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Spatial planning and management as part of a Balanced Approach to noise management at Brussel-National Airport

Management summary

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Brussels (National) Airport is a significant economic gateway and employment hub. However, due to its specific location in the vicinity of many residential areas, the airport currently causes serious noise pollution and sleep disturbance, resulting in a certain amount of highly annoyed and highly sleep-disturbed. The implementation of the Balanced Approach procedure (EU Regulation 598/2024) has been assigned to the Department of Environment. The procedure entails a meticulous determination of the most cost-effective combination of measures within the four pillars of noise abatement, as delineated by the ICAO (International Civil Aviation Organization). Achieving the optimal equilibrium between the economic significance of an international airport and the quality of the surrounding living environment constitutes a significant challenge.

The Department of Environment is committed to meticulous preparation for the implementation of the Balanced Approach procedure. This will be achieved through comprehensive research into the possibilities offered by Pillar 2, Spatial Planning and Management. The objective of this research is to ascertain whether these measures could ultimately form part of the mix of measures with which a predetermined noise target can be achieved.
The present study undertakes an analysis of this question, including an assessment of the feasibility of such measures within the specific context of Brussels Airport. The pillar "Spatial Planning and Management" constitutes a series of measures designed to harmonize airport operations and adjacent land uses.

REPORT 1: INTERNATIONAL EXPLORATION

The primary objective of Report 1 is to examine the potential measures that fall under the umbrella of Pillar 2 of the Balanced Approach. In order to gain a more profound insight into the implementation of these measures, an examination of five neighbouring airports and their respective measures was conducted. The following airports are selected: Liège-Bierset Airport (Walloon Region), Paris-Orly Airport and Basel-Mulhouse Airport (France), Zurich Airport (Switzerland), and Düsseldorf Airport (Germany). The desktop research was supplemented by a series of interviews with both competent authorities and airport companies.

Pillar 2 encompasses three categories of measures, as delineated in the manual formulated by the ICAO. The basis of this approach is **noise zoning**, whereby zones are delineated according to a predetermined noise contour, calculated in accordance with a specific noise indicator. Consequently, the zones delineate a gradient ranging from very high exposure to low exposure to noise.

The primary objective of **planning measures** is to prevent spatial development that is likely to result in significant levels of annoyance and sleep disturbance. This results in planning restrictions. The most frequently implemented restrictions encompass the prohibition of new housing, densification, and the designation of new residential areas, inclusive of any rezoning. Additionally, restrictions are imposed on the establishment of additional facilities for vulnerable groups, such as schools, residential care facilities, and childcare initiatives. The transfer of development rights or an easement acquisition were not employed as measures by the airports studied. The ICAO has indicated that the aforementioned measures can also be linked to a comprehensive spatial planning vision for the airport region.

Mitigation measures are primarily designed to protect or facilitate individuals and communities that have already been impacted. It was evident that every country examined had building codes

mandating the use of insulation in new buildings, in addition to a comprehensive noise insulation programme for renovations. However, it should be noted that each insulation programme differs in terms of its scope, financial support, approach and support and advice. Scope differences may be illustrated by a comparison of insulation programmes that cover only bedrooms versus those that cover the entire dwelling. Financial support differences may be illustrated by a comparison of insulation programmes that provide a percentage of the works versus those that provide a fixed sum. Approach differences may be illustrated by a comparison of insulation programmes that are voluntary versus those that are collective per neighbourhood. Finally, support and advice differences may be illustrated by a comparison of insulation programmes that provide general information versus those that provide active assistance and project management.
Furthermore, a land acquisition policy is in force in exceptional cases. The efficacy of this policy is contingent upon the property in question ceasing to be utilised as a dwelling. A range of other measures have been implemented, including the pursuit of an active real estate information policy that identifies the issue, compensation for outdoor areas to compensate for the loss of quality of life, and compensation for relocation as a tenant or for the cessation of a business as a result of a changing neighbourhood.

An overview of all the different zones, threshold values and associated planning and mitigation measures is included in Appendix 3 of PART 1. The threshold values employed by different countries can only be compared if the same noise indicator is applied.

In conclusion, **financial measures** have been established to provide the necessary funding for the implementation of mitigating measures, including the noise insulation programme. These include noise charges during the landing or take-off of aircraft, or the number of passengers, which are collected in a fund.

