



# FORUM ACUSTICUM EURONOISE 2025

## A SIMPLE STRUCTURED APPROACH TO URBAN GREENSPACE ACOUSTIC DESIGN

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### ABSTRACT

As urban areas become more densely populated, open spaces become increasingly important for recreation. Acoustic quality plays a key role in recreational value. The new website [klangraumarchitektur.ch](http://klangraumarchitektur.ch) of the Cercle Bruit Suisse (Association of Cantonal Noise Protection Offices) therefore aims to provide all those involved in the design or enhancement of such open spaces with basic principles and practical tips for good sound quality, while also highlighting synergies with heat reduction.

As a first step, the situation is analysed using the 12 criteria for restoring sound quality in courtyards, squares and parks (Forum Acusticum 2023). This assessment is carried out by a noise expert in relation to one of the 13 reference locations in 8 Swiss cities with a published assessment.

Possible interventions for the acoustic design or improvement are divided into eight areas: Noise control at source around the site / terrain and structuring / buildings and small structures / walls and facades / ground and paths / plants and animals / water / sound art, always accompanied by examples and binaural sound demonstrations.

Finally, the presentation will show how the issue is being addressed through federal legislation, cantonal policies and measures already taken by cities and municipalities.

**Keywords:** *urban green spaces, restorative soundscapes, acoustic quality, recreation*

### 1. INTRODUCTION

The gradual densification of urban spaces, i.e. building in already populated areas rather than on greenfield sites, is part of everyday urban planning. This also offers the opportunity to have one's workplace, supermarket, doctor's surgery and favourite café within walking distance, making car journeys unnecessary. On the other hand, studies show that more and more people - especially as a result of dense urbanisation - are using urban spaces that offer a high quality of stay.

Quality of stay - and therefore well-being in urban spaces - is influenced by various sensory impressions. Acoustics and temperature play an important role. Measures taken in urban areas, such as unsealing the ground, greening and increasing the amount of water, can have a positive effect on the acoustics of the environment. In addition, these measures can make a significant contribution to promoting plant and animal biodiversity, which in turn benefits acoustics: Different species of birds enrich the noise environment. Therefore, measures to combat heat not only result in more comfortable temperatures in urban open spaces, but also in better acoustics.

Good acoustics should not be left to chance, but should always be considered when planning new or redesigning existing parks, green spaces, squares and courtyards. A participatory process should be used to involve future users, local authorities, neighbourhood associations and other local stakeholders in changing the environment. This results in solutions that not only meet local needs, but also increase people's identification with 'their' place, which promotes recreation.

First, some possibilities for the assessment of the acoustic situation are presented. Afterwards, various measures for the acoustic design or improvement of urban spaces are shown and explained. [\*] refers to audio demonstrations on Youtube channel @Klangraumarchitektur.

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## 1.1 Soundwalks according to ISO/TS 12913-2

On a soundwalk, one or more acoustic environments are experienced and assessed *in situ* by walking through a specific area. People familiar with the area, i.e. local residents, can contribute essential information on aspects relevant to the assessment as 'local experts'.

ISO 12913-2 [1] Method A Part 1 asks to what extent traffic noise, other noise, human noise and natural noise are heard. In Part 2, the noise environment is to be assessed in relation to the eight affective attributes of pleasant, chaotic, lively, uneventful, quiet, disturbing, eventful and monotonous. This is used to calculate a rating in the main dimensions of pleasantness and eventfulness (ISO/TS 12913-3).

In method B, the following questions are to be answered on a five-point scale: How loud is it here? How unpleasant is it here? How appropriate is the noise for the environment? How often would you like to visit this place again? And as an open question: What goes through your mind?

Conclusion: ISO 12913 provides an internationally comparable assessment, but does not (yet) provide any indication of where or how improvements in acoustic quality could be made.

