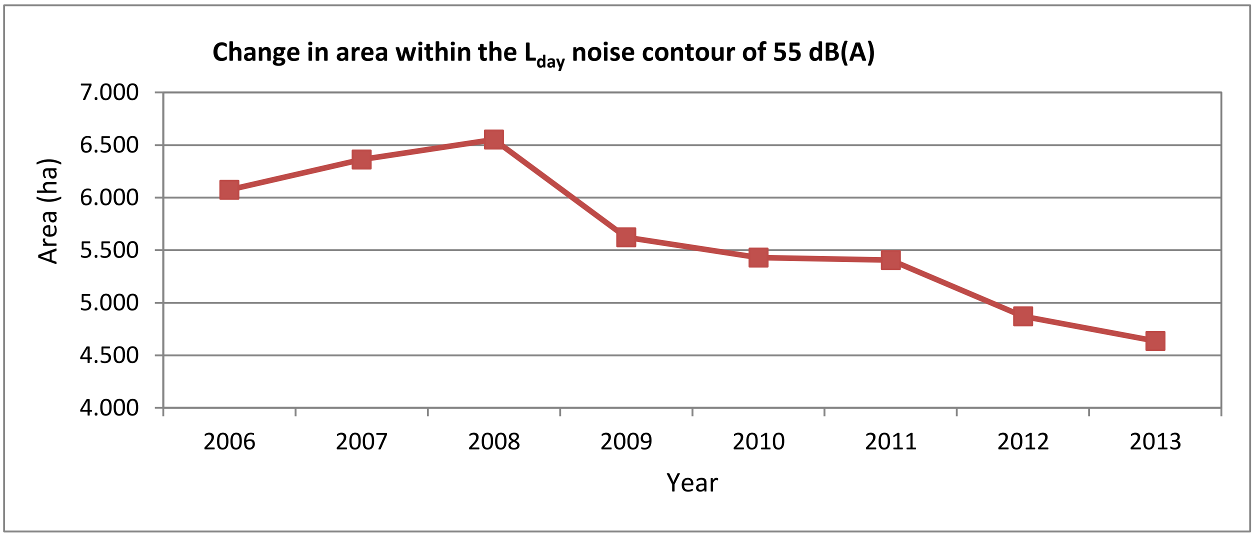


Table 28 Change in the area within the $L_{evening}$ contours (2006-2013)

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**

* Calculated with INM 7.0b

Figure 23 Change in the area within the $L_{evening}$ contours (2006-2013)

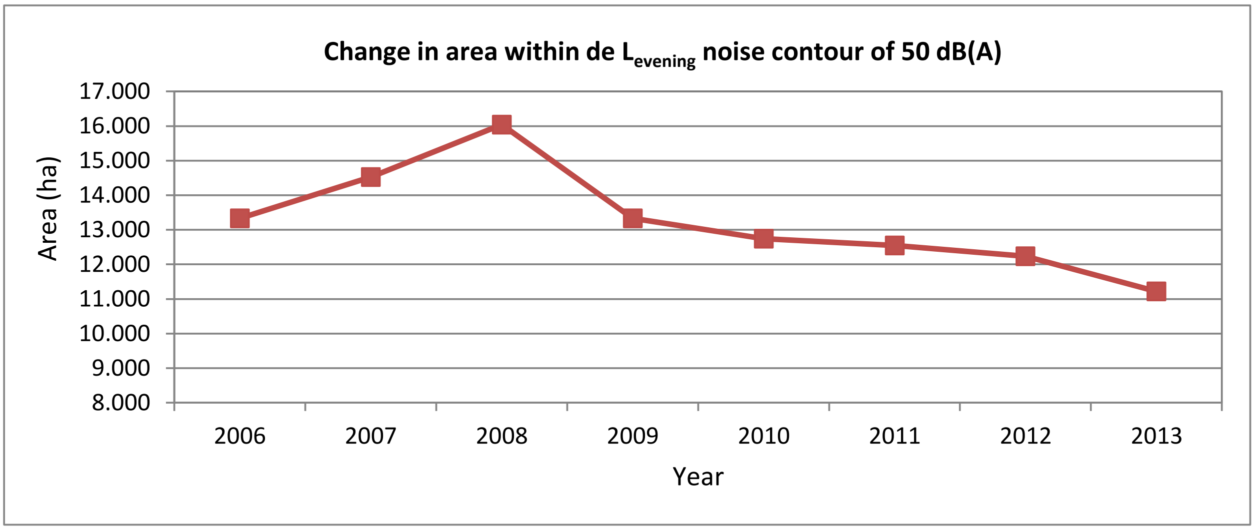


Table 29 Change in the area within the L_{night} contours (2006-2013)

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**

* Calculated with INM 7.0b

Figure 24 Change in the area within the L_{night} contours (2006-2013)

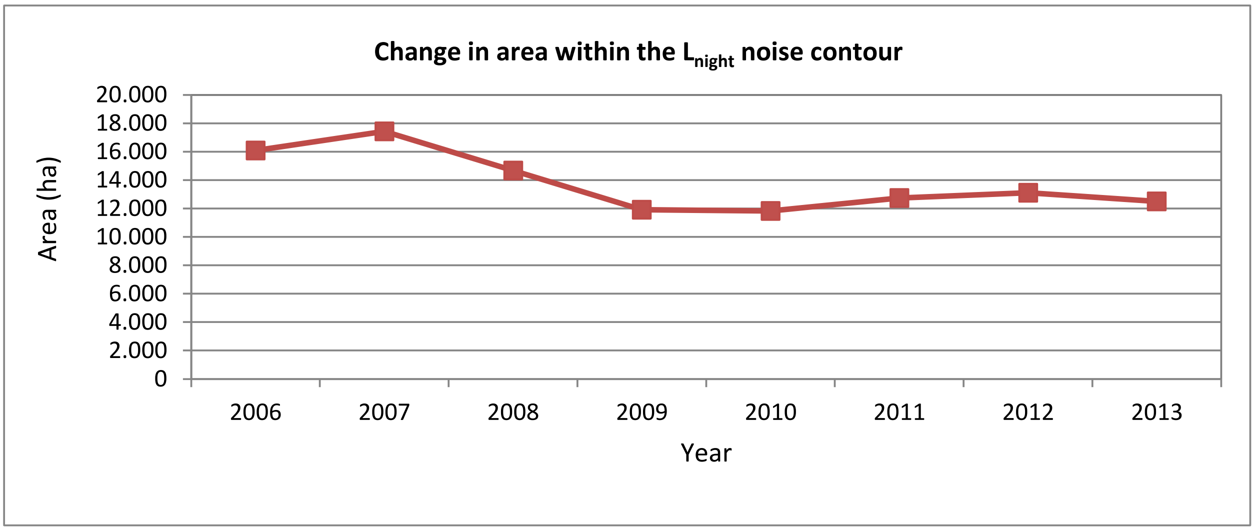


Table 30 Change in the area within the L_{den} contours (2006-2013)

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**

* Calculated with INM 7.0b

Figure 25 Change in the area within the L_{den} contours (2006-2013)

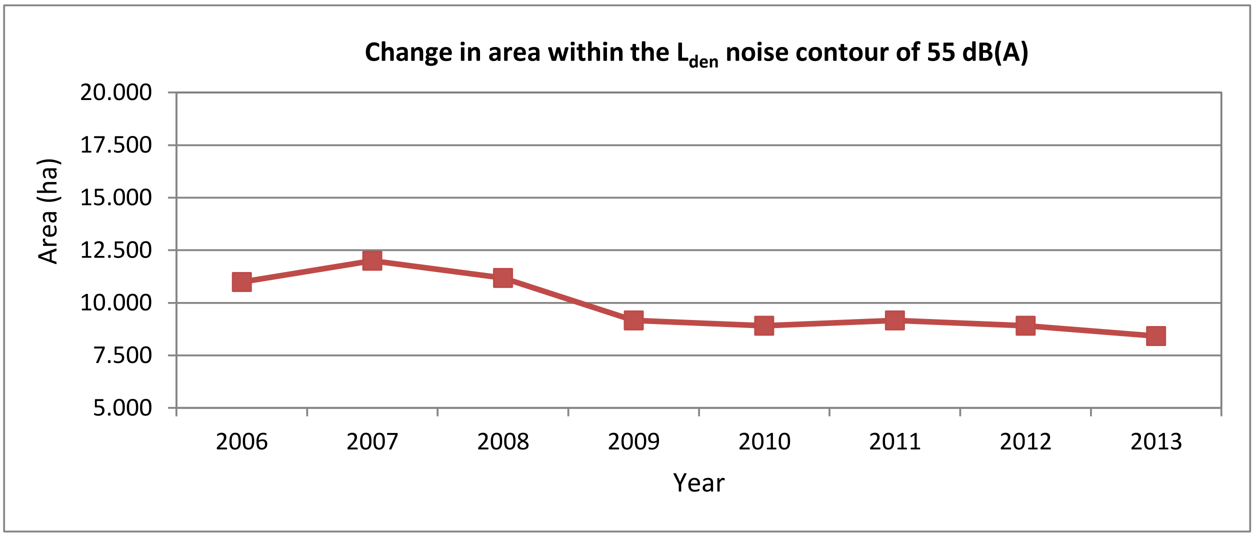


Table 31 Change in the area within the Freq.70,day contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 26 Change in the area within the Freq.70,day contours (2010-2013)

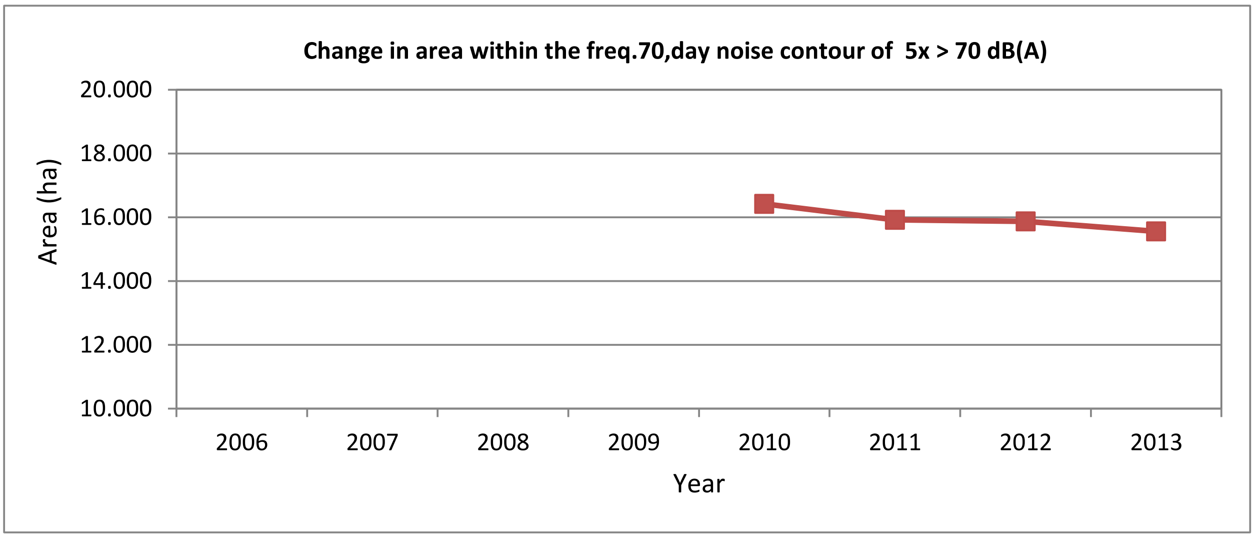


Table 32 Change in the area within the Freq.70,night contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 27 Change in the area within the Freq.70,night contours (2010-2013)

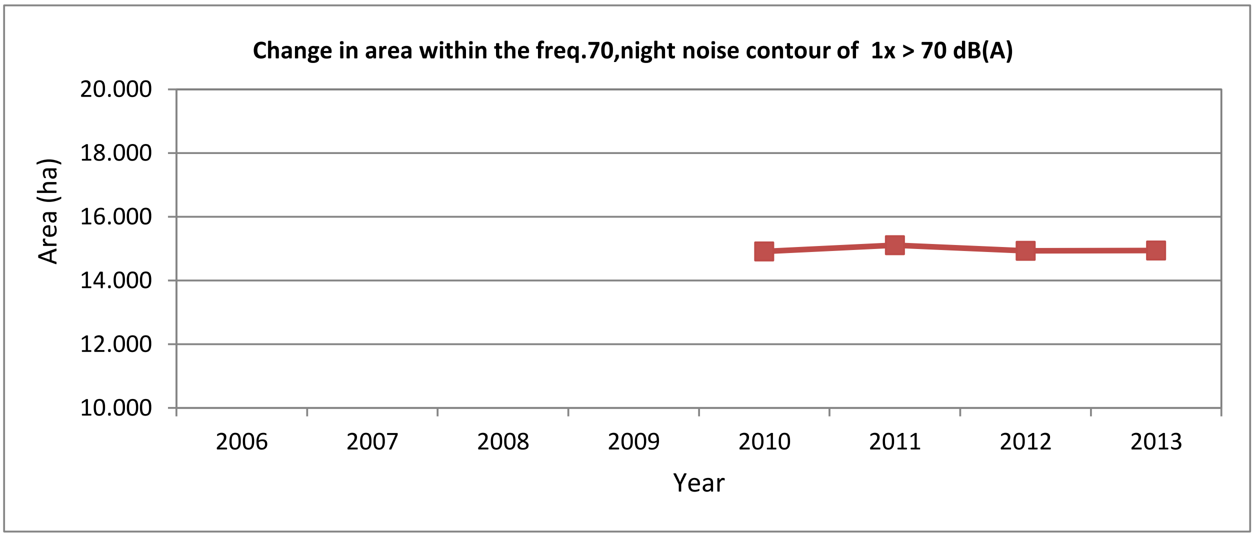


Table 33 Change in the area within the Freq.60,day contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 28 Change in the area within the Freq.60,day contours (2010-2013)

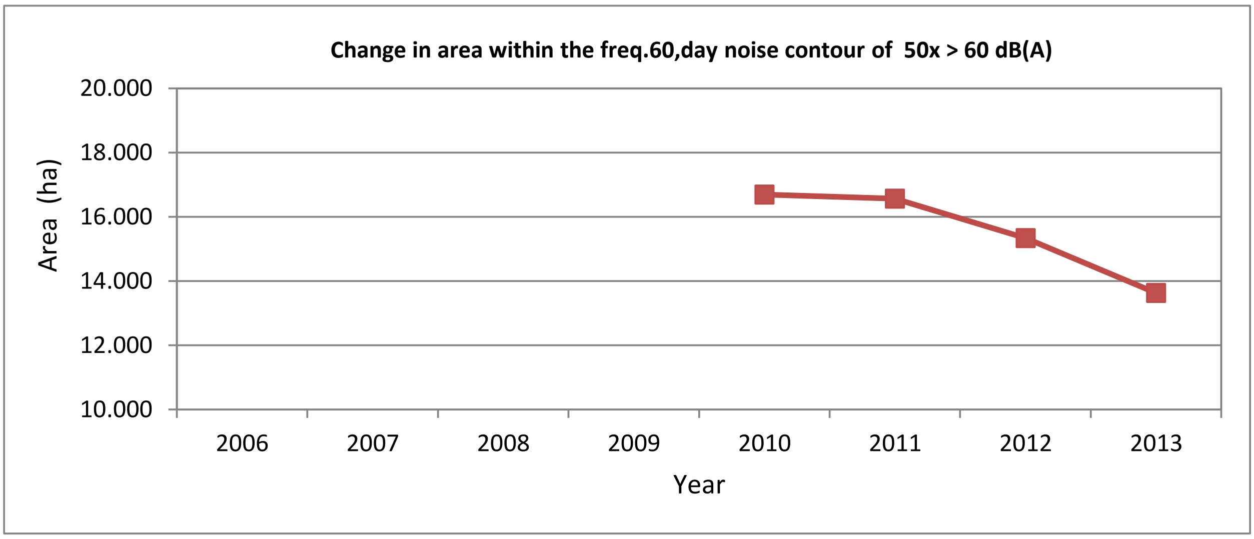
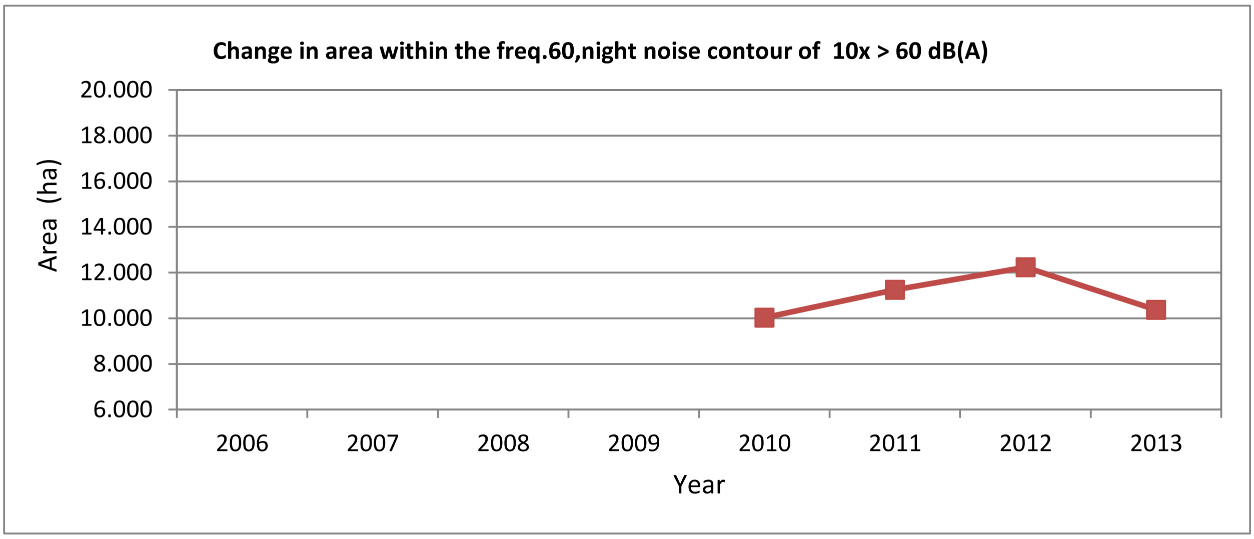


