07.05 Strategic Noise Maps (Edition 2013)

Overview

Legal Provisions and Competent Authorities

The "Directive of the European Parliament and of the Council relating to the assessment and management of environmental noise" came into force on February 18, 2002, when it was published in the Official Journal of the European Community. For the European Community, this opened the path to legal provisions covering noise immission into the environment.

The German Federal Environment Agency (Umweltbundesamt) describes the objectives of the Directive as follows:

"Ensuring a high degree of health and environmental protection is part of the Community policies, one of the objectives being noise protection." To achieve this, "adverse effects of and annoyance caused by environmental noise must be prevented, avoided and reduced." This requires the following action:

- determining the load caused by environmental noise by means of noise maps, according to assessment methods to be used by all Member States;
- ensuring that the public is informed about environmental noise and its effects;
- adoption of action plans by the Member States based on the results of noise maps, aiming to prevent and reduce environmental noise where necessary, particularly in cases where exposure levels might have effects detrimental to health, and further aiming to maintain environmental noise quality where it is good.

Furthermore, the Directive is to form the basis for the further development and enhancement of measures to reduce the noise emission of the most relevant noise sources, also to inform the European Commission about the exposure caused by environmental noise in the Member States.

The Senate Department for Urban Development and the Environment (SenStadtUm) has ordered and implemented the Noise Mapping Project 2012, an update of the Noise Mapping Project 2007, for the State of Berlin, as provided in the requirements of the Noise Mapping Ordinance and the Federal Immission Protection Ordinance (34th BImSchV/ *Bundes-Immissionschutzverordnung*), in connection with §§47 a-f of BImSchG (Federal Immission Protection Act / *Bundes-Immissionschutzgesetz*) and Directive 22002/49/EC (Environmental Noise Directive), with the current LAI instructions on noise mapping taken into consideration.

Due to distinct responsibilities, only the noise maps created by the Senate Department of Urban Development and the Environment are published here. These include road traffic (motor vehicles including buses), streetcar traffic and traffic on the above-ground sections of the subway/underground, air traffic as well as industrial and commercial lots.

The analysis of noise from rail traffic according to the General Railway Act (*Allgemeines Eisenbahngesetz*, AEG) is published here on the site of the Federal Railway Authority (*Eisenbahn-Bundesamt*, EBA).

The plan aims at creating strategic noise maps and the related statistical evaluations (exposure for humans, dwellings, schools and hospitals in specific immissions-level classes). The results were prepared with respect to the following items for further utilization by customers:

- basis for reporting to the EU and for informing the public
- basis for continuing the Noise Action Plan 2013 (noise reduction planning for Berlin [in German])
- basis for managing the output data (data model care)

- basis for re-calculation and evaluation of spatially defined areas.

The BImSchG, §§ 47 a-f, sets the rules for implementing the EU Environmental Noise Directive under German law. The 34th BImSchV defines the requirements for noise maps under §§47 c of the BImSchG.

Noise maps must always be based on calculations. The calculations must comply with the preliminary calculation rules set by the EU, which in some respects differ from the Technical Codes applicable under national law (see below, Calculation Method).

Noise maps are to be reviewed and, if necessary, revised every five years, after they have been drawn up (Level 1 in 2007; Level 2 in 2012; Level 3 in 2017; etc.).

General description of major noise sources by location, magnitude and traffic occurrence/extent of mapping

The boundaries of the area of investigation are the borders of the state of Berlin. The noise sources to reinvestigate are:

- Road traffic (motor vehicles including busses)
- Streetcar traffic and above-ground subway/underground traffic
- Industrial and commercial lots with facilities as per Annex 1, Directive 96/61/EC of the Council of September 24, 1996, on the Integrated Prevention and Reduction of Environmental Pollution (IPPC facilities, including power plant sites and the Westhafen [Western Port]).
- Air traffic
- Rail traffic according to the General Railway Act (AEG)

Significant other major noise sources of road traffic in areas of the state of Brandenburg near the Berlin border which exceed the stipulated immission level were also included.