## 1.2 Tranquillity rating prediction tool TRAPT

The tranquillity rating prediction tool TRAPT [2] is an English method. It is based on the sound level of technical and human sources in dB(A) and on an image analysis that uses the area proportion (without sky) of natural and contextually appropriate elements (such as rural buildings or stone walls) in comparison to the proportion of human and man-made elements (people, cars, machines, buildings, ...). But what should be considered a contextual element in a city park or town square? People present can worsen the calculated tranquillity. Water sounds give a positive point, and visible rubbish leads to a devaluation. However, the positive effect of birdsong in trees and hedges that is so important for park visitors is completely neglected.

## 1.3 Cercle Bruit Switzerland assessment method for urban recreation areas

The Cercle Bruit assessment method developed by a group of experts since 2019 [3, 4] is based on the needs and expectations of the population in an urban recreational space (park, square, courtyard) and combines these – partly based on findings from soundscape research [5, 6, 7, 8] – with the acoustic properties of the location, condensed into twelve criteria. This provides information on the acoustic strengths and weaknesses of the location and possible design improvements.

Natural sounds, such as birdsong (even more so a variety of these), the buzzing of insects, the rustling of leaves and especially the sound of water, have a relaxing effect. In a recreational area, it should be possible to have an effortless conversation, unhindered by noise, but also without worrying that distant bystanders might overhear. Children should be able to play carefree. Generally speaking, the place should enable visitors to do the activities they intend to do (read, chat, play, etc.). A feeling of safety is equally important.

The following 12 criteria are assessed by trained experts, based on a prior assessment of one of the 13 reference locations with a published assessment.

- Is the place perceived as quiet, significantly quieter than the surroundings?
- Do natural sounds predominate over technical sounds?
- Is there a variety of positive sounds: Birdsong, water sounds, ...?
- Is it easy to have a personal conversation, but is there privacy at a distance?
- Do different activities only interfere with each other to a limited extent thanks to shielding or distance?
- Is there shielding against noise from outside and pleasant (diffuse) reflections which support positive sounds without any fluttering echo inside?
- Can critical objects be heard from where they are located or are there irritations caused by mirror reflections?
- Do water sounds, such as dripping, splashing, trickling or rushing, enhance the soundscape?
- Do sound art objects, sound plays or other artificial sound sources enhance the location?
- Is the site protected from blatant disturbances (such as the passage of a motorbike)?
- Are there different acoustic environments (e.g. quiet, lively) to choose from in the immediate vicinity?
- Can the location be recognised by positively perceived typical noises (soundmarks)?

The assessment form [3] lists examples of positive and negative features for each of these criteria, making it easier to make an assessment.

For detailed guidance on the application of these criteria and their underlying principles, please refer to the publication by Cercle Bruit [4] (in German and French, with an English version available upon request).





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## 2. AREAS FOR ACOUSTIC INTERVENTIONS

There are two ways to improve the quality of the environment through acoustic measures: by shielding, absorbing and diffusing noise (passive) or by introducing additional sound sources (active). While the design of terrain, buildings, facades, floors or vegetation passively influences the sound environment, plants and especially animals, but also water or sound art can actively enrich the sound environment. In any case, it is important to recognise and exploit the existing potential for acoustic quality in existing open spaces.

We apply the systematic of design domains as they are discussed in 3.1 to 3.8.:

### 2.1 Noise control at source in the neighbourhood

If a park is simply too noisy and there is no way to reduce the noise through obstacles or topography, then the noise emission outside the park needs to be reduced. This may mean a lower speed limit or a better road surface. In Switzerland, and perhaps in many other countries, noise legislation always protects residents, but never parks or other recreational areas. From a legal point of view, such measures can then prove difficult to implement. As shown in section 3.3, low noise barriers along the road can improve the acoustic quality behind them, although they only provide a small attenuation measured in dB(A).

### 2.2 Topography

The topography of an urban space plays a central role in the sound situation. A terrain with different elevations, recesses and hollows offers different listening experiences and contributes to acoustic diversity (figure 1).



