IN THE SPOTLIGHT

Noise abatement – rules and measures to reduce noise

Noise has highly detrimental effects on health, as numerous studies in the field of noise impact research show. In its Environmental Noise Guidelines for the European Region, the World Health Organization (WHO) provides a list of adverse health outcomes associated with noise: they include cardiovascular diseases, sleep disturbance, hearing impairment and tinnitus, cognitive impairment, and detrimental effects on quality of life, well-being and mental health.

Noise abatement and noise prevention are therefore issues which must be addressed in efforts to protect health. In Germany, a raft of legislation and regulations are in place to protect human health and the environment from harmful noise emissions. The legal provisions are as diverse as the noise sources themselves. The legal basis is established by the Federal Immission Control Act (*Bundes-Immissionsschutzgesetz* – BImSchG) and related items of legislation, such as the Sports Facilities Noise Regulation (*Sportanlagenlärmschutzverordnung*).

Noise abatement and noise protection may also be regulated in specialised legislation for sectors such as aviation; here, the Civil Aviation Act (*Luftverkehrsgesetz*) requires particular consideration to be given to local residents' night-time rest (Section 29b), while the German Act for Protection against Aircraft Noise (*Gesetz zum Schutz gegen Fluglärm* – FluLärmG) specifies reference values for the establishment of noise protection areas. The primary purpose of these provisions is to set reference values for permissible levels of noise pollution, periods of quiet, and entitlements to structural noise abatement measures.

Protection from noise: active and passive noise abatement

In principle, two different approaches may be adopted to minimise noise:

- Active noise abatement aims to avoid and reduce the noise at source. It may include technical measures such as the introduction of quieter engines and machinery or the use of **low-noise** road **surfacing**. Provisions on rest periods are primarily intended to avoid night-time disturbance. Active noise abatement measures can also include introducing speed restrictions or, in the case of aircraft noise, optimising flight paths. For example, noise is reduced if incoming aircraft approach the runway from higher altitudes, while rerouting flight paths avoids overflying of residential areas.
- Passive noise abatement, by contrast, protects local residents by means of structural modifications, such as installation of soundproof windows or roof and roller blind box insulation.

When planning new housing, the floor plan design is important: bedrooms should be located along the least exposed façade.

One noise is not like another

The level of noise-related disturbance that an individual may experience does not depend solely on the type of noise, however. Numerous non-acoustic factors come into play, such as the person's attitude to the noise source, and individual sensitivity.

Noise impact research shows that traffic noise is perceived to be more annoying than commercial noise, for example. If the noise occurs around the clock, it has a more debilitating effect and is also likely to cause sleep disturbance. Individual noise peaks are particularly likely to jolt sleepers awake.

Noise-related conflicts occur mainly in densely populated urban areas. On the one hand, there is a desire to move towards a "compact city" which provides an integrated space for housing, working and leisure. This is also an effective way to reduce land consumption. On the other hand, local residents need peace and quiet and must be protected from the harmful health impacts of noise. Local authorities must consider these aspects in their urban planning.

Oeko-Institut researchers are working on a range of projects which address the issue of noise.

Commercial noise in the compact city

The inclusion of "urban area" as a new zoning category in Section 6a of Germany's Federal Land Utilisation Ordinance (*Baunutzungsverordnung*) is intended to achieve a compact city with a good mix of uses. One effect of this densification is closer proximity between housing and commercial premises. A further objective is to create more housing without increasing the footprint. In parallel to the introduction of the "urban area" category of land use, the Sixth General Administrative Provision to the Federal Immission Control Act (Technical Instructions on Noise Abatement – *TA Lärm*) was also amended. The amendment raised permissible ambient noise reference values for these areas to 63 dB(A) during daytime hours and 45 dB(A) at night. The abbreviation dB(A) stands for decibel, which is the unit of measurement for sound pressure level. "A" is a frequency weighting used to capture the noise source as perceived by the human ear.

Against this background, the German Environment Agency (UBA) commissioned the Oeko-Institut to conduct a research study on "Reduction of commercial noise in cities". Together with ZEUS GmbH and the GeräuscheRechner consultancy, the researchers investigated the effects of commercial noise on local residents at five urban survey sites. They began by determining the objective noise level and conducted a survey of local residents. The survey sites were mixed-use spaces, with housing and typical commercial operations such as food outlets, retail and office buildings alongside parking areas and other smaller business units.

As a result of the study, the following key statements can be made with regard to urban commercial noise as defined here:

- In general, local residents have a positive attitude towards the densification concept and are in favour of mixed use.
- However, the observed satisfaction with housing arrangements does not imply that residents are willing to tolerate noise pollution. From a noise impact perspective, a daytime ambient reference value of 63 dB(A) for urban commercial noise is well above the threshold denoting a risk to health.

- The likelihood of annoyance due to urban commercial noise also increases with duration of residence. In the context of the study, this finding argues against a noise habituation effect.
- The various types of commercial noise differ in terms of the perceived level of disturbance caused. Residents perceived food outlets, for example, to be more of a disturbance than tradesman's services.
- The conclusion to be drawn for the future is that based on this study, there should be no further increases in permissible ambient noise level reference values in densified areas.

Noise from sports facilities in built-up areas

A conflict of interests also exists in relation to club sports and recreational sports. Although sports facilities should be located within easy reach of housing areas, conflicts over noise abatement can arise between sports clubs and local residents. A particular feature of noise from sports facilities is that it occurs at times when the general public has an opportunity to rest and relax, e.g. during evening hours or on Sundays and public holidays. What's more, a characteristic of sound emanating from sports facilities is that there may be sudden changes in the noise level (e.g. short bursts of loud cheering when a goal is scored). Public information announcements over PA systems can be an additional source of disturbance.