An overview of the noise sources included is shown in Table 1:

Table 1: Main noise sources for noise mapping in the conurbation area of Berlin

Noise source	Network	Route length
Road traffic	Federal Motorway / Highway	323.0 km
	Municipal Highway	1,093.3 km
Streetcar traffic and above-ground subway traffic	Streetcar	195.4 km
	Subway	27.3 km
IPPC plants	1 Industrial plant (Westhafen)	
	18 power plant locations	
Air traffic	Tegel Airport	
	Schönefeld Airport (2010)	
Railway traffic		1,160.0 km

Table 1: Main noise sources for noise mapping in the conurbation area of Berlin

In road traffic, deviations from the route lengths on the 2007 map are due to the fact that:

- Federal motorways are digitalized separately for each lane;
- Federal motorways have been extended;
- Some segments of city streets have been removed from the mapping network; and
- Some city streets have been digitalized for each lane.

In rail traffic (streetcar and above-ground sections of the subway/underground), deviations from the route lengths on the 2007 map are due to the fact that some segments are digitalized separately for each direction, and that they have been generally digitalized in a higher degree of detail.

In railway traffic according to the AEG, deviations from the route lengths on the 2007 or 2012 map are due to the fact that individual segments have been added after completion of rehabilitation work on the railway network.

Ancillary conditions when considering the total values of noise pollution

To date, the legal regulations described do not provide for the compilation of overall noise levels, so that each of the major sources of noise is independently determined and assessed separately. However, the 2004 Environmental Report, page 490, of the Advisory Council on the Environment, states "a reduction in noise pollution impact upon the population can therefore only be successful if a combination of various sources of noise is considered."

However, since the dose-response relationships in case of simultaneous impact of several noise sources has hitherto been extremely difficult to describe from a medical and psychological point of view, we have here chosen a simplified approach:

- All immission values for the various major noise sources have an equal degree of impact, i.e. noise-type-specific impact factors based on a bonus-malus system will not assigned.
- Only the energy levels of the separate noise sources are added.

(For more information on "total noise" includes a study of the New Energy and Pollution Control Systems).

Note: The mapping of the railways under the General Railway Act (AEG) by the Federal Railway Authority entered into the consideration of the total values of noise pollution (as of December 2014).

When considering the total values of noise pollution, the peculiarities of the logarithmic decibel scale must be taken into account. For instance, the volumes of two 50 dB (A) events add up to 53 dB (A), since this increase by 3 dB (A) is perceived by the ear as a doubling of impact. Two components of 50 dB (A) and 60 dB (A) add up to 60.4 dB (A).

Statistical Bases and Calculation Model

Statistical Bases

For the calculation of the noise values upon which the present maps are based, the input data available to the State of Berlin for the reference year 2011 were used.

Mapping Zone

The mapping zone covers the area of the State of Berlin, amounting to 892 km². The examination covered the noise load exposure of 3,460,725 inhabitants.

Terrain Model

For the Level 1 noise map (2007, Map 07.05. Strategic Noise Maps (Edition 2008)), an overall terrain model was compiled from various separate models (DGM5, DGM25, elevation points of railway lines), and attenuated into levels.

Moreover, the upper and lower edges, respectively, of the railway embankments and cuts were ascertained from stereo aerial imagery with the precision of < 0.5 m, and integrated into the terrain model as contour lines.

For the current Level 2 noise map, the Level 1 terrain model was adopted, and, on the basis of DGM2 and measurements, also supplemented to show the terrain edges along embankments, cuts and underpasses of roads. The edges along railway embankments are to be checked and corrected if necessary.

The measurement of these edges is carried out as follows:

- Importation of the current aerial imagery (Aerial Imagery Flight Berlin 2011, digital colour aerial photographs [8 bit], resolution approx. 10 cm), in addition to orientations in the ImageStation SSK evaluation system of Intergraph;
- Interactive evaluation of aerial imagery models, and ascertainment of the upper and lower edges of terrain protrusions, underpasses and noise protection facilities in MicroStation DGN files;

- Further processing of the various attributed files in GIS.

Noise Insulation Facilities

The location, elevation and absorption behaviour of noise protection facilities on roads and rail lines were reviewed and updated. For federal motorways, supplemental noise protection facilities were digitalized on the basis of information on their existence, elevation, material, and central axis length. New noise protection facilities on local roads were adopted on the basis of planning documentation. Moreover, corrections of the data were undertaken on the basis of local knowledge, and in consultation with the client.