Figure 1. Topography (Thomas Gastberger)

### 2.3 Buildings, small structures and walls

The arrangement of the buildings creates new public spaces. If acoustic criteria are also taken into account, the quality of the environment can be improved. On the one hand, buildings can shield noise (e.g. from traffic axes), but on the other hand, they can also carry the noise into the areas protected by the building block via reflective surfaces. Small buildings or smaller sound barriers such as low walls can also be effective in improving local acoustics in parks, squares or courtyards, at least at the higher frequencies that are important for the auditory impression. The low wall along Hermannspark in Winterthur (figure 2) attenuates the noise in the park only a by few decibels, but makes the rolling noise of the cars less sharp and the traffic seem a little further away [\*].



Figure 2. Small wall at Hermannspark Winterthur

### 2.4 Surfaces and facades

Building façades and wall surfaces are particularly important for the acoustics of urban spaces, as their orientation and structure and the materials used determine not only the visual but also the acoustic properties. Even a few degrees of deviation from the right angle can prevent annoying fluttering echoes, for example.

Unstructured concrete walls or glass façades reflect sound in a focussed manner and as a single echo, which hardly ever occurs in nature. Structured, three-dimensional façades, such as those typically found on historic buildings, are better. This provides more pleasant acoustics and therefore a better quality of stay. According to a recent survey in Switzerland [9], older buildings make it more likely that people will perceive a square positively, even if this is of course not only due to acoustics.





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On the Hirschenplatz in Lucerne's Old Town, which is surrounded on all sides, a subtle reverberation can be heard, but no echo thanks to the sloping and articulated façades. Old squares often sound better than new ones (figure 3).



**Figure 3.** Hirschenplatz in Lucerne [\*]

## 2.5 Floor and paths

A variety of design options are available here. In any case, unsealed floors disperse and absorb sound and are also an important heat-reducing measure. The quality of footpaths also has a significant influence on the sound of footsteps. They sound very different on a gravel path than on a wooden walkway (figure 4).



**Figure 4.** Wooden footpath in Horw near Lucerne

Lawn areas absorb around 50% of the sound. Because the floor area in a narrow courtyard is smaller than the area of the façades, it is in this case particularly important to make the floor as absorbent as possible. Experience has shown that mounds of earth covered with wood chips are a good option. With their higher absorption (more porosity and

larger surface area), they help to reduce reverberation, as shown by a courtyard in Dietikon near Zürich (figure 5).



**Figure 5.** Limmathof Dietikon [\*], Canton Zurich

## 2.6 Plants and animals

Plants hardly absorb any sound, but they reflect and scatter it in all directions, including down into the ground or up towards the sky. Opaque and sufficiently high hedges improve the quality of stay by attenuating high frequencies: traffic noise from behind the hedge (rolling noise, not so much the engine noise) seems more distant (figure 6).



**Figure 6.** Attenuation due to hedge and ground

Especially when there is a bit of wind, plants produce a variety of noises and sounds. Animals living in the vegetation create a natural atmosphere with their sounds and distract from the omnipresent noise. Birdsong is one of the most recreational sounds and is popular with the public because birds usually have positive connotations in an urban environment. Even better than a flock of sparrows is an audible variety of bird calls - this has now also been scientifically proven [10].





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## 2.7 Water

Water sounds revitalise places in a special way, because we associate water with freshness, coolness, drinking, cleanliness - in short: life. The sound of water can make traffic noise fade into the background and thus improve the sound quality. Natural bodies of water sound cheerful, canalised ones sound hollow or not at all.

The volume and sound of fountains should be adapted to the surroundings and placed in an acoustically favourable position. A fountain or a fountain does not necessarily belong in the centre of the square, but rather at the edge on the side from which the traffic noise penetrates. In this way, the sound of the water mixes with the noise of the traffic, which is ideally assigned to the fountain or water feature closer to the square. This is particularly successful at the edge of the pedestrian zone in Vilnius on Odiminu Skveras (figure 7).



**Figure 7.** Vilnius, Odiminu Skveras [\*]

Spatially distributed water features are not too loud close by and are easier to hear at a distance, as is demonstrated by three long rows of small water fountains on the Place de Libération in Dijon, France.