Germany's Sports Facilities Noise Regulation was amended in 2017 and 2021 to reflect the fact that school and working hours have been extended in recent years. The amendments sought to extend opportunities to engage in sporting activities accordingly. They increased permitted noise levels from sports facilities during evening hours and rest periods on Sundays and public holidays; the reference values for these periods were also increased by 5 dB(A). The aim was to give a boost to association sports and extend sports facility usage periods, particularly for leisure and recreation, while continuing to give due consideration to local residents' need for peace and quiet.

Together with Möhler + Partner Ingenieure AG and ZEUS GmbH, researchers at the Oeko-Institut were commissioned by the German Environment Agency (UBA) to evaluate the desired objectives. To that end, they are investigating the quantitative and qualitative changes in operations at the sports facilities selected as examples in built-up areas. Based on studies of noise pollution and annoyance, they are assessing to what extent the amendment of the Sports Facilities Noise Regulation is affecting local residents. The Oeko-Institut's task is to evaluate the legal framework in light of the findings.

Noise-related conflicts caused by leisure activities

Linking in with the research studies on commercial noise and noise from sports facilities, researchers at the Oeko-Institut, in collaboration with Möhler + Partner Ingenieure AG and ZEUS GmbH, have been commissioned by the German Environment Agency (UBA) to investigate the contentious area of leisure-related noise in cities. The research project complements the studies mentioned above and thus makes a significant contribution to the comprehensive assessment of noise in inner-city areas.

The purpose of the project is to identify and assess common types of noise-related conflict associated with leisure activities such as open air events, skate parks and urban festivals, and to devise conflict avoidance strategies and policy options. To that end, a comprehensive survey will be conducted among local residents in the vicinity of leisure facilities. It will look at acoustic factors, such as the volume, type and frequency of noise occurrence, as well as non-acoustic factors, such as personal attitude towards the noise source.

The following questions are the main focus of research interest:

- Why do local residents feel disturbed or annoyed by leisure-related noise?
- What is their subjective attitude towards the leisure activity in question?
- To what extent does society regard the activity as acceptable?
- Are local residents who take part in or benefit from the leisure activity disturbed by the noise in the same way as non-participating local residents?
- Is there scope to influence the acceptance of noise if information is supplied to local residents in advance and opportunities are provided for them to get involved?
- How can event organisers and businesses be sensitised more effectively to the noise caused by their leisure offer? How can they be motivated to address the issue of noise abatement?

The researchers will then critically examine the findings in light of the current legal framework. A comparison with European regulations will further enhance the analysis. It should be noted, however, that regulations on leisure-related noise are generally adopted at the municipal level and vary considerably.

The results of the analysis will be presented in the form of exposure-response curves which show the relationship between noise pollution and the affected individuals' perceived annoyance, which is an objective measure of noise impact recognised in noise impact research. Guidance for local authorities and event organisers will show how to avoid and manage conflicts over leisure-related noise.

Noise abatement around Frankfurt Airport

Frankfurt Airport (Fraport) is Germany's largest airport. Up to 1,500 planes take off and land here every day. The noise pollution for local residents, particularly those living right under the flight path, is high. As noise impact research shows, aircraft noise has highly detrimental effects on health. Effective measures to protect the communities concerned from the negative impacts of aviation are therefore essential.

Researchers at the Oeko-Institut have been sharing their expertise with the Airport and Regional Forum (*Forum Flughafen und Region* – FFR) for many years. The FFR is a voluntary dialogue process which brings together policy-makers, industry and affected communities to identify and mitigate negative impacts of the airport's operations. For example, the Oeko-Institut coordinates and supports the Expert Group on Active Noise Abatement (ExpASS) within the FFR and is involved in local consultation processes.

ExpASS is primarily concerned with the development and application of active noise abatement measures in dialogue with all stakeholders, including policy-makers, the aviation industry and local authorities. Options for mitigating the impacts of noise include rerouting flight paths to less densely populated areas and increasing overflight altitudes over residential areas.

Website: The AMTIX short takeoff route: consultation process, with Oeko-Institut involvement

Study: Noise-Related Annoyance, Cognition and Health (NORAH), with Oeko-Institut involvement (on external website)

Expert reports on aircraft noise abatement

In addition to providing specific support at the Frankfurt site, Oeko-Institut researchers are working at federal level to address broader questions relating to aircraft noise abatement. Various studies have been produced on behalf of the German Environment Agency (UBA):

Weiterentwicklung der rechtlichen Regelungen zum Schutz vor Fluglärm [Further development of legal provisions on aircraft noise abatement]: Expert report by the Oeko-Institut on behalf of the German Environment Agency (UBA)

Evaluation der 2. Fluglärmschutzverordnung [Evaluation of the Second Decree on the Implementation of the Act on Protection against Aircraft Noise]: Expert report by the Oeko-Institut on behalf of the German Environment Agency (UBA)

Here, a project commissioned by the German Environment Agency (UBA) to assess the implementation status of the Second Decree nationwide is currently under way. It focuses on the application of structural noise abatement measures at airports used for civilian and military purposes.

Contact

Christoph Brunn
Deputy Head of Division
Environmental Law & Governance

Oeko-Institut e.V., Office Darmstadt
Phone: +49 6151 8191-128
Mail: c.brunn@oeko.de

Silvia Schütte
Senior Researcher
Environmental Law & Governance

Oeko-Institut e.V., Office Darmstadt
Phone: +49 6151 8191-134
Mail: s.schuette@oeko.de

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