Special Structures

Tunnels – Railway Stations

Tunnel facilities were depicted in the calculation model by interruptions in route lines. Tunnel openings were not modelled as separate noise sources.

Noise levels for railway traffic in railway stations were calculated as is equal to those on open tracks, without accounting for reduction in speed. The blocking of noise by railway platforms and railway station buildings was not taken into account in the calculation of rail traffic noise. For other types of noise, railway station buildings were accounted for as obstacles.

Road Bridges

Bridges across roads and waters were taken into account in 426 sections where the high position of a road has a relevant acoustic effect on the neighbouring built-up area. A reflecting bridge platform was modelled across the width of the road in each of these cases.

When using the noise map, the following must be observed: bridge structures are not included in the surface of the terrain; rather, they rise above the terrain. **Noise maps are calculated at a height of 4 m above the terrain, and can therefore be related to the area below a "noisy" road bridge which acts as a sound barrier, with accordingly low local immission levels.**

Built-up Area

The floor plans of 535,920 buildings, with specification of the number of floors and the building uses shown in the Table below were taken from the Automated Real Property Map (ALK) of the City of Berlin (as of June 2011) (see Table 2):

Table 2: Building uses and number of buildings, used as input parameters for the strategic noise maps of Berlin

Use	Number of buildings
Residential	284,714
School	2,535
Hospital	702
Miscellaneous	247,969

Table 2: Building uses and number of buildings used as input parameters for the strategic noise maps of Berlin

Explicit building heights were not available and were, therefore, defined through the following empirically determined function: [building height = 3.2 m + number of storeys x 2.8 m]. Information on 182,327 buildings in Brandenburg in a strip of land 2 km wide along the city border, with explicit height data, was provided by the State of Brandenburg and applied to the model. These buildings act as obstructions and reflectors of road and railway noise sources at the edge of the area under examination.

Building façades were included in the calculations as reflecting objects, with an absorption loss of 1 dB(A).

Building Inhabitants

The figures for numbers of residents, with principal and secondary domiciles, are available in 14,466 sections of the municipal area. These residents were proportionately assigned to the storeys of the blocks of flats located in the respective sections. Segments with a total of 17,338 residents could not

be precisely assigned. Buildings with mixed use were incorporated into the distribution, and assigned shares of between 25 and 90%, in accordance with their respective use levels.

Dwellings

The number of dwellings was taken from *Kleine Berlin-Statistik* 2011 (Die kleine Berlin-Statistik 2011) the total being 1,899,000. This resulted in a mean value of 1.8224 inhabitants per dwelling. This factor and the number of inhabitants affected yielded the number of dwellings affected.

Geometry – Road Traffic

For the 2012 noise map, the location-corrected network of city streets and motorways from the detailed network of the Senate Department for urban development and environment, including traffic volume (traffic count 2009 cf. Map 07.01 Traffic Volumes (2011 Edition)) , permitted maximum speeds, and information on median strips was adopted. The pavement-reference parameters were updated in the context of a field examination of the road network in the fourth quarter of 2010, and then transferred to the detailed network geometry.

In the model formation for the calculation, the following properties were taken into account:

- Lanes: For road segments with different numbers of lanes in each direction, the symmetrical position of the outer lane has purposely been taken over. The mean distance from the road centre-line is not used in this case.
- One-way streets: For one-way streets, the right lane is used, if it deviates from the position of the road centre-line.
- Traffic: For road segments with different levels of traffic flow in each direction, the asymmetrical distribution of traffic has purposely been taken over. The assumption of a 50-50 occurrence of traffic flow in each direction is not used in this case.

Data on the principal roads in the State of Brandenburg close to the Berlin border, including the required calculation parameters, have been provided by the Brandenburg State Agency for Environment, Health and Consumer Affairs. The total length of these roads is 523,9 km.

A total of 1940.2 km of roadway have been incorporated into the calculation, of which 1416.3 km are located on the territory of the city of Berlin.

Geometry – Streetcar Traffic, Above-Ground Subway Traffic

Streetcars

A total of 195.4 km of track of the streetcar network were modelled. Differences in route lengths from the 2007 map are due to the fact that certain segments were digitalized separately for each direction, and overall, a higher degree of detail was digitalized.