Table 34 Change in the area within the Freq.60,night contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 29 Change in the area within the Freq.60,night contours (2010-2013)



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 (2006-2013)

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**

* Calculated with INM 7.0b

Figure 30 Change in the number of inhabitants within the L_{day} contours (2006-2013)

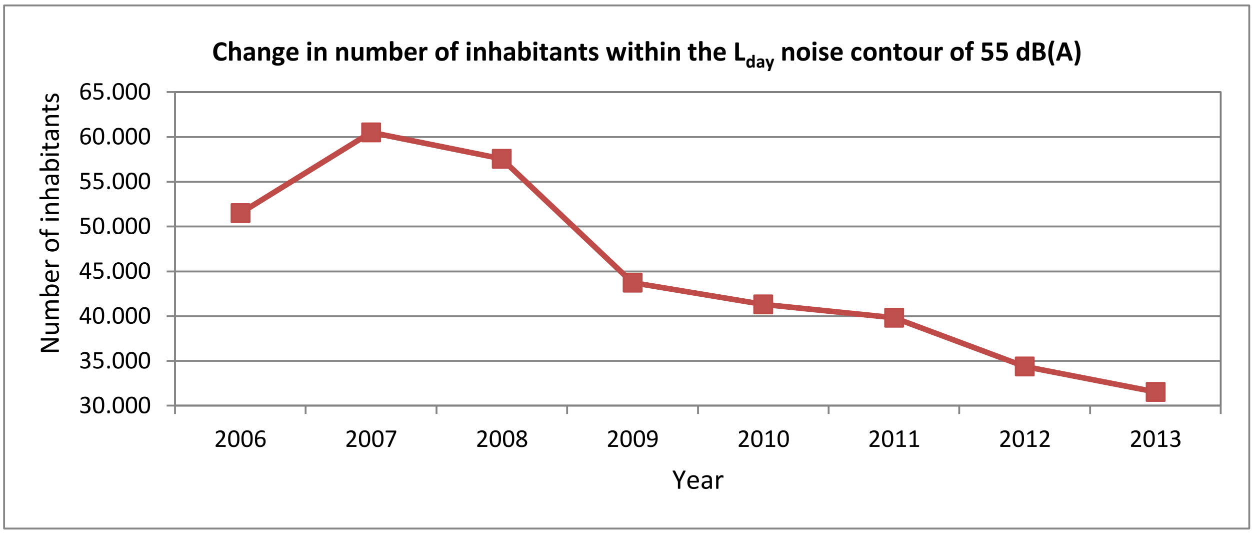


Table 36 Change in the number of inhabitants within the $L_{evening}$ contours (2006-2013)

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**

* Calculated with INM 7.0b

Figure 31 Change in the number of inhabitants within the $L_{evening}$ contours (2006-2013)

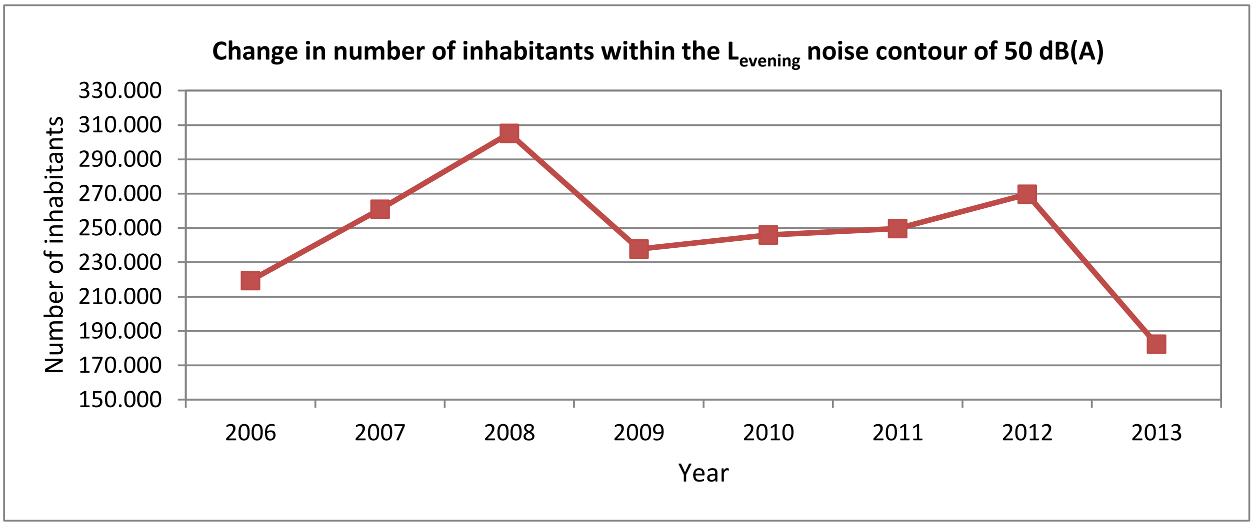


Table 37 Change in the number of inhabitants within the L_{night} contours (2006-2013)

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**
2005	01jan03	76.926	21.319	5.663	533	95	3	**104.539**
2006	01jan03	72.848	20.601	5.582	594	135	2	**99.762**
2007	01jan06	111.136	21.026	6.945	909	142	2	**140.160**
2008	01jan07	79.797	18.555	5.254	457	66	3	**104.132**
2009	01jan07	60.093	13.765	4.153	327	27	2	**78.367**
2010	01jan08	62.896	15.011	3.918	329	18	5	**82.177**
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**

* Calculated with INM 7.0b

Figure 32 Change in the number of inhabitants within the L_{night} contours (2006-2013)

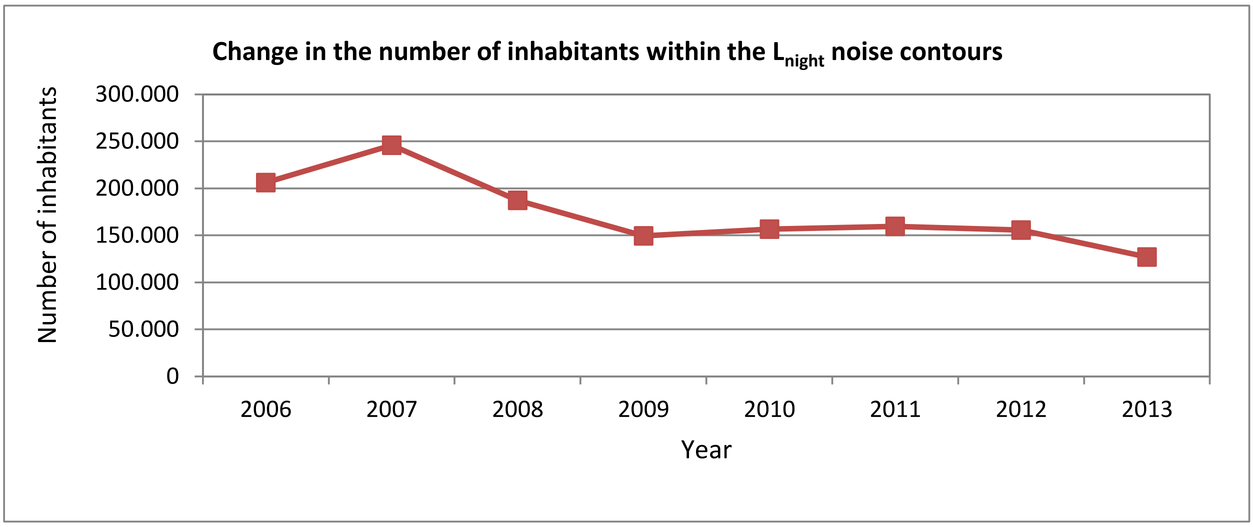


Table 38 Change in the number of inhabitants within the L_{den} contours (2006-2013)

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**

* Calculated with INM 7.0b

Figure 33 Change in the number of inhabitants within the L_{den} contours (2006-2013)

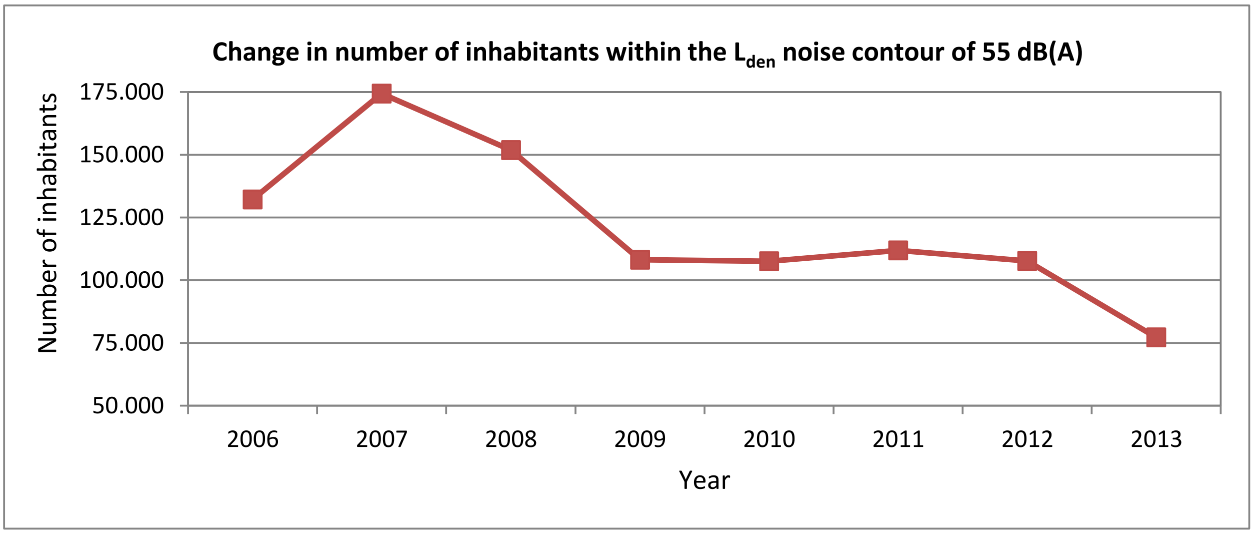


Table 39 Change in the number of inhabitants within the Freq.70,day contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 34 Change in the number of inhabitants within the Freq.70,day contours (2010-2013)

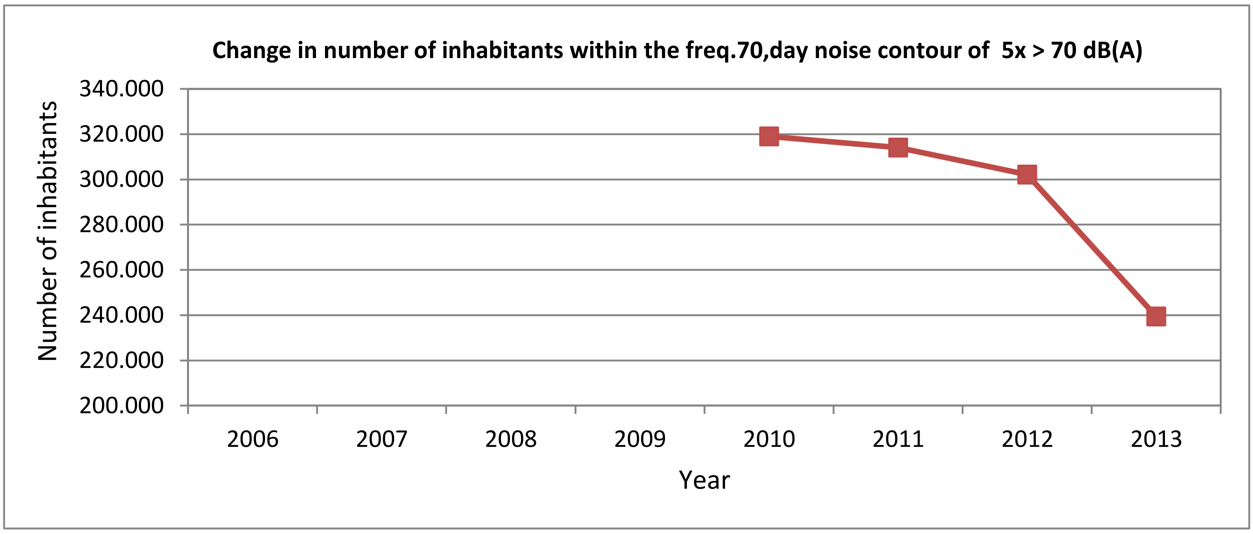


Table 40 Change in the number of inhabitants within the Freq.70,night contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 35 Change in the number of inhabitants within the Freq.70,night contours (2010-2013)

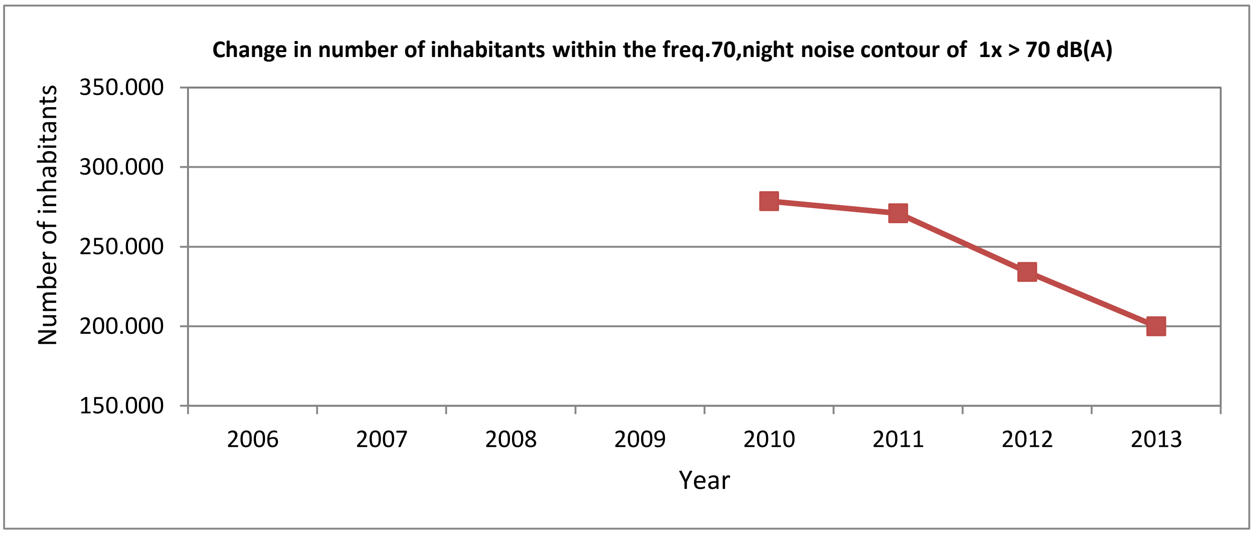


Table 41 Change in the number of inhabitants within the Freq.60,day contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 36 Change in the number of inhabitants within the Freq.60,day contours (2010-2013)