The international comparison resulted in the following specific observations:

- The countries studied primarily utilise two distinct categories of noise indicators: firstly, the average noise level over a 24-hour period (L_{den}); and secondly, a separate average noise level for day and night. Furthermore, in exceptional cases, a criterion per overflight is taken into account based on the frequency of exceedances of event-related variables, the noise indicator NAT (Number Above Threshold). This indicator is intended to demonstrate the number of times the noise from an aircraft exceeds a certain noise threshold. This approach enables the consideration of both peak level and frequency.
- The noise zone structures of the countries studied vary. The disparities can be attributed to the quantity of maps depicting temporal frameworks (short term and long term), the number of threshold values, and consequently the number of zones, and the influence of the environmental type or sensitivity class.
- It has been established that specific measures are linked to each zone in which a specific threshold value is exceeded. In addition to practical and economic factors, it is imperative that these threshold values are aligned with the nuisance experienced and other health effects.
- Each of the countries studied has its own unique combination of measures. It should be noted that certain measures are applied uniformly by all national authorities and airport authorities:
    - The construction of new housing, irrespective of its type, is prohibited in the zone that has the highest exposure.
    - The necessity for insulation in new construction and densification is a matter of crucial importance.
    - A noise insulation programme for renovation is to be implemented for all noise zones in which a differentiated subsidy policy or other support is in place per zone. The approach of

each programme varies significantly from country to country. A fund is established from noise charges with the objective of financing the measures.

- It is also notable that other measures are more unique, such as an additional ban on the construction of new vulnerable facilities with and without sleeping accommodation implemented in Germany, (financial) compensation for outdoor areas in the vicinity of Düsseldorf Airport and (financial) compensation for tenants and for the closure of businesses, situated around Liège-Bierset Airport.
- Research has demonstrated that the implementation of the measures is anchored in federal legislation on noise control (e.g. in the form of laws and regulations) that was introduced many years ago in the countries under study. Consequently, the majority of measures are consistent across all airports within a given country, with the same indicators and threshold values being applied. In the region of Flanders, this would be analogous to regional legislation, given that environmental policy falls under the jurisdiction of the Flemish government.
- However, there is also a degree of flexibility, as evidenced by the removal of the third zone, known as "zone C" in the context of Paris-Orly airport. Concurrently, the designation of "urban renewal sectors" emerged, enabling the development of substantial residential projects as a concession to the challenges posed on quality of life and housing shortages in the vicinity of the airport. A second example of designation is that of the Schutzkonzept Süd, located to the south of Zurich Airport, which involves the implementation of an additional noise insulation programme. This programme is intended to protect against the noise of landing aircraft during the early morning hours, from 6 a.m. to 7 a.m.

The comprehensive implementation and extent of a Pillar 2 measure are contingent upon the measures **inherent to the other pillars of the Balanced Approach**, including reduction of noise at source (Pillar 1), noise abatement operational procedures (Pillar 3), and, when deemed requisite, operating restrictions (Pillar 4). It is evident that this has a considerable impact on the spatial scope and distribution of potential nuisances, and consequently the associated measures.

REPORT 2: EVALUATION OF EXISTING PROPOSALS UNDER PILLAR 2

In Report 2, an analysis is conducted of the available proposals for the mitigation of noise issues which have been advanced by two groups: Actie Noordrand and WerkgroepLeuven. The two groups presented their proposals during a physical meeting. Each of the participants presented an alternative proposal for measures to reduce the number of people affected by noise and sleep disturbance. The proposals encompass all the pillars of the Balanced Approach, yet, as per the study, the report places particular emphasis on the elements that fall within the purview of pillar 2. Both groups contend that the mandatory noise indicators, such as L_{den} and L_{night}, are inadequate in providing sufficient protection against noise nuisance. They further argue that these indicators fail to reflect the actual nuisance experienced or its impact on health. However, it is important to note that each proposal focuses on different additional parameters that should be taken into account. The proposal by Actie Noordrand focuses primarily on the impact of the number of overflights and the concentration of noise in densely populated areas. The proposal entails the implementation of a diversified overflight policy, entailing distinct maximum limits for daytime, evening, and night-time periods. The proposal by WerkGroepLeuven calls for the consideration of background noise levels in conjunction with peak levels and the average values L_{den} and L_{night}. The proposal sets out a framework for noise imission standards based on the VLAREM II legislation.

This segment of the study contemplates the viability of incorporating supplementary parameters in conjunction with L_{den} for the formulation of zoning criteria within Pillar 2. The four aspects or parameters under consideration are as follows: maximum noise level, overflight frequency, background noise level, and habituation. The correlation with report 1 of the study is determined by examining whether and how these parameters have been factored into the development of zoning criteria in the countries studied.