The situation of the streetcar network, including the root parameters, is based on the network of the 2007 Level 1 map, with the following modifications:

- Systematic situation correction based on the network geometry of the streetcar tracks as provided by the BVG, with the additional use of ortho-photos
- in cases of relevant distances between the tracks in the two directions, division of those roots by direction
- Supplementation to include trips into service railyards
- Extensive modification of types of roots as per information from the client, the BVG and comparison with ortho-photos (e.g., via detailed ascertainment of changes in the types of paving in junction areas)
- Adoption of current information on maximum speed from the BVG
- Assignment of correction values for squeaking sounds in curves caused by curve radii
- Assignment of correction values for bridges and railway overpasses, after comparison with orthophotos

Streetcar traffic was adopted into the calculation model by assignment of detailed electronic "count slips" of the BVG (as of 2012) to 159 route segments, and the Schöneiche-Rüdersdorf Tram Co. GmbH (Line 88).

Above-Ground Subway

The situation of the subway/underground lines, including the root parameters, is based on the network of the Level 1 2007 map, with the following modifications:

- Gap closures at stations
- Modification of pavement types as per information from the BVG
- Adoption of current information on maximum speeds from the BVG
- Assignment of correction values for squeaking noises in curves, depending on curve radii, and the presence of lubrication facilities.

The subway/underground traffic was taken into the calculation model by reference to the schedule of the BVG on aboveground segments (as of 2012).

A total of 27.3 km of subway/underground track were modelled.

Geometry – Industrial and Commercial Plants

The Berlin noise map for commercial sites which affected ambient noise covers:

- 18 power plant sites
- 1 industrial facility in the Westhafen area.

Plants (see Tab. 3) have an effect on environmental noise if they dampen relevant sound immissions, i.e., those in excess of L_{DEN} = 55 dB(A) and/or L_{Night} = 50 dB(A), from a near-by source. For this reason, and due to new measurement results, the site of the Häfele Co. was removed from the 2007 noise map. The new site of the TSR Recycling GmbH & Co. KG in the Westhafen had to be considered.

A noise emissions report of November 3, 2008, is available for that facility.

For the 18 power plants in the area of the city of Berlin, there was no change compared with the 2007 noise map.

Tab. 3: Location of the IPPC facilities taken into account for the strategic noise maps

No:	IPPC Facility
1	Lichtenberg Cogeneration Plant, Rhinstraße
2	Mitte Cogeneration Plant, Köpenicker Straße
3	Scharnhorststraße District Heat Plant, Habersaathstraße
4	Reuter West Cogeneration Plant, Großer Spreering
5	Reuter Cogeneration Plant, Otternbuchstraße
6	Lichterfelde Cogeneration Plant, Ostpreußendamm
7	Charlottenburg Cogeneration Plant, Am Spreebord
8	Klingenberg Cogeneration Plant, Köpenicker Chaussee
9	Wilmersdorf Cogeneration Plant, Forckenbeckstraße
10	Moabit Cogeneration Plant, Friedrich-Krause-Ufer
11	Köpenick Block-Scale Power Plant, Wendenschloßstraße
12	Buch Cogeneration Plant, Schwanebecker Chaussee
13	Neukölln District Heat Plant, Weigandufer
14	Märkisches Viertel District Heat Plant, Wallenroder Straße

15	Lange Enden Peak Heat Plant, Lange Enden
16	Schering AG Firing Plant, Müllerstraße
17	BTB mbH Berlin, Albert-Einstein-Straße
18	Neukölln Wood-fired Cogeneration Plant, Köpenicker Straße
19	TSR GmbH & Co. KG, Westphalenstraße

Tab. 3: Location of the IPPC facilities taken into account for the strategic noise maps

Geometry/Traffic at Berlin's Tegel and Schönefeld Airports

For the aircraft noise calculation at **Tegel Airport,** the following input data were available:

- The data recording system DESTXL2011_VBUF, as of 2011
- The geometric description of the runways and the arrival and departure routes (location, altitude, flight corridors) and route assignments, with movement figures for each aircraft type
- Distribution of the 169,396 flight movements of various aircraft types on the runways for the periods daytime, evening and night-time, in 2011.

