

## Comparing noise policies of eight European cities using a noise intervention classification scheme

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### ABSTRACT

Over the last decades, cities have been developing noise policies. Comparing such efforts, however, is not straightforward. For this purpose, a previously proposed noise intervention classification scheme is used as a framework. This framework discriminates between source interventions, path interventions, closing/opening new infrastructure, other physical interventions (e.g. achieving a quiet side) and communication/education measures. Responsible officers dealing with noise at environmental departments of eight large European cities were interviewed. The invitations for an interview were sent out taking into account the geographical distribution of cities over Europe while a reasonably high position on a sustainable cities ranking was required. The interviews focused on the noise problem definition and what is in the noise management toolbox of the city. In addition, it is assessed how noise policies are evaluated, and to what extent public participation in the noise policy and planning process occurs. The interviews show highly contrasting opinions and practices among the interviewed cities at almost any aspect of the noise management process.

Keywords: Noise policy, public participation, city noise planning

### 1. INTRODUCTION

Environmental noise management, or environmental noise control, is usefully conceived of as interventions designed to improve human health. The World Health Organization, in its development of its recent Environmental Noise Guidelines (1), commissioned a range of systematic reviews of health effects of environmental noise to provide an evidence base for guideline development, including a review of measured changes in health effects arising from noise interventions. In the absence of prior systematic examinations of noise intervention, Brown and van Kamp (2) found it useful to develop a classification of interventions, and a simple framework illustrating where different noise interventions potentially act along the pathway between noise sources and human health is shown in Figure 1.

This framework of interventions is used in this study to classify interview responses describing the implementation of noise policies in a selection of European cities. The paper provides a snapshot of current approaches to noise management in cities.

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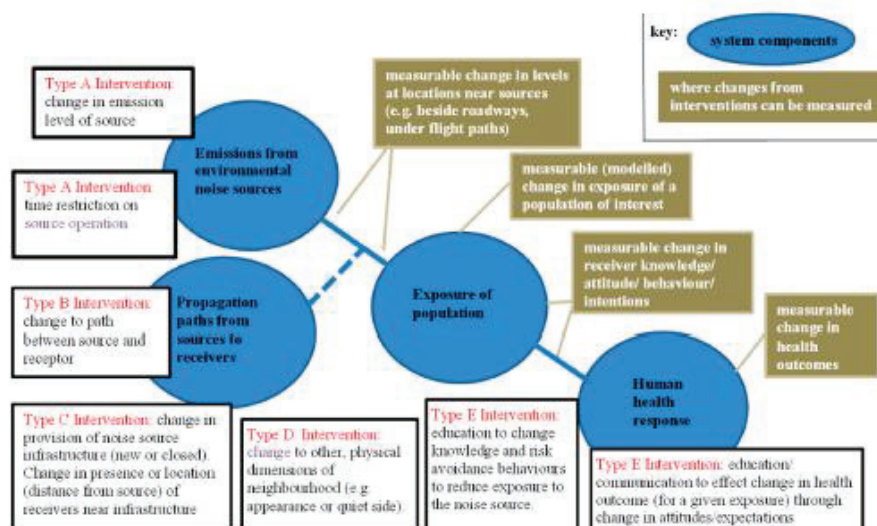


Figure 1 – Environmental noise intervention framework from Brown and van Kamp (2).

## 2. INTERVENTION CLASSIFICATION

Interventions on environmental noise were defined according to five broad categories based on the available intervention literature and the experience of decades of environmental noise management (see Table 1). Interventions Type A and B are self-explanatory. Intervention Type C categorizes situations where noise levels from a source have changed from non-existent to high because of new infrastructure (e.g. little or no road traffic adjacent to a newly opened freeway, or an area now under a new flight path where previously there had been no overflights), or the converse where a roadway or a runway has been closed. The Type C category is also extended to incorporate controls on building a new dwelling near an existing noise source. In an urban planning sense, a noise management “intervention” is the requirement of some minimum distance between existing noise source and new residential development. Type D, “other physical interventions” includes quiet sides (3) for dwellings or changing the appearance of a neighbourhood. Type E includes education and communication interventions intended to change behaviours – this category could be broadened to include all “other social interventions”.