Fountains and water features with fluctuating noise attract attention again and again, even if they are not particularly loud, and thus distract from the traffic noise. However, occasionally switching off the water should not draw attention to the traffic noise. In this respect also, the Place de Libération in Dijon is a good example, as the traffic noise is only distant in this spacious pedestrian zone.

40 examples of water sound in the context of traffic noise are discussed in a publication [10] of Cercle Bruit, together with binaural audio demonstrations.

## 2.8 Sound art

Artistic interventions help to characterise the quality of urban spaces. Ideally, they give meaning to sounds, communicate with the surroundings, draw our attention and allow us to experience the environment in a new way. Sound art can help to strengthen identification with a place and thus make it more valuable for people.

Adding or transforming sounds can mask unpleasant noises and improve the sound quality. The aim is to draw attention to other sound aspects of the place. One example of this is the work 'Harmonic Gate' by Sam Auinger and Bruce Odland at Europaplatz near Zurich main station, which uses microphones to capture and transform sounds in the station, among other things, and then emits them from blue sound stones onto the square (figure 8).



**Figure 8.** Harmonic gate, Zurich main station [\*]

Sound art with water: Water is a popular component of art objects. In densely built-up areas, water features are also perceived as a pleasant refreshment. One example of this is the Tingueley Fountain in Basel: with its diverse and atypical sounds, which go far beyond the usual splashing of a fountain, it makes you forget the noise of the neighbourhood.

The examples shown in the International Catalogue of Soundscape Interventions by TU Berlin and University College London provide a wide range of ideas for sound art and acoustic interventions in public spaces.

## 3. CRITERIA AND DESIGN AREAS

Now which of the design domains are possibly helpful for improvements if the assessment shows a weakness in one or more of the 12 criteria?



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Based on the experience of more than 50 sample sites that have been evaluated in Switzerland over the last few years, table 1 shows which design area could be promising for an

improvement and to what extent or with what probability. The legend below the table gives practical examples for the respective intersection in the table.

**Table 1.** Criteria for acoustic quality and design areas that could contribute to an improvement.

| Criteria for a relaxing acoustic quality |  | Design areas                      |                   |                                    |                      |                  |                    |                   |                   |
|--|--|-----------------------------------|-------------------|------------------------------------|----------------------|------------------|--------------------|-------------------|-------------------|
|  |  | Noise control at source (outside) | Topography        | Buildings, small structures, walls | Surfaces and Facades | Ground and paths | Plants and animals | Water             | Sound art         |
| A  | General criteria                                       |                                   |                   |                                    |                      |                  |                    |                   |                   |
| B  | Specific criteria                                      |                                   |                   |                                    |                      |                  | XXX <sup>4</sup>   |                   |                   |
| C  | Bonus criteria   |                                   |                   |                                    |                      |                  | XXX <sup>4</sup>   | XX <sup>4</sup>   | X <sup>4</sup>    |
| A  | General Situation, (relative) quietness                | XXX <sup>1</sup>                  | XXX <sup>2</sup>  | XXX <sup>2</sup>                   |                      |                  |                    |                   |                   |
|  | Predominant sounds (natural vs. technical)             | XX <sup>3</sup>                   | XX <sup>3</sup>   | XX <sup>3/4</sup>                  |                      |                  |                    |                   |                   |
|  | Diversity of positive sounds (natural +)               |                                   |                   |                                    |                      |                  | XXX <sup>4</sup>   | XX <sup>4</sup>   | X <sup>4</sup>    |
|  | Communication friendliness (e.g. STI-PA)               | X <sup>5</sup>                    | XX <sup>5</sup>   | XX <sup>5</sup>                    | XX <sup>6</sup>      | XX <sup>6</sup>  | X <sup>7</sup>     |                   |                   |
|  | Acoustic compatibility of different uses               |                                   | XXX <sup>8</sup>  | XX <sup>8</sup>                    | XX <sup>9</sup>      | XX <sup>9</sup>  | XX <sup>10</sup>   |                   |                   |
|  | Sound propagation: attenuation / reflections           |                                   | XXX <sup>11</sup> | XX <sup>11</sup>                   | XXX <sup>12</sup>    |                  |                    |                   |                   |
| B  | Locating critical sounds in direction and distance     |                                   | XXX <sup>13</sup> | XXX <sup>13</sup>                  | XXX <sup>13</sup>    |                  |                    |                   |                   |
|  | Water sounds (fountains, rivers, ...)                  |                                   |                   |                                    |                      |                  |                    | XXX <sup>14</sup> |                   |
|  | Special sound sources, e.g. sound art                  |                                   |                   |                                    |                      |                  |                    |                   | XXX <sup>15</sup> |
| C  | Safety from severe disturbances                        |                                   |                   | XXX <sup>16</sup>                  |                      |                  | XX <sup>17</sup>   |                   |                   |
|  | Choice of soundscapes within short distance            |                                   |                   | XX <sup>18</sup>                   | XX <sup>18</sup>     |                  |                    |                   | X <sup>19</sup>   |
|  | Uniqueness, identifiability due to positive soundmarks |                                   |                   |                                    |                      |                  |                    | XXX <sup>20</sup> | XXX <sup>20</sup> |