Note: When Tegel Airport was mapped in 2007, overly low altitudes were assumed for some routes. Moreover, a directional distribution of traffic was undertaken which did not exactly match that of the DES 2011. As a result of these differences, the 2007 flight mapping process resulted in an overestimation of flight noise occurred, with level values which in some cases were higher than the levels obtained during the mapping process in 2011.

For Berlin-Schönefeld Airport, the calculation results of 76,607 aircraft movements were taken from the mapping process of the state of Brandenburg, with reference year 2010.

Moreover, the numbers of people, facilities and plots of land affected were taken from the Brandenburg mapping process with reference year 2015. The corresponding noise map for areas within the state of Berlin was also shown.

Mapping process for the railways subject to the General Railway Act

The Federal Railway Authority (EBA) independently carried out the noise mapping process for the federal railways according to the General Railway Act (AEG). The current data (as of December 2014) can be viewed via the EBA's map service [in German]. The data were passed on to the Senate Department of Urban Development and the Environment and entered into the consideration of the total values of noise pollution.

Calculation Model

Software Employed

The input data were prepared and compiled in a 3D calculation model of the software (IMMI 2012 / IMMI 2014).

Obstructions

Obstructions, such as terrain edges, buildings and noise insulation facilities, were taken into account, with the parameters described in the input data (location, altitude, reflection properties, etc.). The basic model formed from the terrain and obstructions remained as it was for the calculation of all noise types.

Determination of Reception Points

At residential buildings, hospitals and schools, the position of reception points was determined according to the Preliminary Calculation Method for Determining the Exposure Figures Caused by Environmental Noise (VBEB). The number of inhabitants in residential buildings was distributed among the reception points of the respective residential buildings in equal shares.

Plausibility Check

The plausibility check consists of a visual check of 3D-views of the calculation model and numerous automatic plausibility queries. The following contexts are automatically checked in this process:

- Crossing of terrain contour lines
- Crossing of rail lines with buildings
- Crossing of noise protection walls with rail lines or buildings
- Value range of emissions factors (traffic, speed, etc.)
- Value range of building heights and areas, reflection properties

Calculation Parameters

It is not possible to carry out a mapping process which meets the requirements of the Environmental Noise Directive within economically realistic parameters, if the calculation rules are followed completely and strictly. For that reason, calculation parameters were determined in a simplified manner (minimum level at 25 m distance, range of reflection surfaces limited to 200 m, first-order reflection), essentially resulting in a neglect of irrelevant immission effects at certain reception points. As tested and certified, the accuracy requirements for the noise mapping calculation results were met, and achieved an overall accuracy of 2 dB(A).

Calculation Method

Road Traffic

The Preliminary Calculation Method for Environmental Noise at Roads (VBUS) was used for the acoustic calculations of the strategic noise maps (cf. 34th BImSchV, § 5, Section 1). The noise indices L_{DEN}(weighted 24-h mean value) and L_{Night} were calculated with a step size of 10 m x 10 m at a reception point height of 4 m above the ground.

The number of persons exposed in their dwellings, of schools and hospitals was determined according to the VBEB.

The corrections for multiple reflections were determined and considered according to the specifications made in the VBUS. Separate corrections for traffic lights were not allowed.

Streetcar and Subway/Underground Traffic

The Preliminary Calculation Method for Environmental Noise at Railways VBUSch and the VBEB (cf. 34th BImSchV, § 5, Sect. 1) were used for acoustic calculation of the strategic noise maps as well as the persons exposed in their dwellings, schools and hospitals. The noise indices L_{DEN} and L_{Night} were calculated with a step size of 10 m x 10 m at a reception point height of 4 m above the ground.

Commercial Plants

The Preliminary Calculation Method for Environmental Noise Caused by Industrial and Commercial Plants (VBUI) and the VBEB were used for the acoustic calculation of the strategic noise maps, as well as the persons exposed in their dwellings, schools and hospitals. The noise indices L_{DEN} and L_{Night} were calculated with a step size of 10 m x 10 m at a reception point (façade level) height of 4 m above the ground.