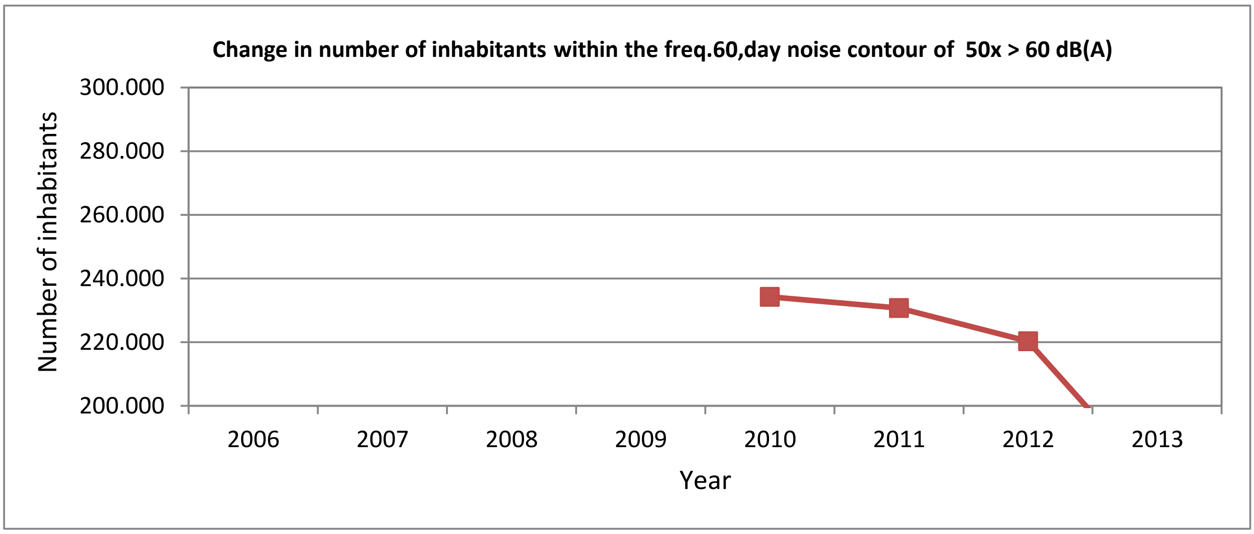
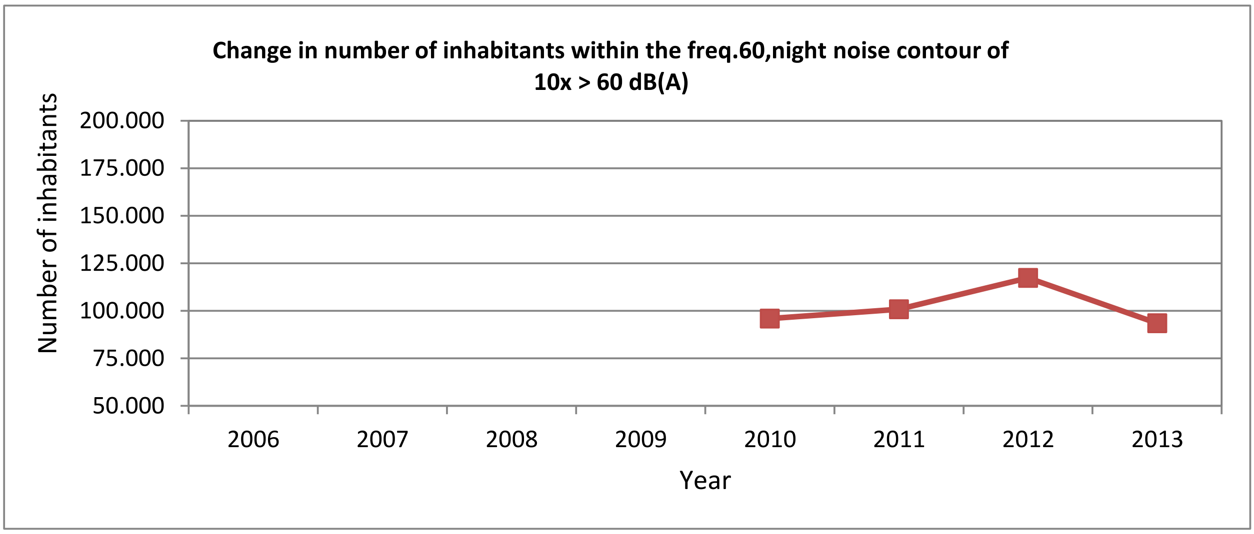


Table 42 Change in the number of inhabitants within the Freq.60,night contours (2010-2013)

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**

* Calculated with INM 7.0b

Figure 37 Change in the number of inhabitants within the Freq.60,night contours (2010-2013)



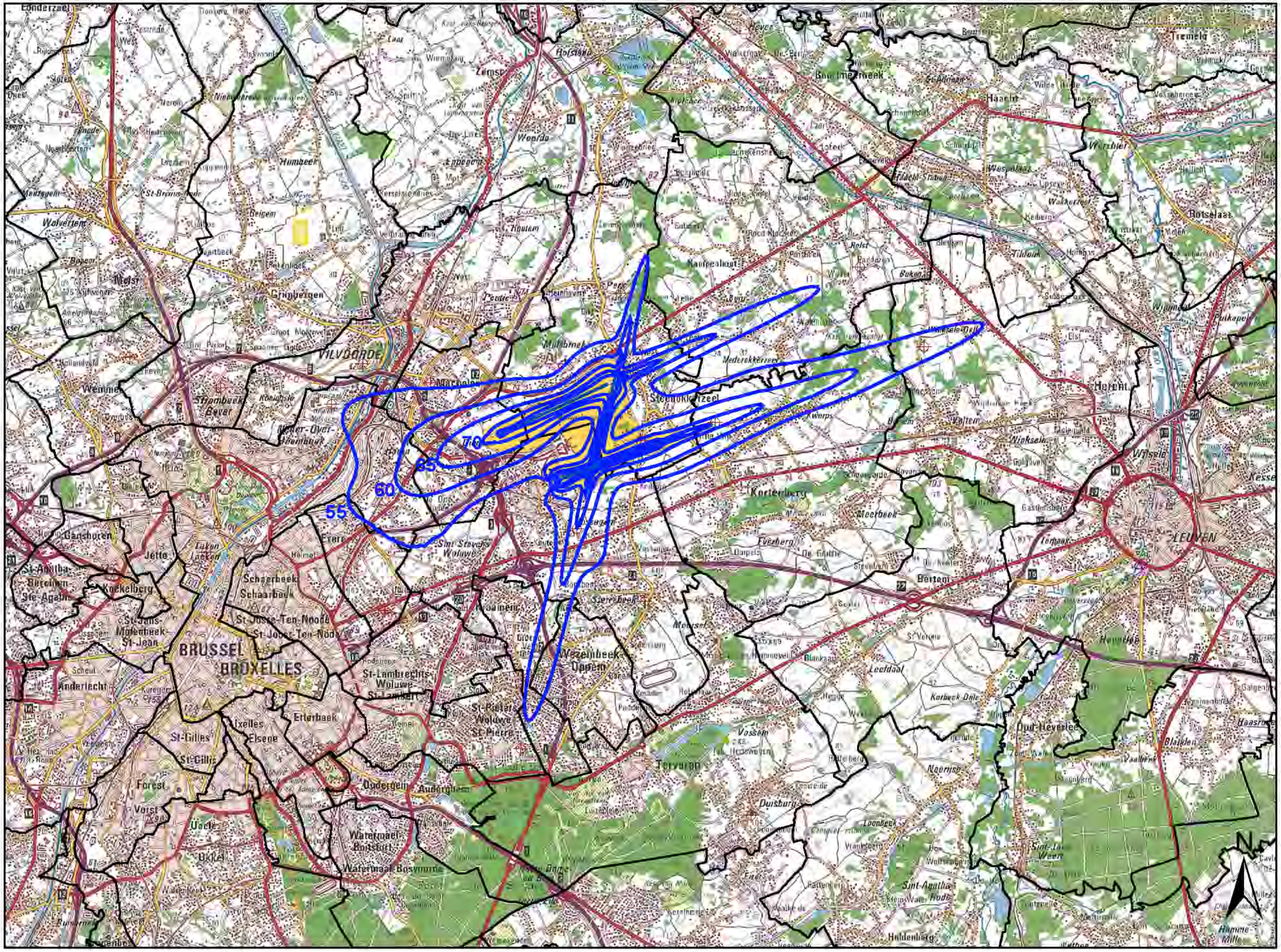
Appendix 6. Noise contours for the year 2013 on a topographical map

- L_{day} noise contours for 2013, background topographical map
- $L_{evening}$ – noise contours for 2013, background topographical map
- L_{night} noise contours for 2013, background topographical map
- L_{den} noise contours for 2013, background topographical map
- Freq.70,day – noise contours for 2013, background topographical map
- Freq.70,night – noise contours for 2013, background topographical map
- Freq.60,day – noise contours for 2013, background topographical map
- Freq.60,night – noise contours for 2013, background topographical map

L_{day} noise contours for 2013

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 2013

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
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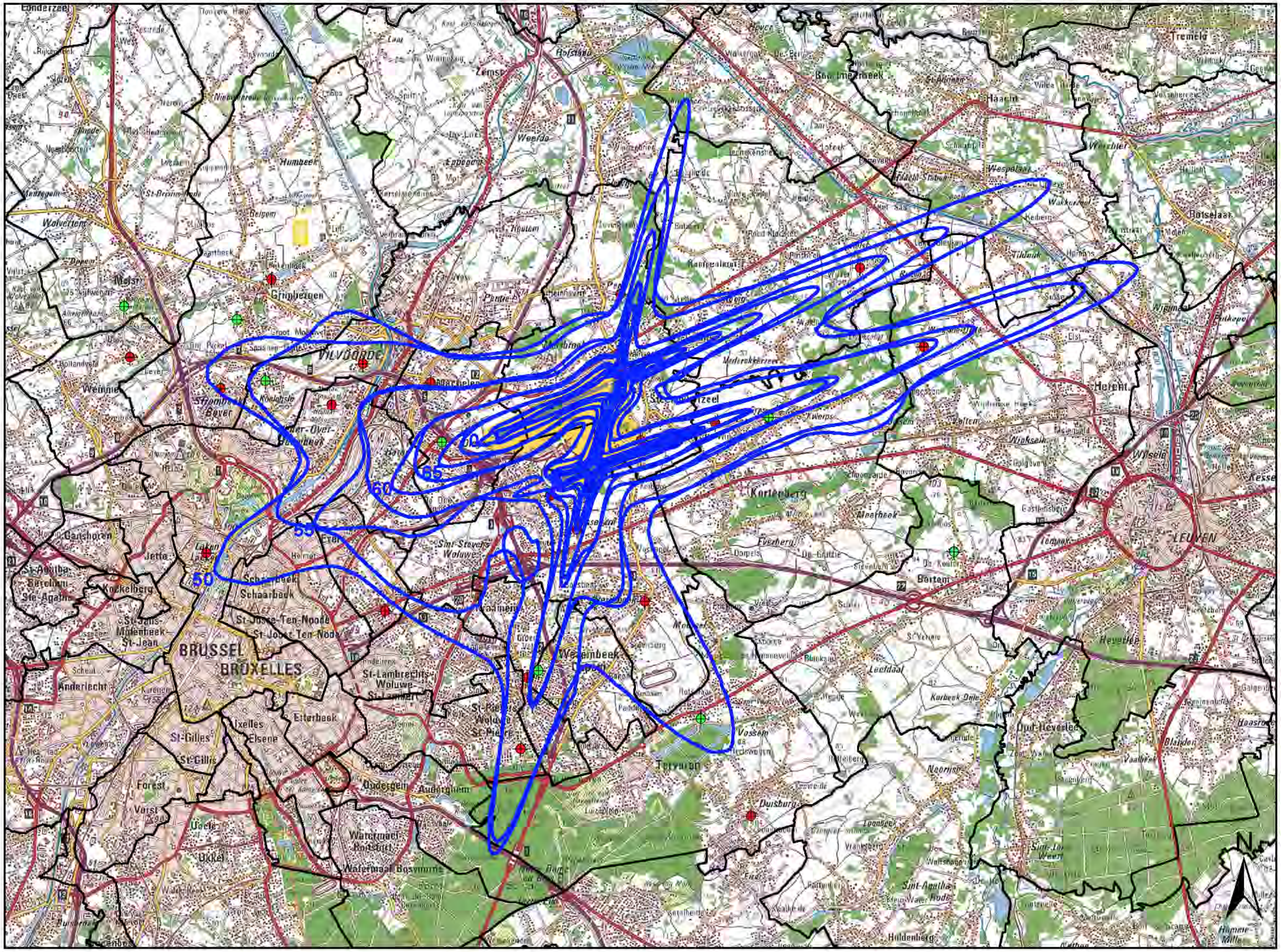
$L_{evening}$ noise contours for 2013

evening 19.00 - 23.00

Noise contours around Brussels Airport on a topographic map



Legende

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

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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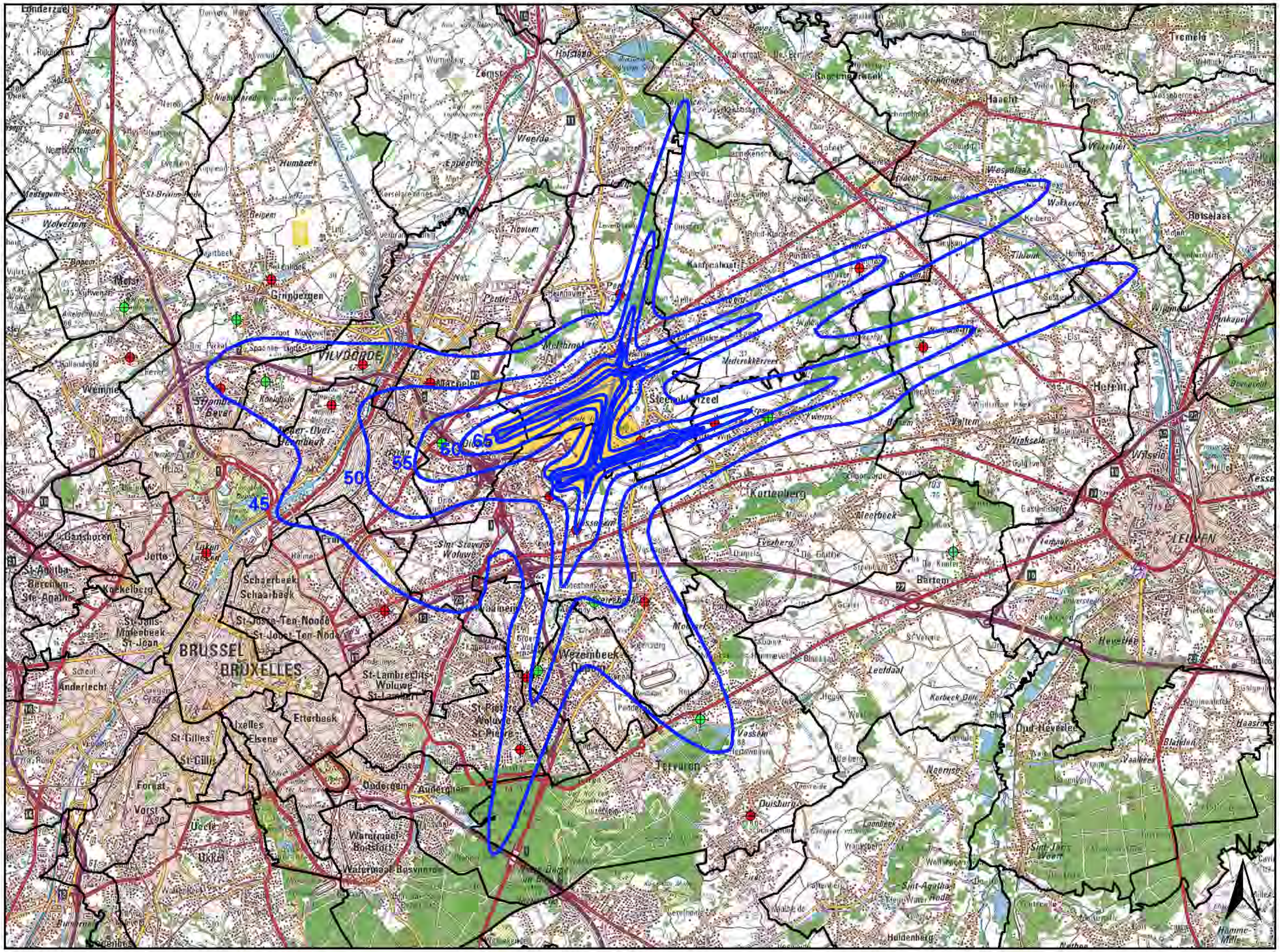
L_{night} noise contours for 2013