XXX most effective

XX may be effective

X may contribute

- 1 reduce external technical noise at source
- 2 attenuate technical noise from the outside
- 3 less noise makes natural sounds more audible
- 4 amplify or give rise to natural sounds
- 5 lower noise => better speech intelligibility
- 6 absorption / diffusion for better privacy
- 7 attenuation; noise floor for better privacy
- 8 acoustic separation of different activities
- 9 no disturbing reflections from even surfaces
- 10 natural sounds can mask noise from activities

- 11 attenuation of external noise, acoustic niches
- 12 no annoying echoes, no excessive reverberation
- 13 no irritation due to pronounced (hard) reflections
- 14 water sounds enrich the soundscape (if adapted)
- 15 sound art can enrich the soundscape (if adapted)
- 16 e.g. if topography hinders access by motor vehicles
- 17 e.g. soft flooring hinders scooters / rolling boards
- 18 acoustic niches with differing soundscapes
- 19 local water sounds create different soundscapes
- 20 water or sound art can give identity to the place



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## 4. STATUS OF APPLICATION IN SWITZERLAND

### 4.1 Swiss Confederation: Legislation

The revised law on the protection of the environment (not yet in force) states that "... building zones may be designated or changes to utilisation plans in building zones may be decided if there is an overriding interest in inward settlement development and if *there is an open space accessible to the population concerned within the building zone or in its vicinity that is used for recreation.*"

Within two to three years, the noise protection ordonnance will have to define the requirements for such a free space. A good acoustic quality will be a part of these requirements.

### 4.2 Cercle Bruit and Swiss Acoustical Society

An expert group of Cercle Bruit (umbrella organisation of the cantonal noise protection authorities) began its work in 2018 with a fact sheet on the acoustic design of urban green spaces, which set out initial criteria for acoustic quality and provisional indications for its assessment, even if at that time no legal base existed.

A conference organised by the Swiss Acoustical Society SGA-SSA in May 2019 put this topic up for discussion in a wider circle, with 12 parks, squares and courtyards in four Swiss cities serving as case studies, which were presented not only in pictures but also acoustically in 3D sound reproductions (5.1.2). The Cercle Bruit specialist group then set itself the goal of assessing the acoustic quality of such outdoor spaces in a structured and standardised manner. After several trials and optimisations, it was published in German and French at the end of 2020 [3], together with a publication on the background and scientific base [4].

In April 2024, a conference organised by SGA-SSA, Cercle Bruit and Empa, together with the Swiss Association of Landscape Architects, presented research projects, methods and results, and discussed remaining obstacles.

At an international level, the Swiss assessment criteria and their application were presented for the first time at the Forum Acusticum 2023 in Torino [12].

### 4.3 SIA Code of Practice 2066:2025 on free spaces

The Swiss association of Engineers and Architects (SIA) has published the SIA Code of Practice 2066:2025 "Planning, building and maintaining open spaces sustainably" in February 2025. The keyword "acoustic quality" appears – after interventions by Cercle Bruit and SGA-SSA – in the in several places, as well as in the cited publications and refers to the assessment of the acoustic quality as published by Cercle Bruit.