Using the Data Display

The various subject maps made available to the public here represent the noise situation in relation to areas broken down by classes, as provided in the Environmental Noise Directive. Moreover, they also provide the possibility of obtaining factual data by surveys: Maps 07.05.1 through 07.05.10 show the grid values which constitute the basis for the classification, and, for road traffic noise, additional background information about the principal road network registered. Since the grid used for representation in these maps is a 10 m x 10 m grid, the individual statements are not suited for precise evaluation of buildings. For that reason, Map 07.05.11 (Façade Levels at Residential Buildings within the Exposure Range of Main Noise Sources) provides a complete overview of the reception points used on the façades of residential buildings, schools and hospitals, including the immissions levels calculated.

Calculation Results / Tabular Evaluations

As required in the "Directive on the Assessment and Management of Environmental Noise", strategic noise maps graphically represent the noise situation in the following isophone classes:

Fig. 1: Representation of isophone classes according to the requirements of 34th BImSchV	
	L_{Night} > 50 dB(A) up to 55 dB(A)
L_{DEN} > 55 dB(A) up to 60 dB(A)	L_{Night} > 55 dB(A) up to 60 dB(A)
L_{DEN} > 60 dB(A) up to 65 dB(A)	L_{Night} > 60 dB(A) up to 65 dB(A)
L_{DEN} > 65 dB(A) up to 70 dB(A)	L_{Night} > 65 dB(A) up to 70 dB(A)
L_{DEN} > 70 dB(A) up to 75 dB(A)	L_{Night} > 70 dB(A)
L_{DEN} > 75 dB(A)	

Fig. 1: Representation of isophone classes according to the requirements of the "Directive on the Assessment and Management of Environmental Noise"

They form the basis for preparing an overall urban noise reduction plan (in German).

The noise exposure is specified through the following variables:

- Tabular data about the estimated number of persons living in areas located within the isophone bands according to Fig. 1. Figures should be rounded up or down to the next hundredth place.
- Tabular data about noise-exposed areas as well as the estimated number of dwellings, schools and hospitals in these areas for the following L_{DEN} values: L_{DEN} > 55 dB(A), L_{DEN} > 65 dB(A), L_{DEN} > 75 dB(A).

The summarized results of the exposure and area statistics for the main federal railway lines for conurbation areas are available here.

Road Traffic

Table 4: Number of people impacted in their homes due to road traffic noise (related to noise index L_{DEN})					
Level range L_{DEN} in dB(A)	>55 to 60	>60 to 65	>65 to 70	>70 to 75	>75
Number of persons	201,900	148,000	147,000	91,000	6,400

Table 4: Number of people impacted in their homes due to road traffic noise on all streets assessed (based on the noise index L_{DEN})

Table 5: Number of persons exposed to road traffic noise in their dwellings (related to noise index L_N)					
Level range L_{Night} in dB(A)	>50 to 55	>55 to 60	>60 to 65	>65 to 70	>70
Number of persons	168,200	150,100	121,600	24,300	300

Table 5: Number of people impacted in their homes due to road traffic noise on all streets assessed (based on the noise index L_{Night})

Table 6: Plots of land, residences, and school and hospital buildings impacted by road traffic noise				
		Level range L_{DEN} in dB(A)		
	Total	>55	>65	>75

Area in km²	891.7	255.9	87.7	16.7
Number of dwellings	1,899,000	326,100	134,500	3,500
Number of school buildings	2,535	519	62	0
Number of hospital buildings	702	130	19	0

Table 6: Plots of land, residences, and school and hospital buildings impacted by road traffic noise on all streets assessed

In the assessment of schools and hospitals affected, each building of the respective facility was considered.

Streetcar and Subway/Underground Traffic

Table 7: Number of people impacted in their homes due to streetcar and subway noise (based on the noise index L_{DEN})					
Level range L_{DEN} in dB(A)	>55 to 60	>60 to 65	>65 to 70	>70 to 75	>75
Number of persons	41,800	27,200	13,900	1,700	300

Table 7: Number of people impacted in their homes due to streetcar and subway noise (based on the noise index L_{DEN})

Table 8: Number of people impacted in their homes due to streetcar and subway noise (based on the noise index L_N)					
Level range L_{Night} in dB(A)	>50 to 55	>55 to 60	>60 to 65	>65 to 70	>70
Number of persons	33,700	20,400	6,900	800	0

Table 8: Number of people impacted in their homes due to streetcar and subway noise (based on the noise index L_N)

Table 9: Plots of land, residences, and school and hospital buildings impacted by streetcar and subway noise				
		Level range L_{DEN} in dB(A)		
	Total	**>55**	**>65**	**>75**
Area in km²	891.7	23.5	6.8	0.3
Number of dwellings	1,899,000	46,600	8,700	200
Number of school buildings	2,535	47	2	0
Number of hospital buildings	702	18	1	0

Table 9: Plots of land, residences, and school and hospital buildings impacted by streetcar and subway noise

In the assessment of schools and hospitals affected, each building of the respective facility was considered. For example, if school complexes consisted of three buildings, all three buildings were evaluated.