night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
topographic map



Legende

L_{night} noise contours of 45, 50, 55, 60, 65 and70 dB(A) for 2013

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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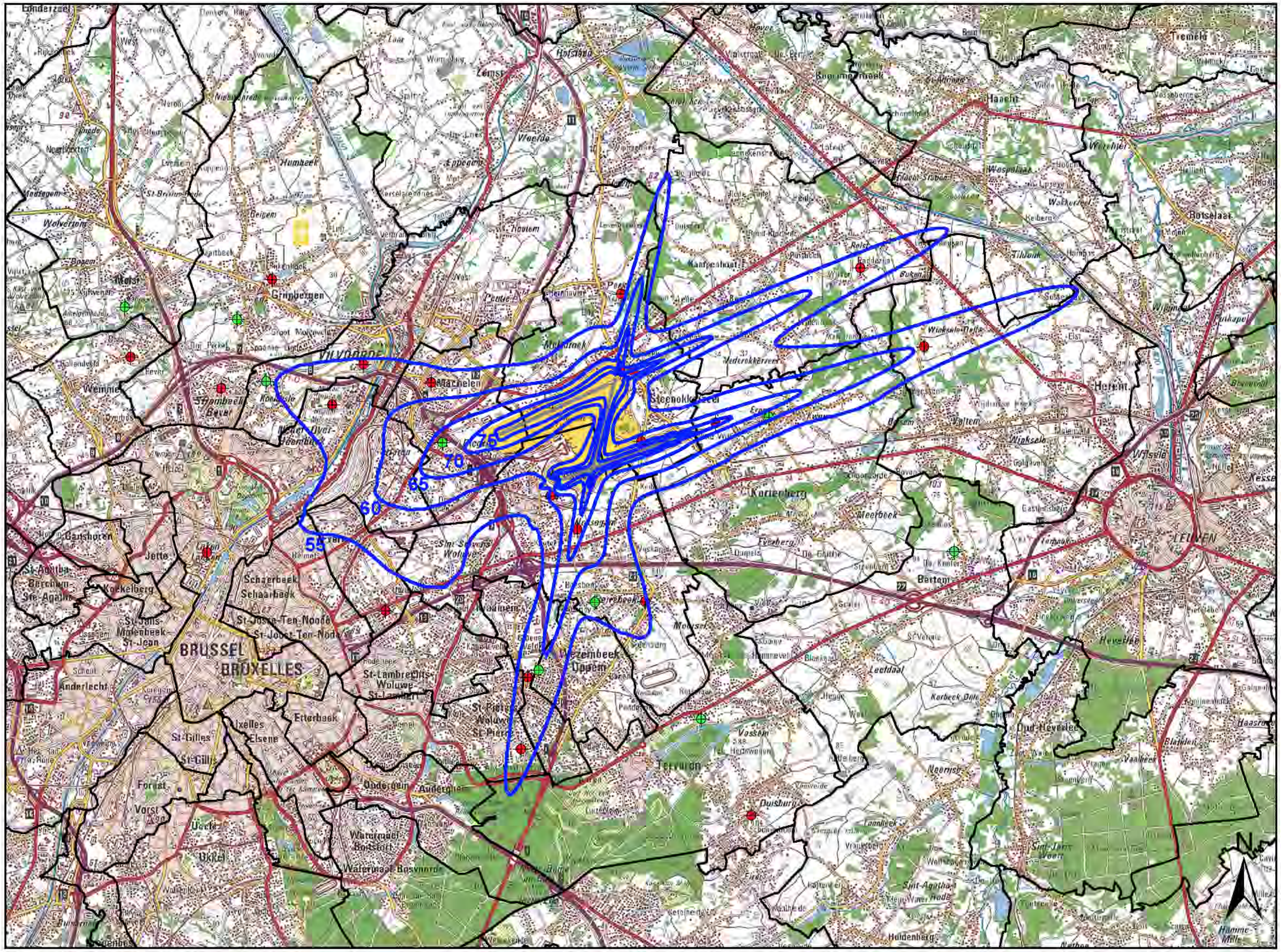
L_{den} noise contours for 2013

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

Noise contours around Brussels Airport on a topographic map



Legende

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

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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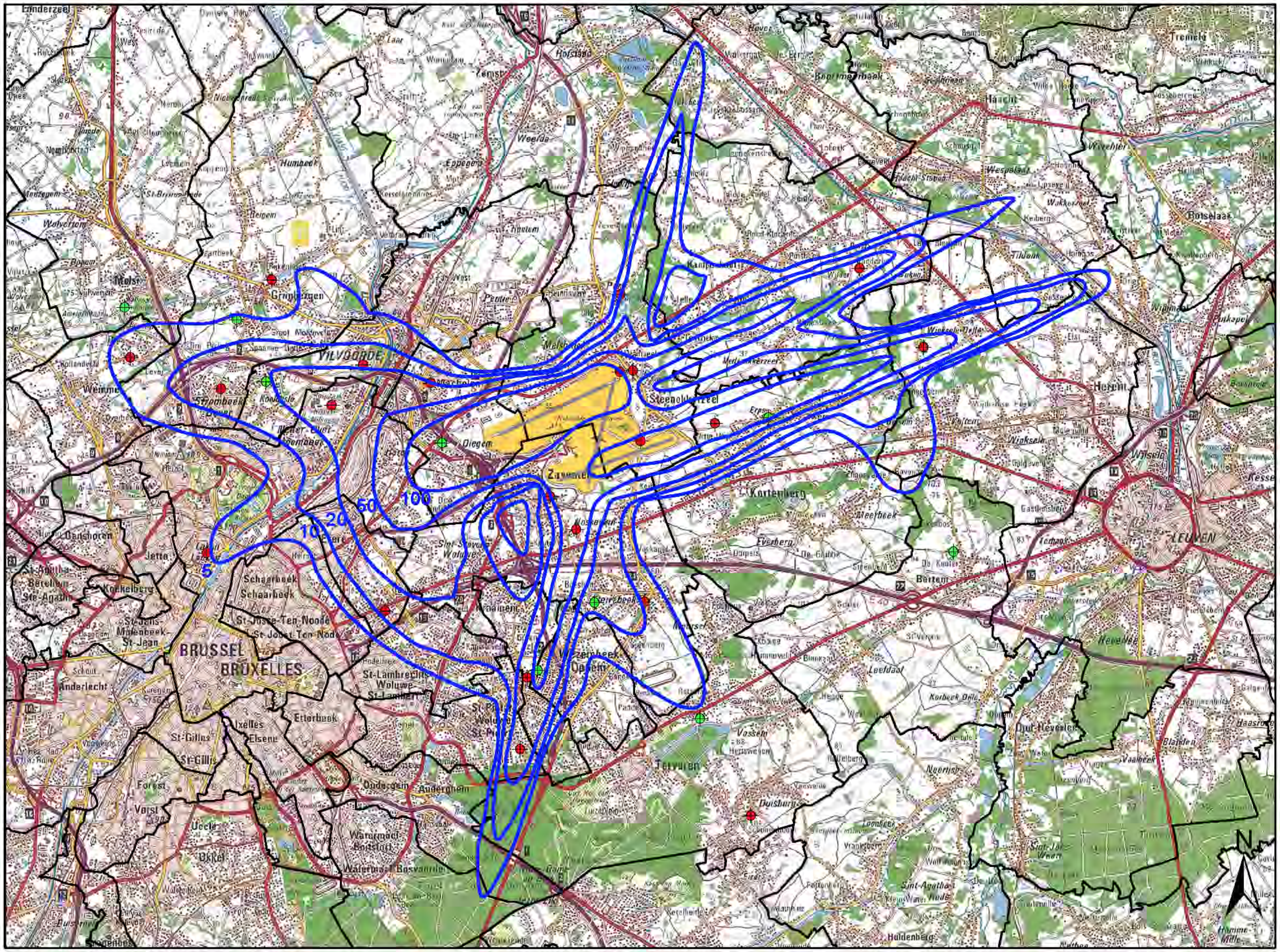
Freq.70,day noise contours for 2013

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
topographic map



Legende

Freq.70,day noise contours of 5x, 10x, 20x, 50x en 100x for 2013

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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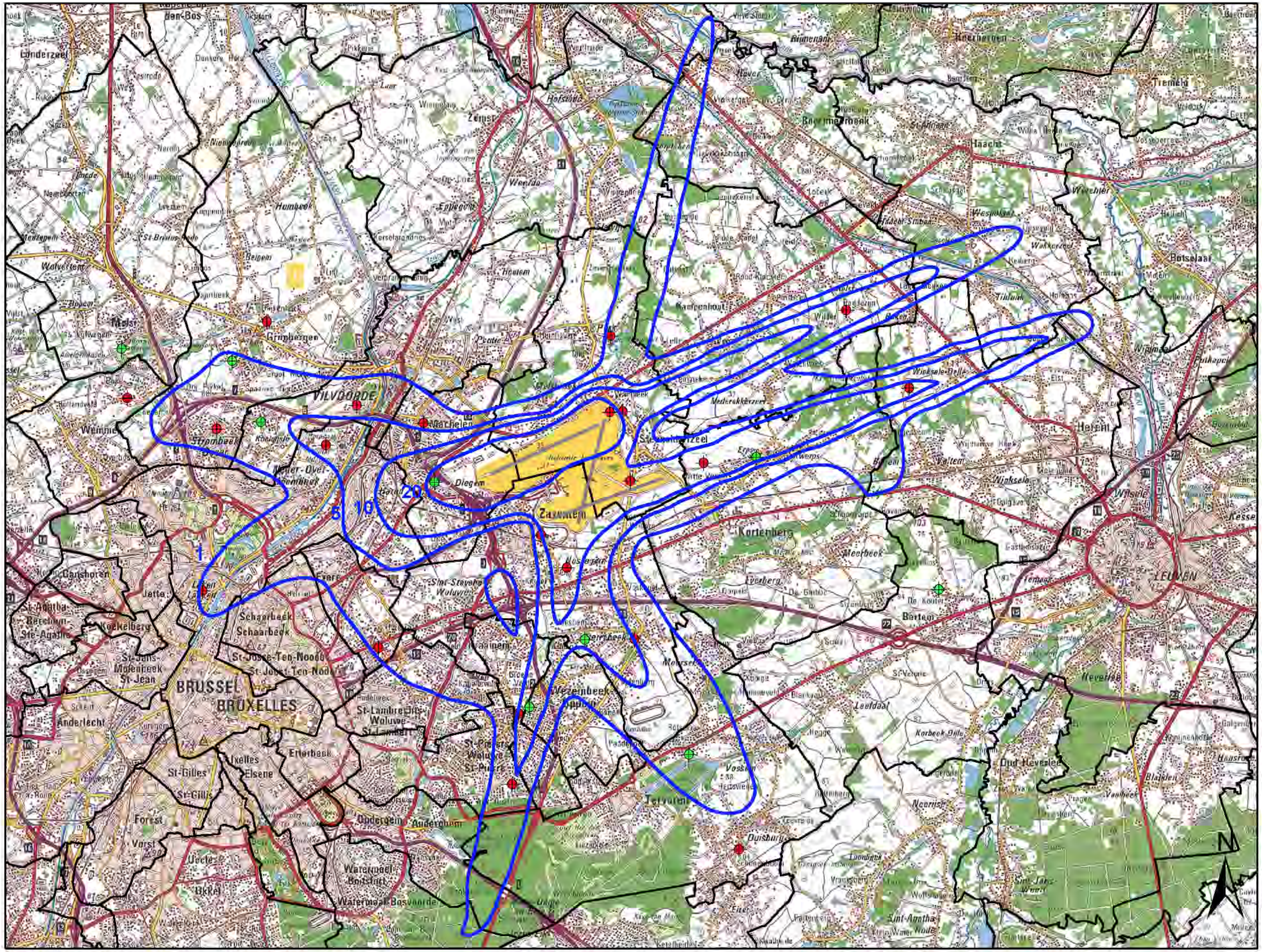
Freq.70, night noise contours for 2013

naight 23.00 - 07.00

Noise contours
around Brussels Airport
on a
population map



Legend

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

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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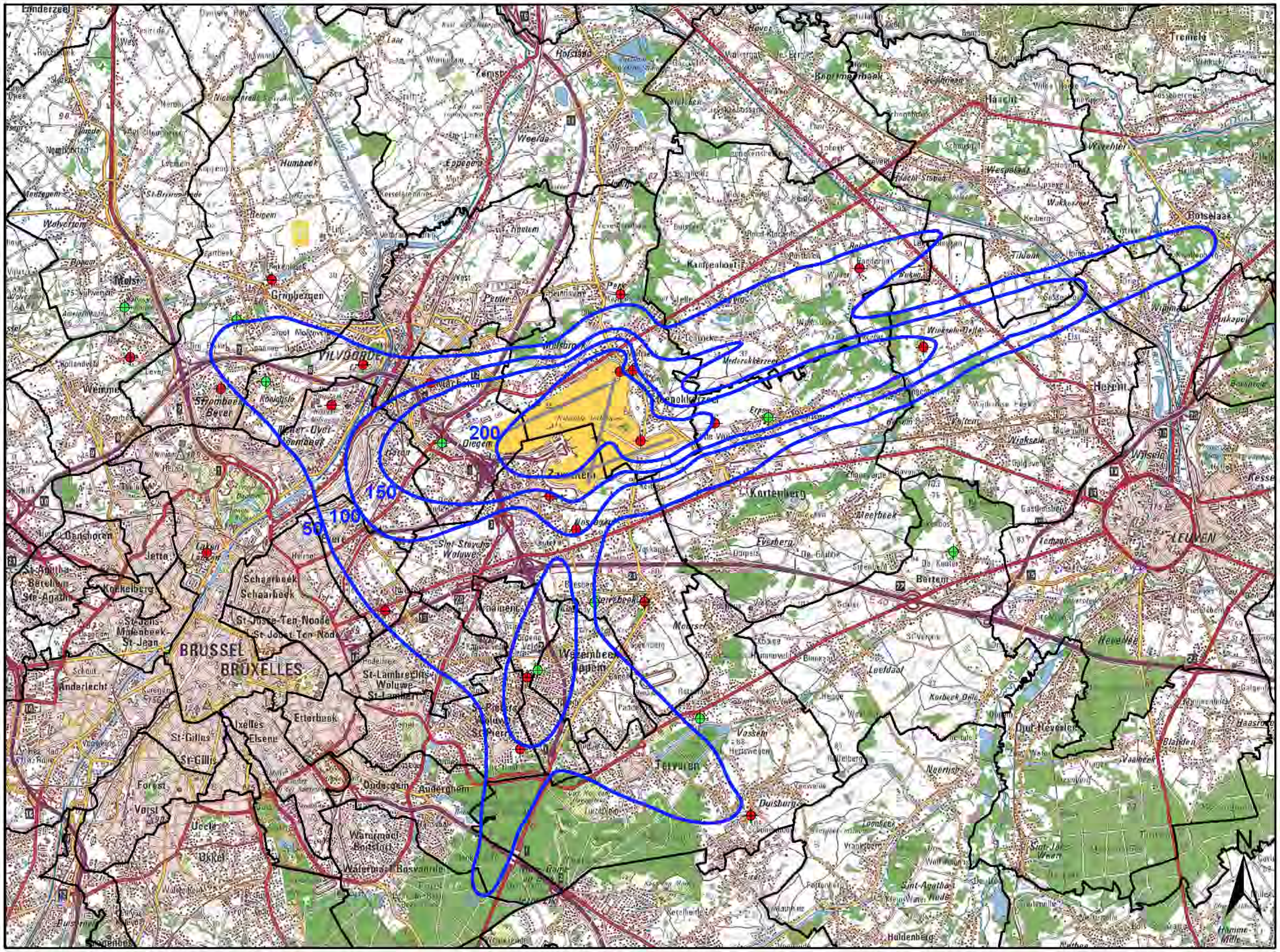
Freq.60,day noise contours for 2013