### 4.4 Activities of Swiss Cantons

#### 4.4.1 Geneva: Strategy "Bruit 2030"

To ensure that acoustic aspects are taken into account when designing open spaces, it is necessary to provide an anchor point in the strategy.

A good example is the Canton of Geneva's STRATEGIE CANTONALE DE PROTECTION CONTRE LE BRUIT – BRUIT 2030, which sets out and describes the target acoustic quality of public spaces as follows:

"... The presence of nature in public spaces has been identified as a need. Pleasant soundscapes, with natural sounds, are conducive to a greater sense of well-being. These include birdsong, the sound of water or the rustling of leaves as particularly soothing (Cercle Bruit 2021). Thus, the creation and maintenance of public spaces with a strong natural component must be reinforced, ...". This forms the basis for practical acoustic improvements in green spaces.

#### 4.4.2 Lucerne: Awareness and knowledge in authorities

In 2023 and 2024, the canton of Lucerne organised five so-called sound tours for representatives of municipalities and towns. In line with the practical objective, these were not sound walks according to ISO 12913 aimed at research with assessment of the affective attributes, but sound tours in which these experts visited and discussed four parks, two squares and one courtyard on the basis of the twelve Cercle Bruit criteria and with a view to concrete possibilities for improvement (see table 1).

Synergies between acoustic and climate-friendly design were highlighted by the cantonal specialist.

As is customary in Switzerland, the sound tours ended with an aperitif for an informal exchange between participants, speakers and organisers.



**Figure 8.** Sound tour in Lucerne: The acoustics of Helvetiaplatz were discussed *in situ* [\*]



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## 4.5 Activities of two major Swiss cities

### 4.5.1 Basel (authority: Canton Basel Stadt)

The acoustic quality of public urban spaces has been an issue in the city of Basel for nearly 10 years, but the systematic and early involvement of acoustics experts in projects has not always been guaranteed.

The 5000 square meter area called Lysbüchelplatz is to be built by 2026. Involving noise protection and acoustic design specialists of the local authorities at an early stage, a high quality of stay is aimed for by a good sound design. Planned are: A large proportion of unsealed surfaces, good shielding against noise from outside, tall-growing trees with spreading crowns for diffuse reflections, terrain lowering for a different listening experience, water sounds as an acoustic accent, a pavilion as a separate sound space with very good speech intelligibility, many natural sounds such as birdsong and the buzzing of bees, and finally absorbing façade elements on adjacent buildings (no audible echoes).

### 4.5.2 Zurich

The city of Zurich is growing and so is noise pollution. The pressure on public spaces is increasing.

With regard to urban development, the city of Zurich states: "Outdoor spaces with good acoustic quality provide the necessary recreation and ideally also promote heat reduction and biodiversity in the city. In particular, natural sounds such as birdsong, the rustling of leaves or the splashing of water are perceived as pleasant."

A first step was to raise awareness and impart expertise on the acoustics of outdoor spaces among internal specialists. With this goal in mind, a meeting room was equipped with a loudspeaker system for 3D sound reproduction in 5.1.2 in order to transport listeners (acoustically) to different places and situations in the city of Zurich in a plausible way.

In the summer of 2024, the City of Zurich conducted two sound tours from the quiet Lindenhof Park above the city to the ambivalent modern Europa Quarter near the main railway station. The Cercle Bruit criteria grid was used and the renowned sound artist and ETH lecturer Nadine Schütz contributed her experience in sound space design.

Since March 2025 a 'mobile listening room' enables binaural listening demonstrations in ten headphones, especially for use in meetings, in reliable sound quality (aim: plausible reproduction of soundscapes of open spaces), with reproducible dB-accurate level adjustment in the headphones, low transport volume and installation effort (hardware costs below 2000 EUR).

Recently, a new position for the acoustic quality of urban spaces was created in the city administration.

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