It is concluded that a criterion which takes into account the highest noise peaks or frequent quieter overflights, e.g. NAT68 = 6 or NAT60 = 100, better reflects the actual nuisance and has more support among local residents, because it is more understandable. This indicator is intended to demonstrate the number of times the noise from an aircraft exceeds a certain noise threshold. This approach enables the consideration of both peak level and frequency.

Despite the absence of a definitive consensus on the precise values associated with the occurrence of health effects, this does not constitute an impediment to its implementation. Threshold values are not merely a means of evaluating what is deemed acceptable from a health perspective; rather, they delineate a limit beyond which specific measures are deemed imperative. The determination of these values is not solely contingent on health considerations, but is also informed by cost-effectiveness in relation to the objectives, economic feasibility, and geographical reality. The additional criteria of "maximum noise level" and "overflight frequency" assume particular importance during nocturnal periods, given the potential for triggering wake-up reactions. These parameters can be utilised to establish an additional night-time zone, with specific measures implemented to safeguard sleep functions.

The aspect of "background noise level" has moderate validity. This is attributable to the ongoing discourse surrounding the ethical considerations of exposing individuals who have already been exposed to elevated levels of noise. Furthermore, the masking of aircraft noise by background noise is found to be contingent on spectral content and continuity. The concept of "habituation" is found to exert minimal influence as an additional parameter within the zoning criteria and is therefore not retained.

It is evident that only a limited number of these measures will contribute to a reduction in the number of people seriously affected and the number of people with serious sleep disturbances. However, it can be argued that these measures frequently attempt to limit the growth in the number of individuals exposed in the areas with the highest exposure. Moreover, the measures can continue to be utilised as a supportive policy to enhance public support.

REPORT 3: POSSIBLE MEASURES WITHIN PILLAR 2

Report 3 offers a more comprehensive analysis of the potential measures within the "spatial planning and management" pillar, with a particular focus on the context of Brussels Airport.

WHERE TO INTERVENE? NOISE ZONING

The concept of noise zoning is a term used to describe the process of dividing an area into different zones based on the level of noise they generate.
It is imperative to acknowledge the significance of noise zoning in determining the scope of measures. This zoning framework provides a structural framework that indicates the locations where measures need to be taken in relation to noise pollution. Within the context of Brussels Airport, the noise impact zone extends over two regional entities: the Flemish Region and the Brussels-Capital Region. The coordination of a uniform zoning structure to regulate noise pollution around the airport necessitates interregional cooperative efforts.

The design of the spatial zoning around Brussels Airport is informed by several research questions. These questions are based on noise zoning at the airports or in the countries studied. In order to establish a well-founded spatial differentiation in the form of specific zoning and the accompanying measures, it is necessary to address the following questions:

- Is the noise pollution expected to differ in the short or long term?
- Should zoning be distinguished between planning and mitigation measures?
- Are adapted measures needed at night, early morning and late evening?
- Should noise zones be refined based on a frequency contour?
- Is it desirable to pursue a differentiated policy based on land use zones?

The delineation of the impact zone and the consequent measures is dependent on the calculated noise exposure, which is, in turn, influenced by the comprehensive set of measures, encompassing the other pillars of the Balanced Approach. An enlarged impact zone has the potential to result in more intricate scenarios, necessitating the implementation of measures that are more costly and encompass a greater number of stakeholders. This necessitates comprehensive communication and collaboration with local communities and government agencies.

The study provides an initial outline for a possible zoning structure. Each zone has its own specific characteristics:

- **Zone A: Heaviest exposure zone** – This zone is located right next to the airport and experiences very high exposure. Rigorous measures are necessary to guarantee quality of life.
- **Zone B: Heavy noise zone** - This zone includes areas with high exposure where noise pollution is significantly high but still manageable within certain regulations.
- **Zone C: Manageable noise zone** - This zone has moderate exposure and is suitable for noise control measures such as sound insulation and sound-absorbing infrastructure.
- **Zone D: Low noise zone** - Areas with relatively low exposure where minimal measures are required to ensure quality of life.
- **Zone E: Additional night zone** - Specific measures for the night period and/or late evening/early morning hours apply here.