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 2013

Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2,000 4,000 Meters

Sources

Topographic layer :
Raster version topographic layer NGI
Scale 1 5 100.000 (OC GIS-Vlaanderen)

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

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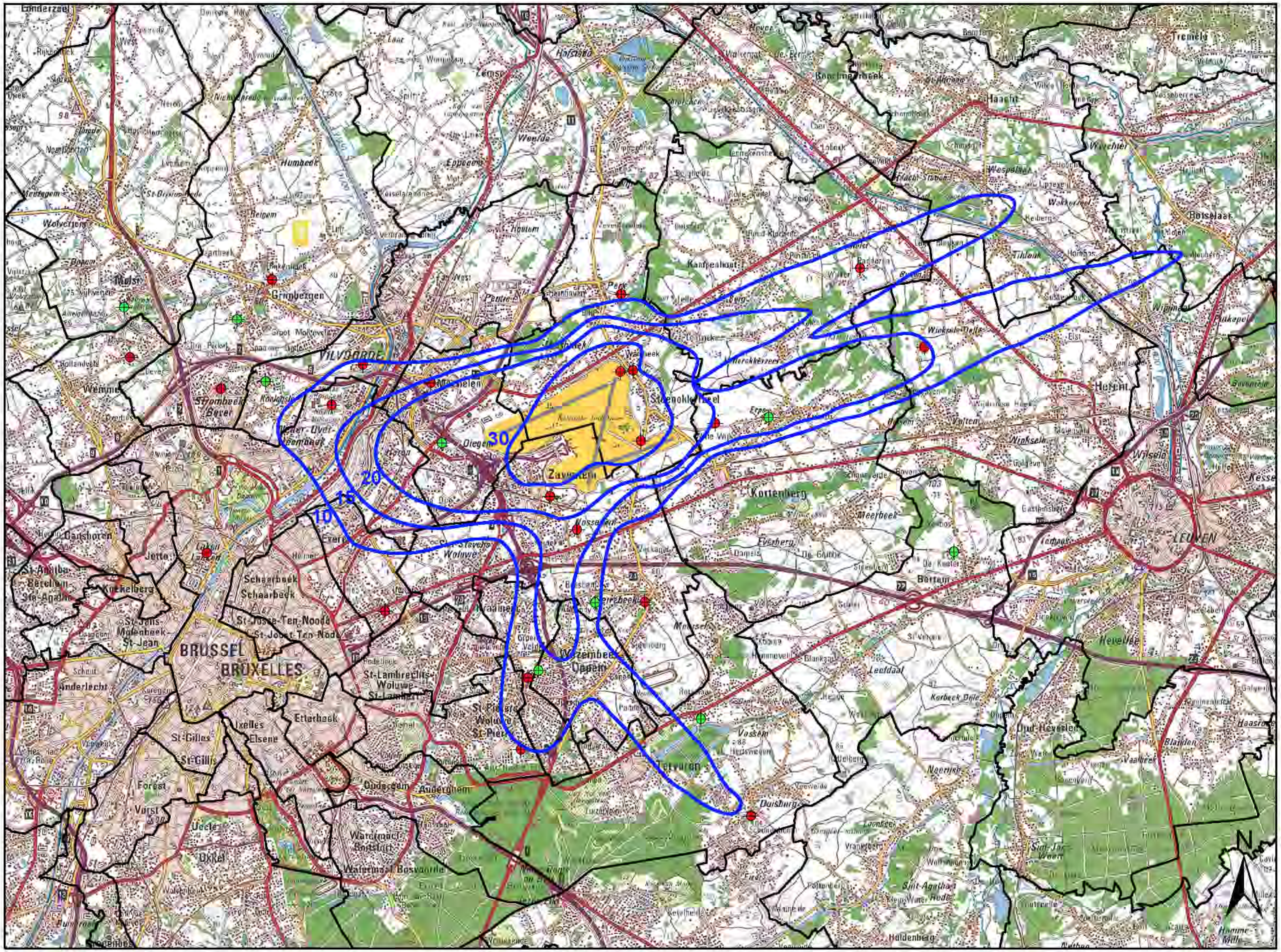
Freq.60,night noise contours for 2013

night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
topographic map



Legende

Freq.60,night noise contours of 10x, 15x, 20x en 30x for 2013

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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Appendix 7. Noise contours for the year 2013 on a population map

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

L_{day} noise contours for 2013

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 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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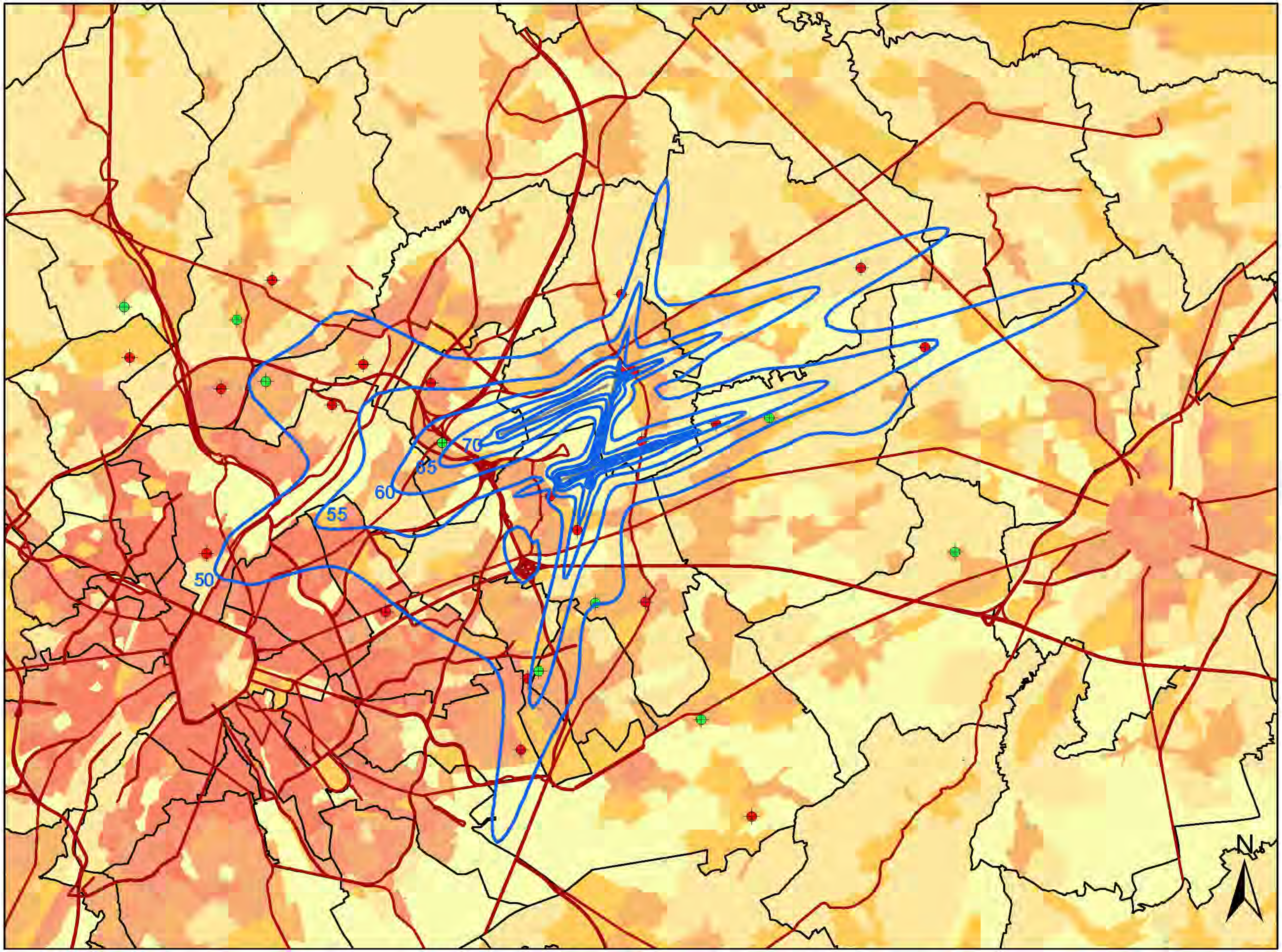
$L_{evening}$ noise contours for 2013

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 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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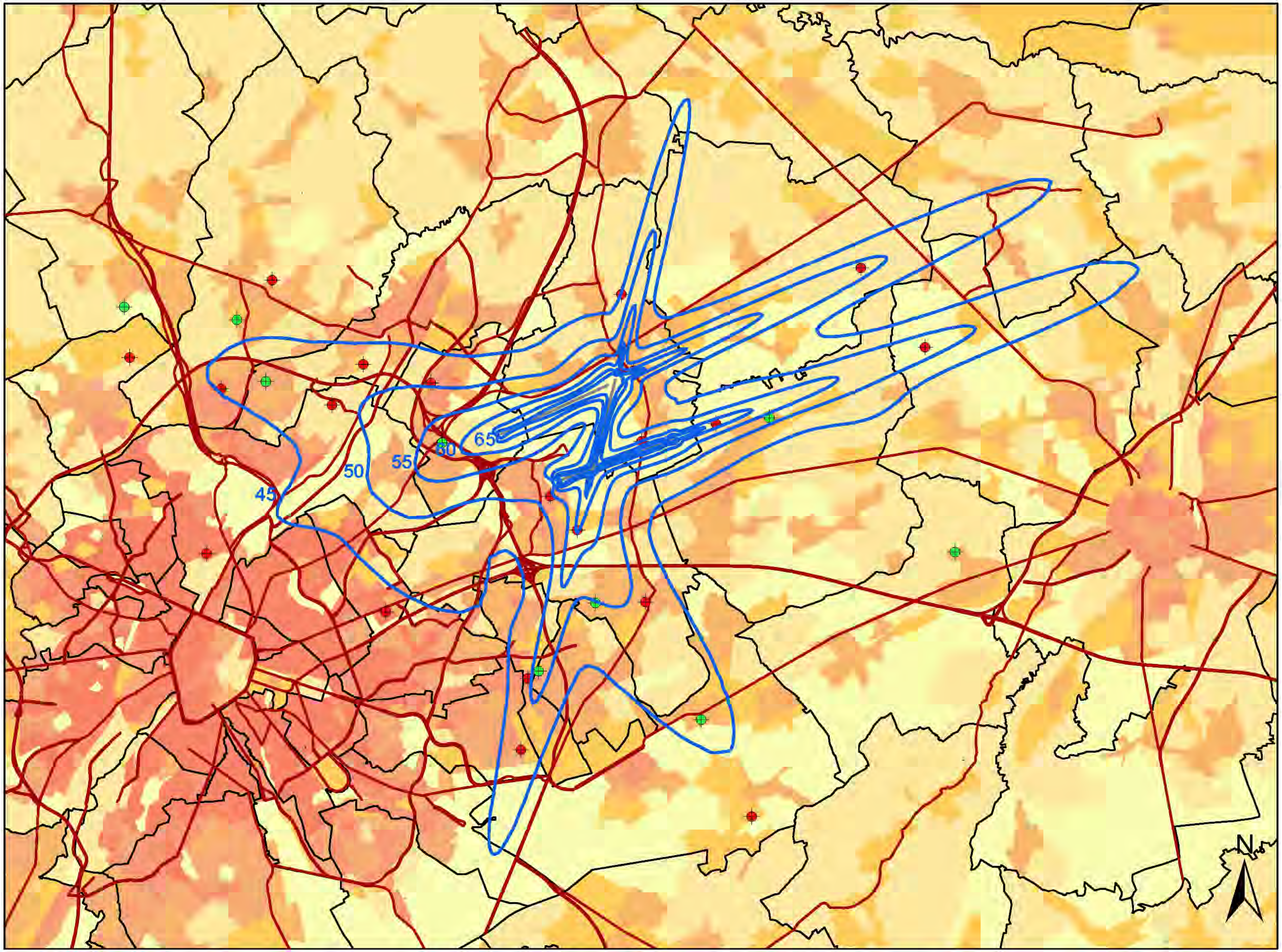
L_{night} noise contours for 2013

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 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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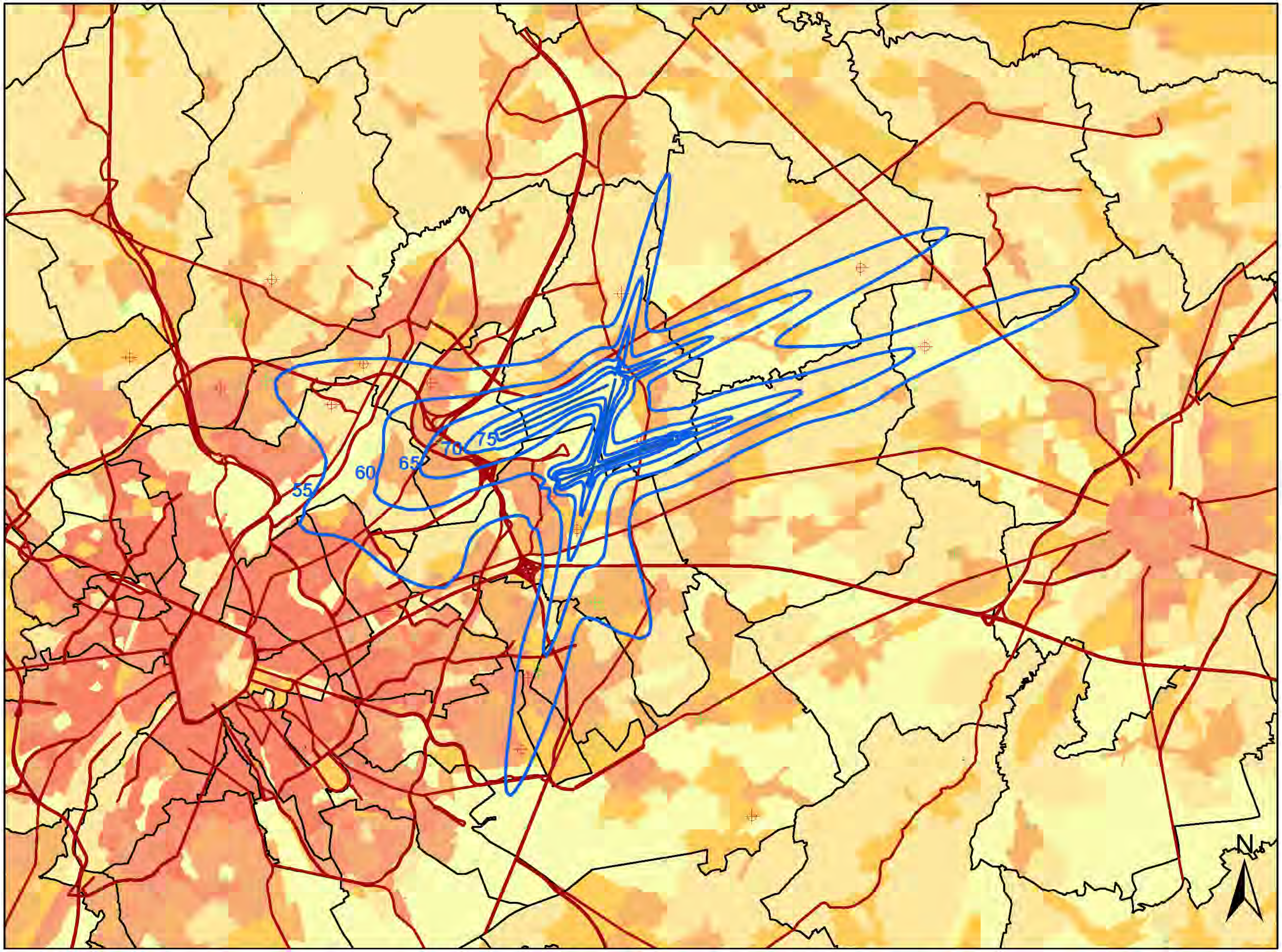
L_{den} noise contours for 2013