Industry and Commerce

Table 10: Number of people impacted in their homes due to industrial noise (based on the noise index L_{DEN})					
Level range L_{DEN} in dB(A)	>55 to 60	>60 to 65	>65 to 70	>70 to 75	>75
Number of persons	300	100	100	0	0

Table 10: Number of people impacted in their homes due to industrial noise (based on the noise index L_{DEN})

Table 11: Number of people impacted in their homes due to industrial noise (based on the noise index L_N)					
Level range L_{Night} in dB(A)	>50 to 55	>55 to 60	>60 to 65	>65 to 70	>70
Number of persons	200	100	0	0	0

Table 11: Number of people impacted in their homes due to industrial noise (based on the noise index L_N)

Table 12: Plots of land, residences, and school and hospital buildings impacted by industrial noise				
		Level range L_{DEN} in dB(A)		
	Total	**>55**	**>65**	**>75**
Area in km²	891.7	3.0	1.2	0.0
Number of dwellings	1,899,000	300	0	0
Number of school buildings	2,535	0	0	0
Number of hospital buildings	702	0	0	0

Table 12: Plots of land, residences, and school and hospital buildings impacted by industrial noise

All individual buildings were included in the evaluation of the schools and hospitals involved. For example, if school complexes consisted of three buildings, three school buildings were evaluated.

Air Traffic

Tegel Airport

Tab 13: Number of people impacted in their homes due to aircraft noise from Tegel Airport (based on the noise index L_{DEN})					
Level range L_{DEN} in dB (A)	**>55 to 60**	**>60 to 65**	**> 65 to 70**	**> 70 to 75**	**> 75**
Number of people	131,200	88,800	88,800	1,700	0

***Tab. 13:** Number of people impacted in their homes due to aircraft noise from Tegel Airport (based on the noise index L_{Den}).*

Tab 14: Number of people impacted in their homes due to aircraft noise from Tegel Airport (based on the noise index L_{Night})					
Level range L_{Night} in dB (A)	**>50 to 55**	**>55 to 60**	**>60 to 65**	**>65 to 70**	**>70**
Number of people	45,200	8,700	200	0	0

***Tab. 14:** Number of people impacted in their homes due to aircraft noise from Tegel Airport (based on the noise index L_{Night}).*

Tab 15: Plots of land, residences, and school and hospital buildings impacted by

aircraft noise from Tegel Airport				
		Level range L_{DEN} in dB (A)		
	Total	>55	> 65	> 75
Area in sq km	891.7	55.8	9.5	1.7
Number of residences	1,899,000	132,000	11,200	0
Number of school buildings	2,535	211	2	0
Number of hospital buildings	702	38	1	0

Tab 15: Plots of land, residences, and school and hospital buildings impacted by aircraft noise from Tegel Airport

Schönefeld Airport (2010)

Tab 16: Number of people in Berlin impacted in their homes due to aircraft noise from Schönefeld Airport (2010) (based on the noise index L_{DEN})					
Level range L_{DEN} in dB (A)	>55 to 60	>60 to 65	> 65 to 70	> 70 to 75	> 75
Number of people	4700	1,400	0	0	0

Tab 16: Number of people in Berlin impacted in their homes due to aircraft noise from Schönefeld Airport (2010) (based on the noise index LDEN)

Tab 17: Number of people in Berlin impacted in their homes due to aircraft noise from Schönefeld Airport (2010) (based on the noise index L_{Night})					
Level range L_{Night} in dB (A)	>50 to 55	>55 to 60	>60 to 65	>65 to 70	>70
Number of people	2,100	200	0	0	0

Tab. 17: Number of people in Berlin impacted in their homes due to aircraft noise from Schönefeld Airport (2010) (based on the noise index L_{Night})