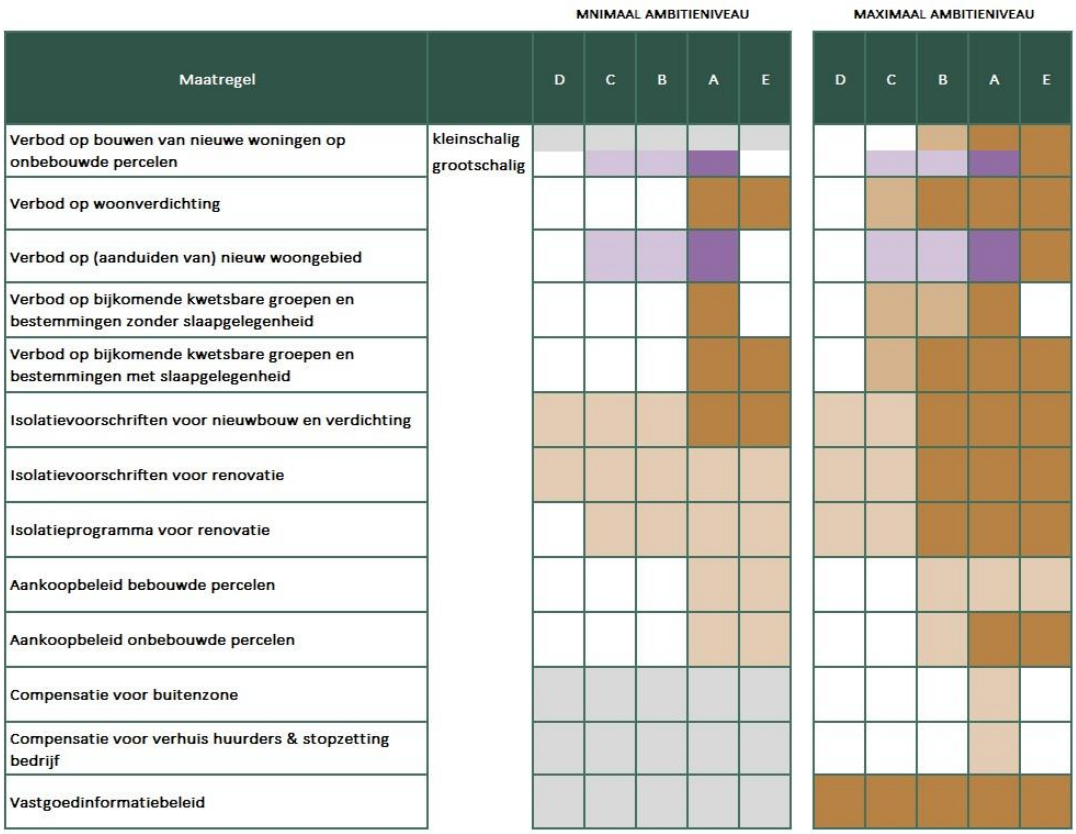
HOW TO INTERVENE? PROPOSED MEASURES

In the absence of a comprehensive understanding of all selected measures to mitigate noise pollution in the vicinity of the airport, this study offers insights into two proposed combinations of measures within pillar 2

- **The minimum level of ambition** is focused on a basic package of measures with a high impact. The emphasis is on actions for which there is already broad social and political support. These

measures aim to reduce nuisance for the most affected and are a first step towards a more structural approach.

– **The maximum level of ambition** aims to achieve a structural and sustainable reduction in noise pollution on as broad a scale as possible . The proposed approach is characterised by an integrated framework, encompassing a broader zone of influence surrounding the airport. The maximum level of ambition is ambitious and forward-looking, but also requires a broader investment framework and broad political and social support.



Legend used in the figure above

Level of implementation

Existing EIA assessment framework for new residential developments

Measure is mandatory	*Measure is mandatory with modified conditions*	*Measure is voluntary*	*Measure is not applied*	*Strictest application*	*Applicable unless passive protection measures are in place*

A wide spectrum of intermediate forms is observable between the minimum and maximum levels of ambition. The deployment of measures is dependent on various factors, including the spatial context, the availability of resources, local sensitivities, and policy priorities. These intermediate levels facilitate a systematic, step-by-step approach to noise reduction, achieving a balance between ambition and feasibility. This enables a transition to a more integrated approach tailored to the region, with room for growth, evaluation and adjustment.

It is imperative to make a judicious selection of ambition level in order to achieve a harmonious balance between effectiveness, feasibility and support. The implementation of clearly defined zones, each with a corresponding set of measures appropriate to its level of ambition, fosters the establishment of a policy framework characterised by transparency. This framework serves to

safeguard the quality of life, while concurrently directing future spatial development in a manner that is congruent with the airport's objectives.

It is imperative that this framework is then granted sufficient legal force, for example by means of various planning initiatives such as a regional spatial implementation plan to anchor changes in building rights and a regional urban development regulation to anchor the legal obligation for high-performance acoustic façade insulation. The option of issuing a decree to strengthen the entire system merits consideration.