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 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 :
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Noise contours :
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Street maps :
Streetmap - Teleatlas

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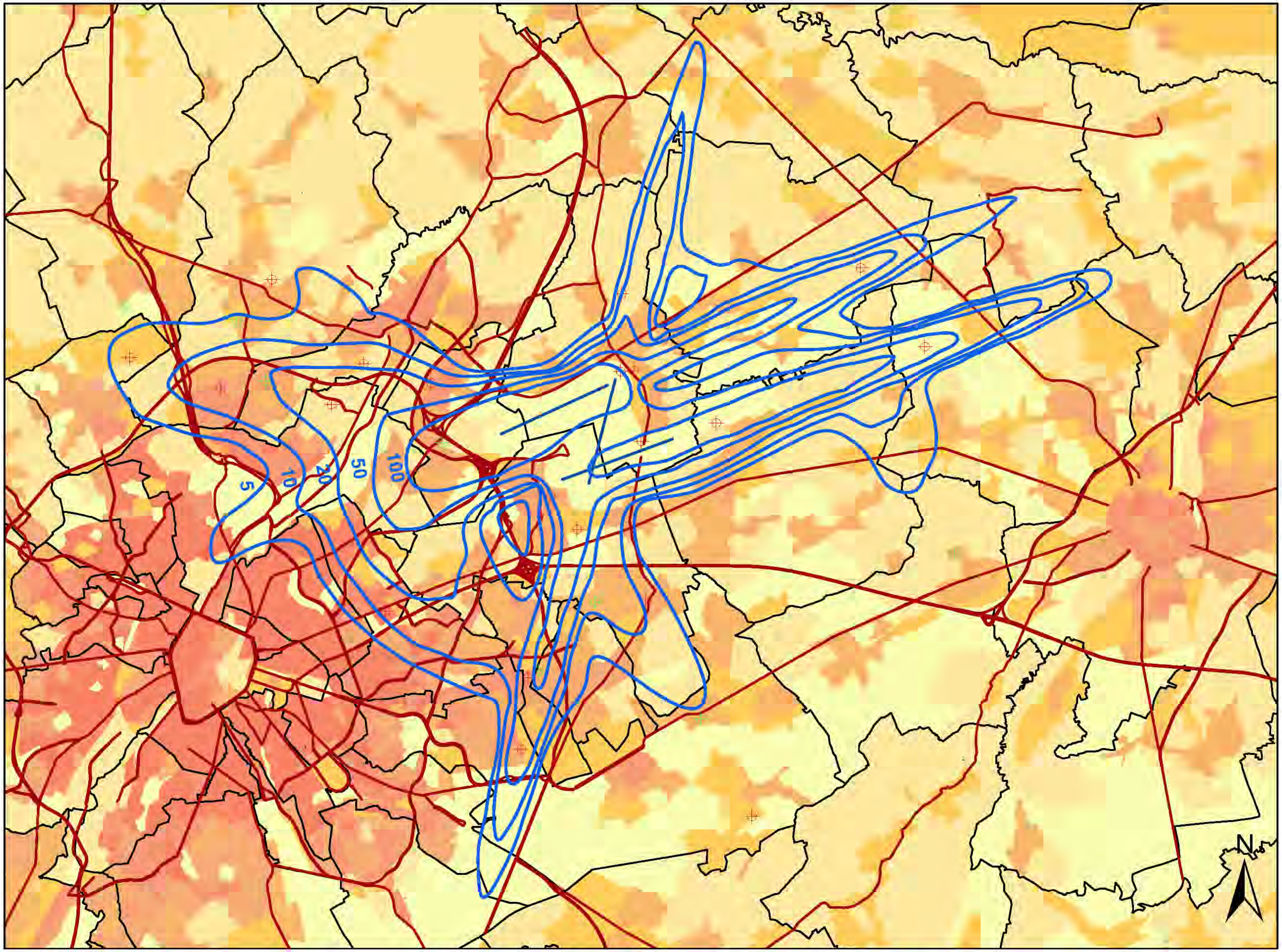
Freq.70,day noise contours for 2013

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 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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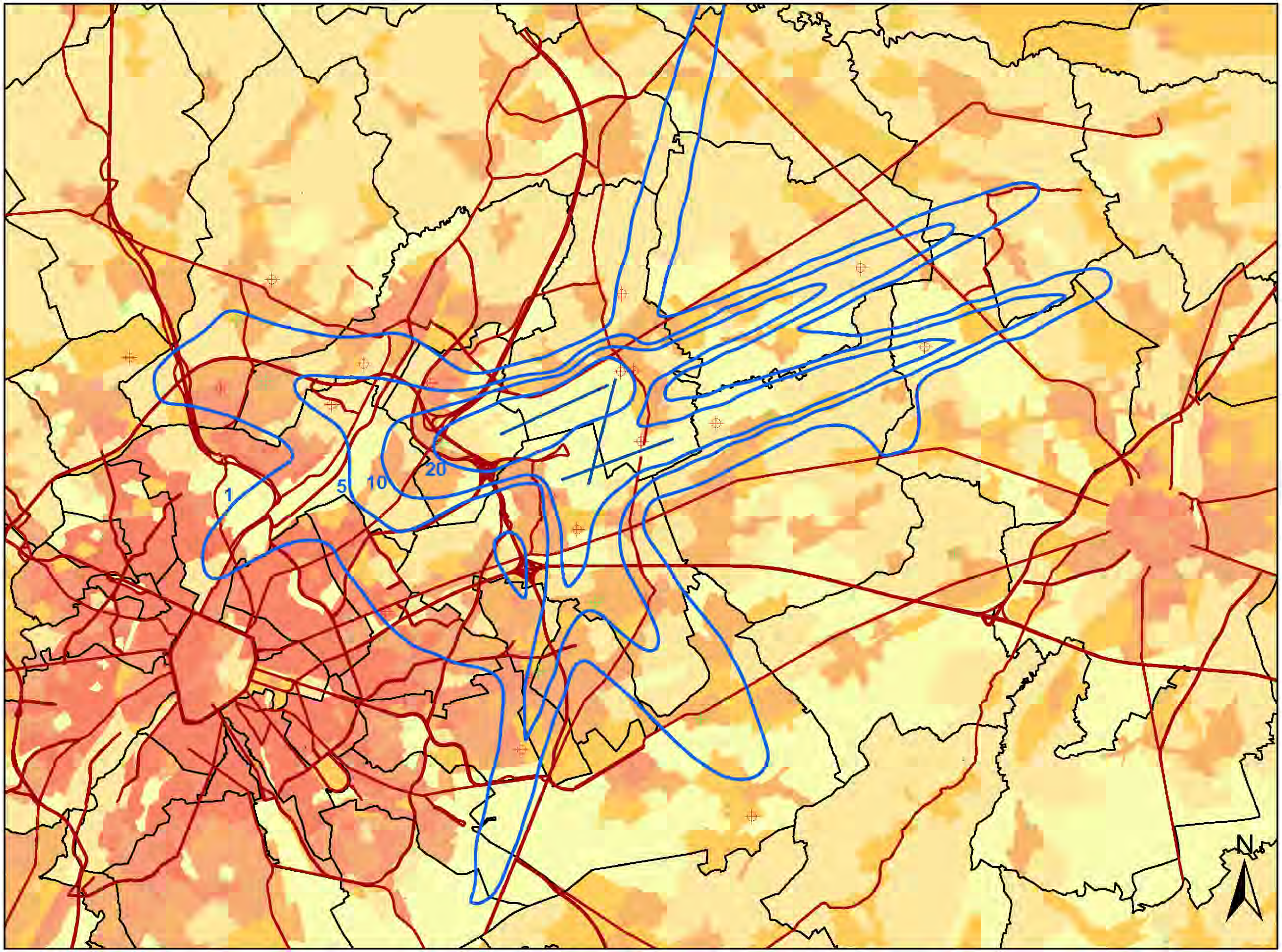
Freq.70,night noise contours for 2013

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 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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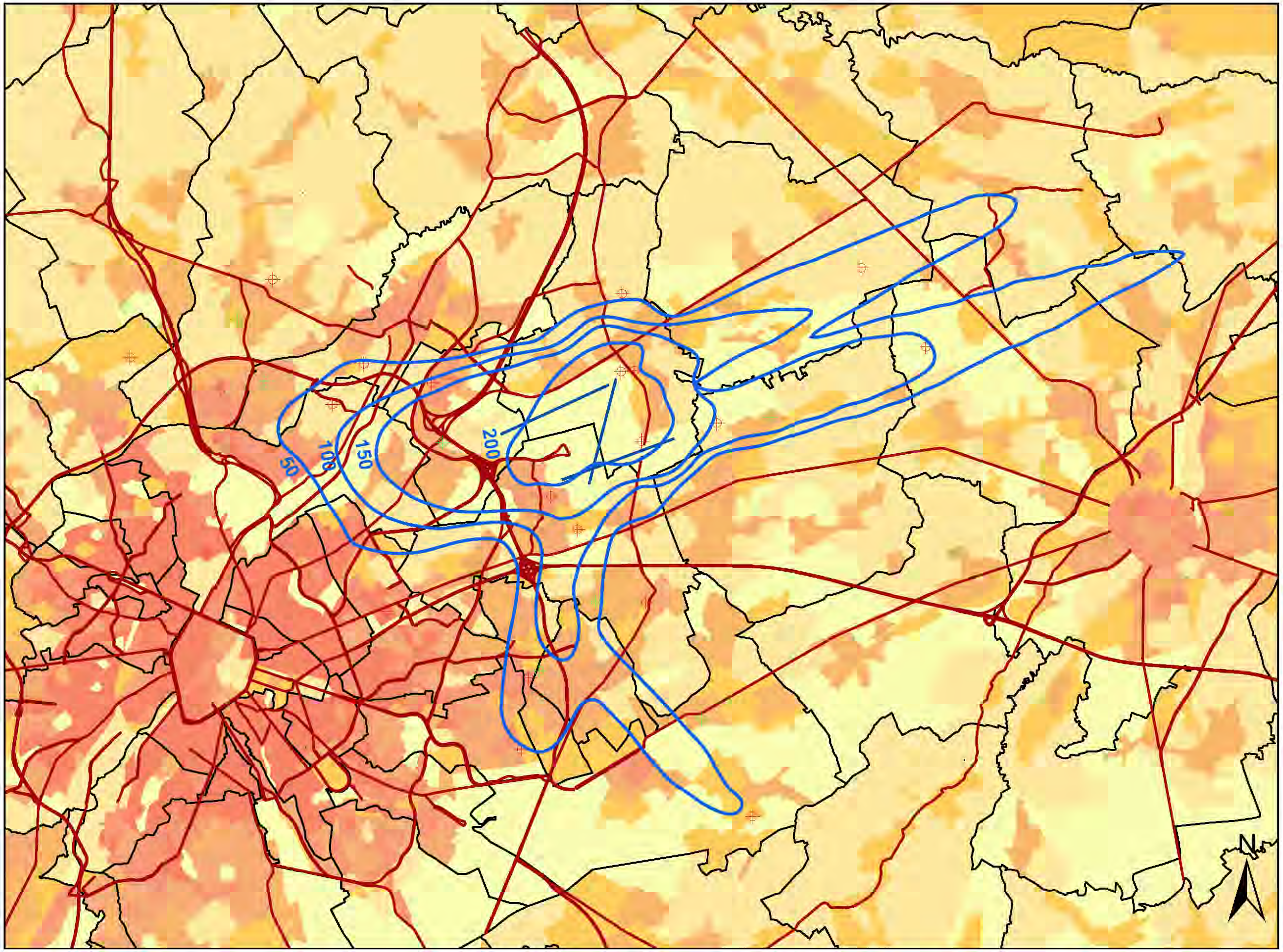
Freq.60,day noise contours for 2013
day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
population map



Legend

Freq.60,day noise contours of 50x, 100x,150x and 200x for 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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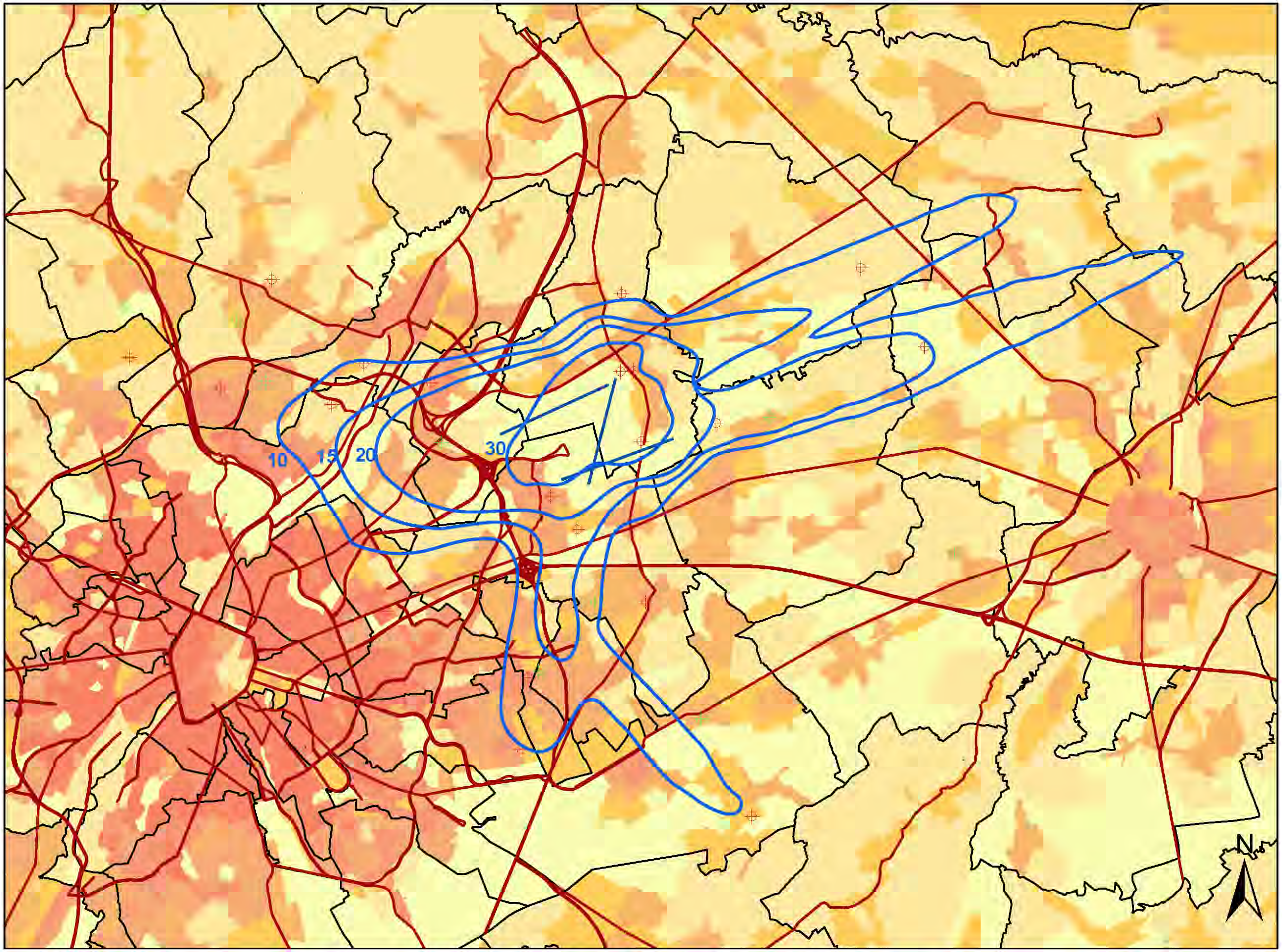
Freq.60,night noise contours for 2013