Tab 18: Plots of land, residences, and school and hospital buildings in Berlin impacted by aircraft noise from Schönefeld Airport (2010)				
		Level range L_{DEN} in dB (A)		
	Total	>55	> 65	> 75
Area in sq km	891.7	9.5	0	0.0
Number of residences	1,899,000	3,400	0	0
Number of school buildings	2535	0	0	0
Number of hospital buildings	702	0	0	0

Tab. 18: Plots of land, residences, and school and hospital buildings in Berlin impacted by aircraft noise from Schönefeld Airport (2010)

Tegel und Schönefeld Airports (2010)

Tab 19: Total number of people in Berlin impacted in their homes due to aircraft noise from Tegel and Schönefeld Airports (2010) (based on the noise index L_{DEN})					
Level range L_{DEN} in dB (A)	**>55 to 60**	**>60 to 65**	**> 65 to 70**	**> 70 to 75**	**> 75**
Number of people	135,900	90,200	18,800	1,700	0

Tab. 19: Total number of people in Berlin impacted in their homes due to aircraft noise from Tegel and Schönefeld Airports (2010) (based on the noise index L_{DEN}).

Tab 20: Total number of people in Berlin impacted in their homes due to aircraft noise from Tegel and Schönefeld Airports (2010) (based on the noise index L_{Night})					
Level range L_{Night} in dB (A)	**>50 to 55**	**>55 to 60**	**>60 to 65**	**>65 to 70**	**>70**
Number of people	47,300	8,900	200	0	0

Tab. 20: Total number of people in Berlin impacted in their homes due to aircraft noise from Tegel and Schönefeld Airports (2010) (based on the noise index L_{Night}).

Tab 21: Total of plots of land, residences, and school and hospital buildings in Berlin impacted by aircraft noise from Tegel and Schönefeld Airports (2010)				
		Level range L_{DEN} in dB (A)		
	Total	**>55**	**> 65**	**> 75**
Area in sq km	891.7	65.3	9.5	1.7
Number of residences	1,899,000	135,400	11,200	0
Number of school buildings	2.535	211	2	0
Number of hospital buildings	702	38	1	0

Tab. 21: Total of plots of land, residences, and school and hospital buildings in Berlin impacted by aircraft noise from Tegel and Schönefeld Airports (2010)

Schönefeld Airport (2015, Prognosis)

Tab 22: Number of people in Berlin impacted in their homes due to aircraft noise from Schönefeld Airport (2015, prognosis) (based on the noise index L_{DEN})					
Level range L_{DEN} in dB (A)	**>55 to 60**	**>60 to 65**	**> 65 to 70**	**> 70 to 75**	**> 75**
Number of people	11,000	1,900	0	0	0

Tab. 22: Total number of people in Berlin impacted in their homes due to aircraft noise from Tegel and Schönefeld Airports (2010) (based on the noise index L_{DEN}).

Tab 23: Number of people in Berlin impacted in their homes due to aircraft noise from Schönefeld Airport (2015, prognosis) (based on the noise index L_{Night})					
Level range L_{Night} in dB (A)	**>50 to 55**	**>55 to 60**	**>60 to 65**	**>65 to 70**	**>70**
Number of	1900	0	0	0	0

people					

Tab. 23: Total number of people in Berlin impacted in their homes due to aircraft noise from Tegel and Schönefeld Airports (2010) (based on the noise index L_{Night}).

Tab 24: Plots of land, residences, and school and hospital in Berlin impacted by aircraft noise from Schönefeld Airport (2015, prognosis)				
		Level range L_{DEN} in dB (A)		
	Total	>55	> 65	> 75
Area in sq km	891.7	20.8	0.0	0.0
Number of residences	1,899,000	7,100	0	0
Number of school buildings	2,535	3	0	0
Number of hospital buildings	702	0	0	0

Tab 24: Plots of land, residences, and school and hospital in Berlin impacted by aircraft noise from Schönefeld Airport (2015, prognosis)

All individual buildings were included in the evaluation of the schools and hospitals involved. For example, if school complexes consisted of three buildings, three school buildings were evaluated.

Sources of Expert Opinions and Advanced Links

Sources of Expert Opinions

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