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 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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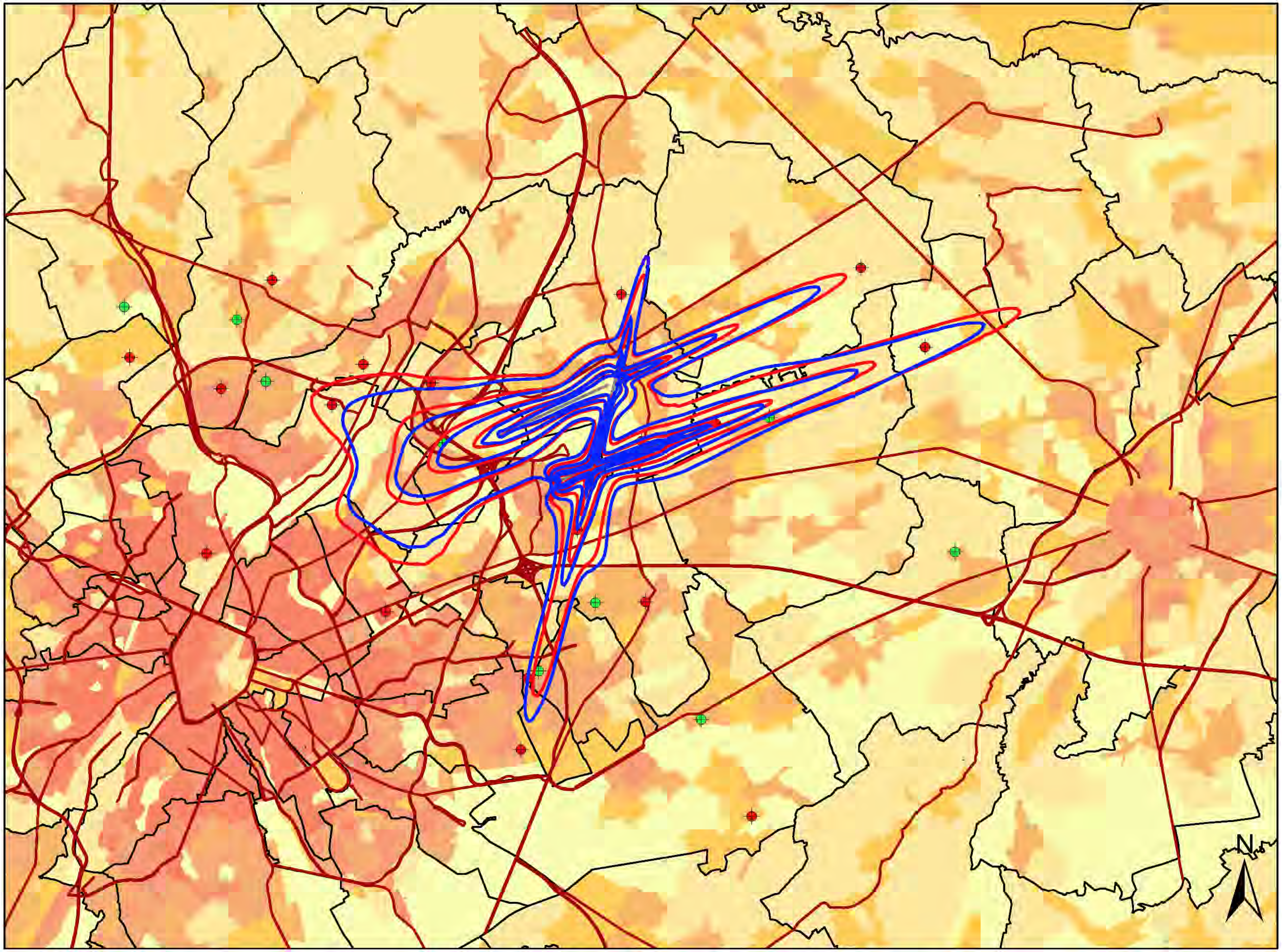
Appendix 8. Noise contour maps: change 2012-2013

- L_{day} noise contours for 2012 and 2013, background population map 2010
- $L_{evening}$ noise contours for 2012 and 2013, background population map 2010
- L_{night} noise contours for 2012 and 2013, background population map 2010
- L_{den} noise contours for 2012 and 2013, background population map 2010
- Freq.70,day noise contours for 2012 and 2013, background population map 2010
- Freq.70,night noise contours for 2012 and 2013, background population map 2010
- Freq.60,day noise contours for 2012 and 2013, background population map 2010
- Freq.60,night noise contours for 2012 and 2013, background population map 2010

Evolution of the L_{day} noise contours for 2012 and 2013

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 2013

L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2012

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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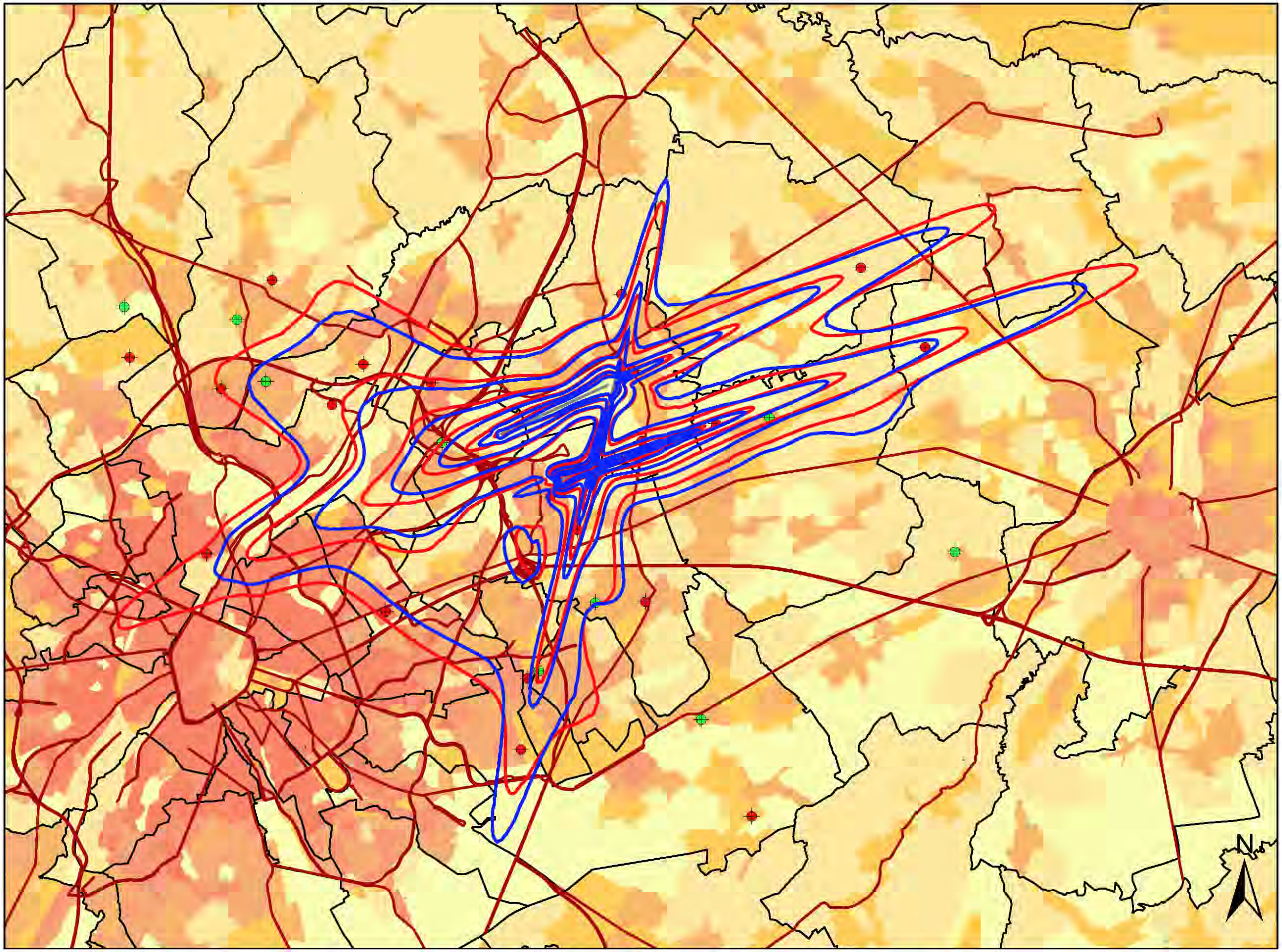
Evolution of the $L_{evening}$ noise contours for 2012 and 2013

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 2013

$L_{evening}$ noise contours of 50, 55, 60, 65, 70 and 75 dB(A) for 2012

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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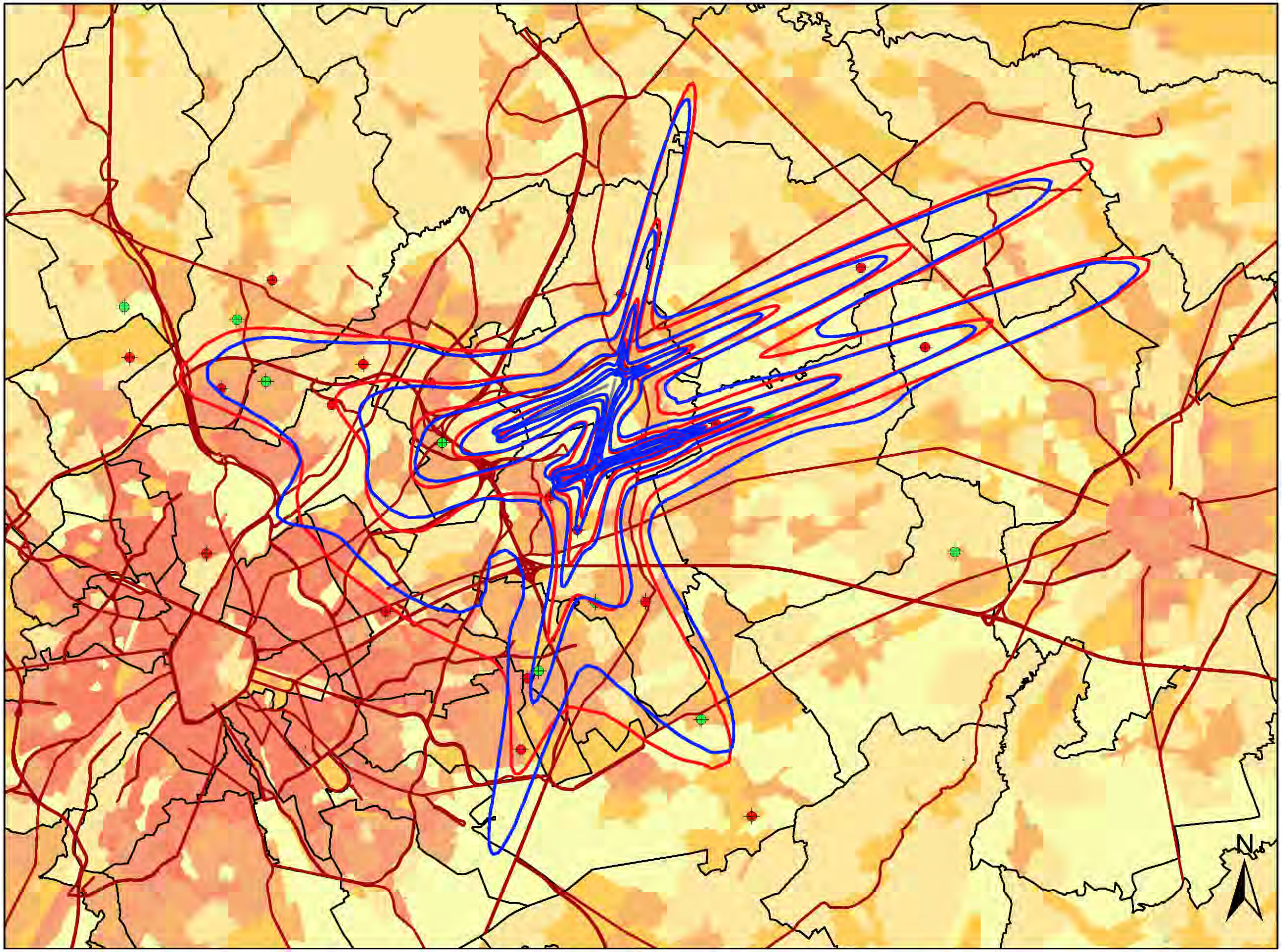
Evolution of the L_{night} noise contours for 2012 and 2013

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 2013

L_{night} noise contours of 45, 50, 55, 60, 65 and 70 dB(A) for 2012

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

KU Leuven
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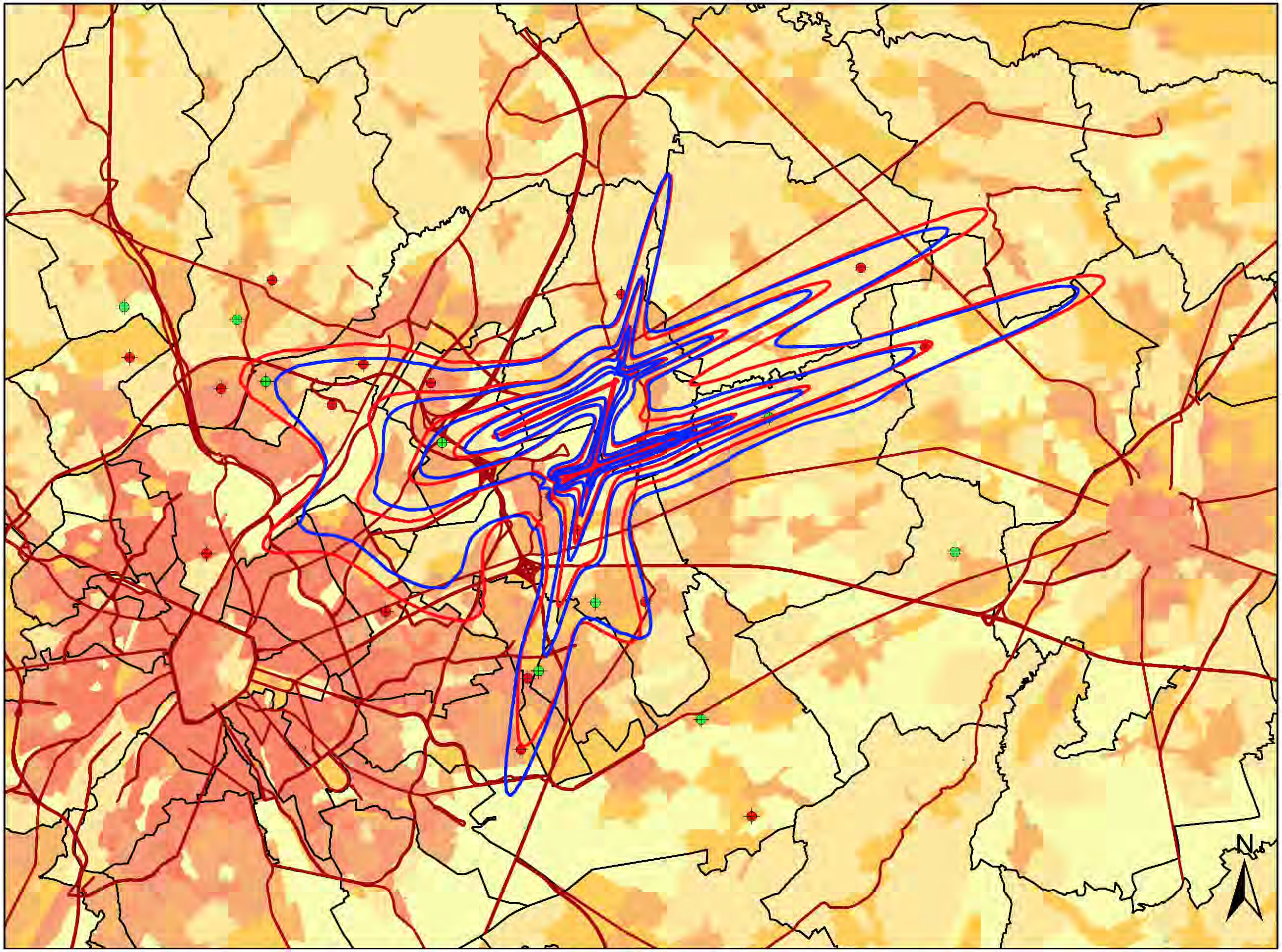
KU LEUVEN

Evolution of the L_{DEN} noise contours for 2012 and 2013

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 2013

L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) for 2012

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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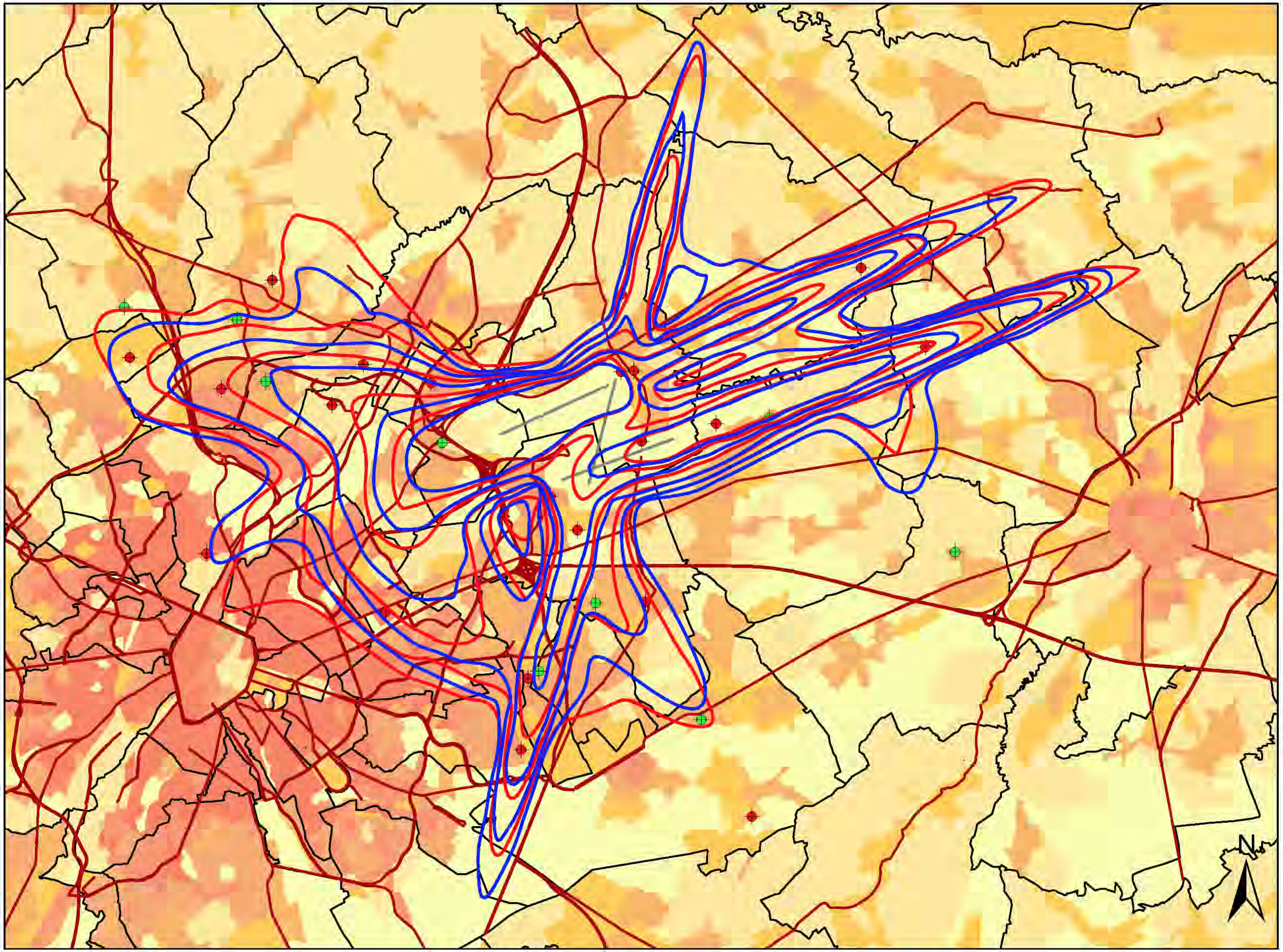
Evolution of the freq.70,day - noise contours for 2012 and 2013

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 and100x for 2013

Freq.70,day - noise contours of 5x, 10x, 20x, 50x and100x for 2012

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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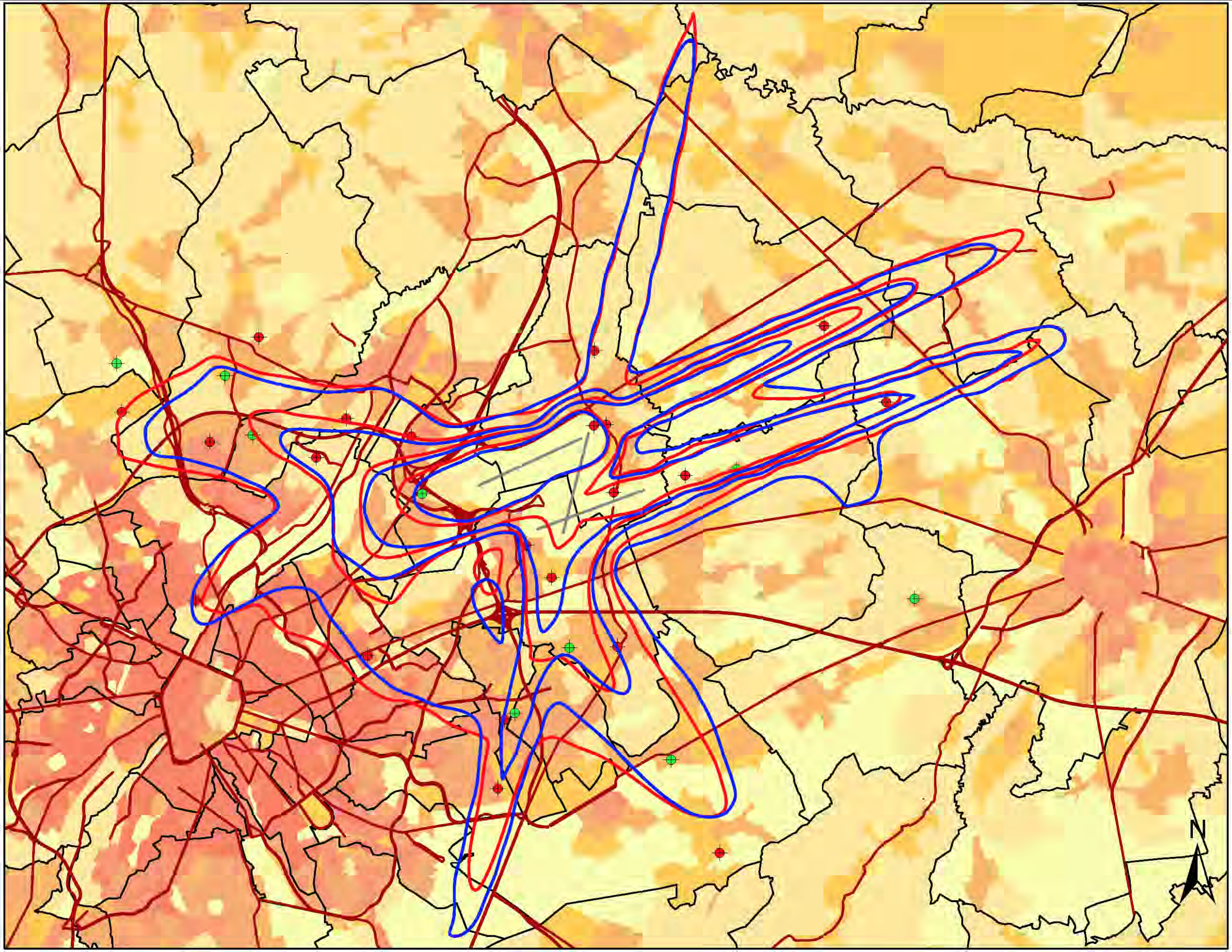
Evolution of the freq.70,night - noise contours for 2012 and 2013

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 2013

Freq.70,night - noise contours of 1x 5x, 10x, 20 and 50x for 2012

Noise Monitoring Terminals

LNE

Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

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

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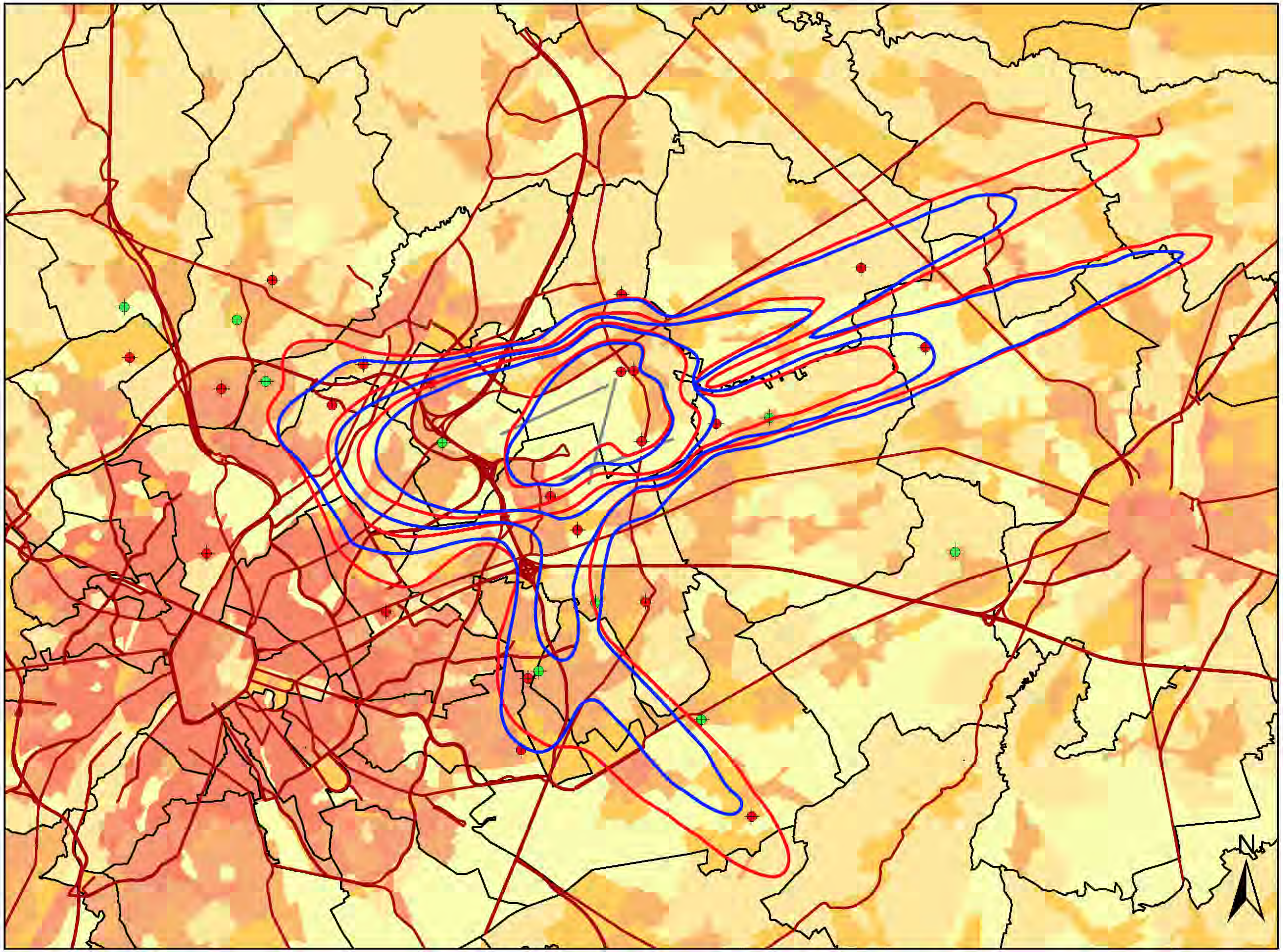
Evolution of the freq.60,day - noise contours for 2012 and 2013

day 07.00 - 23.00

Noise contours
around Brussels Airport
on a
population map



Legend

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

Freq.60,day - noise contours of 10x, 15x, 20x and30x for 2012

Noise Monitoring Terminals

LNE

Brussels Airport

Boundary municipality

Population density 2010 [inhabitants/hectare]

< 0.5
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0 2,000 4,000 Meters

Sources

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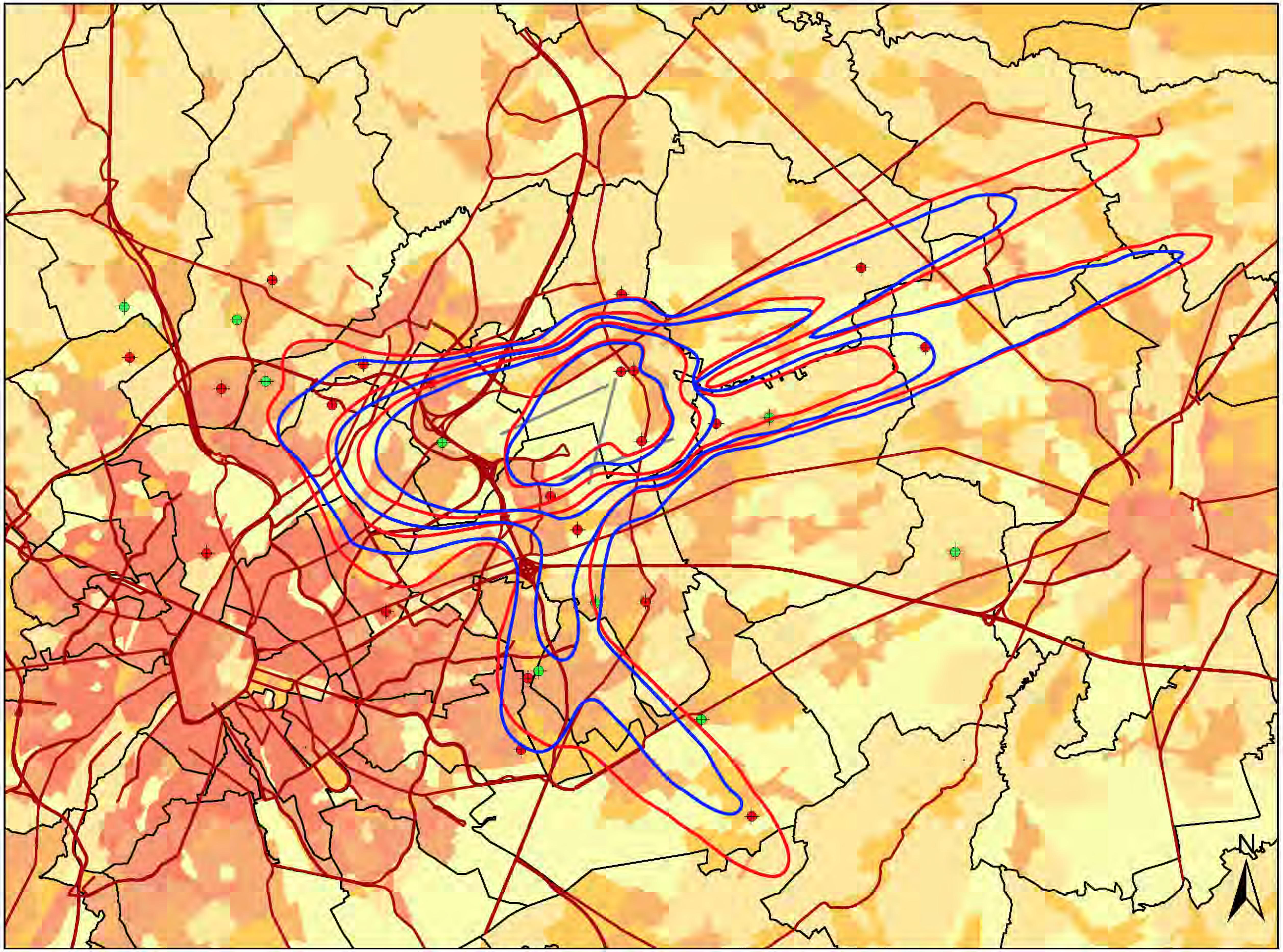
Evolution of the freq.60,night - noise contours for 2012 and 2013

night 23.00 - 07.00

Noise contours
around Brussels Airport
on a
population map



Legend

- Freq.60,night - noise contours of 10x, 15x, 20x and30x for 2013
- Freq.60,night - noise contours of 10x, 15x, 20x and30x for 2012

Noise Monitoring Terminals

- LNE
- Brussels Airport
- Boundary municipality

Population density 2010 [inhabitants/hectare]

- < 0.5
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