Table 1 – Categories of environmental noise interventions

Type	Intervention Category	Intervention Sub-category
A	<b>Source interventions</b>	<ul style="list-style-type: none"> <li>change in emission levels of sources</li> <li>time restrictions on source operations</li> </ul>
B	<b>Path interventions</b>	<ul style="list-style-type: none"> <li>change in the path between source and receiver</li> <li>path control through insulation of receiver’s dwelling</li> </ul>
C	<b>New/closed infrastructure</b>	<ul style="list-style-type: none"> <li>opening of a new infrastructure noise source</li> <li>closure of an existing one</li> <li>planning controls between (new) receivers and sources</li> </ul>
D	<b>Other physical intervention</b>	<ul style="list-style-type: none"> <li>change in other physical dimensions of dwelling/neighborhood</li> </ul>
E	<b>Change in behavior interventions</b>	<ul style="list-style-type: none"> <li>change in behavior to reduce exposure</li> <li>avoidance or duration of exposure</li> <li>community education, communication</li> </ul>

### 3. METHODOLOGY

#### 3.1 City selection

The selection of candidate cities in this study was based on the involvement in a few recent European noise-focused research projects and Arcadis' sustainable cities index (4). This increased the chance that the invited city departments were concerned with environmental topics including urban noise. There is a focus on densely populated European cities, where the environmental noise problem is likely to be relevant. In total, 25 cities were invited for an interview, of which 8 promptly accepted (see Figure 2). It is expected that there will be a bias towards cities with a more elaborate noise policy as these might be more inclined to spontaneously respond; noise policy was explicitly mentioned in the invitation letter. Genève is the only non-EU (European Union) city involved.

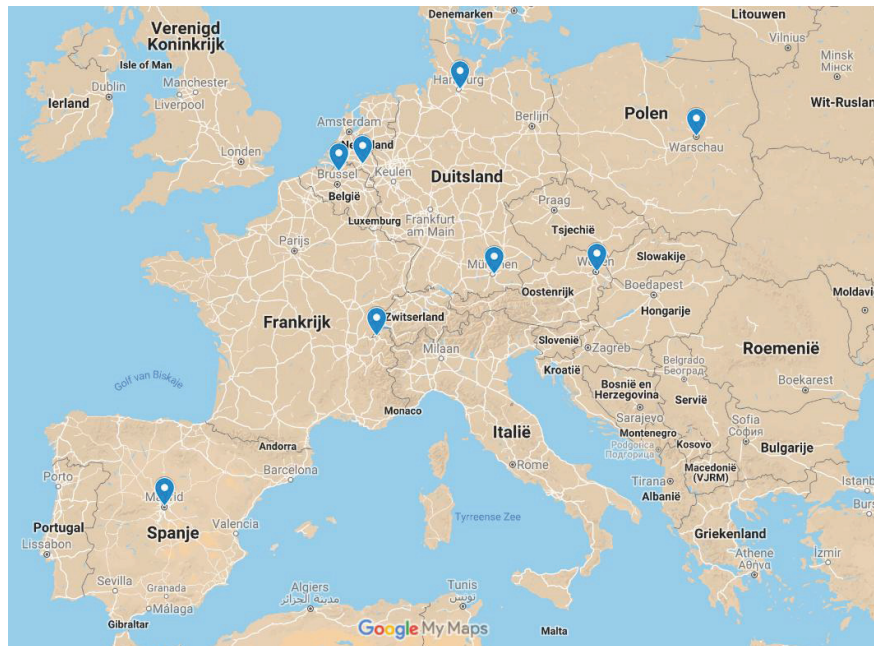


Figure 2 – Geographic distribution of the European cities interviewed in this study.

#### 3.2 Interviews

A video-chat interview was proposed. If there was interest to participate, but the interviewee expected a significant language barrier, a paper survey (in English) was allowed. The interviewer started with asking to position noise among the other environmental problems in the city and how noise issues were assessed. Secondly, the noise mitigation measures typically used in the city were asked for. Thirdly, evaluation procedures to follow up the effectiveness of the noise policy were queried. Additional questions were posed regarding the degree of public participation at any stage in the urban (noise) planning process. Although this same questioning structure was followed in each interview, the person responding will inevitably have a large influence in such a narrative open-questioned interview with plenty of possibilities to expatiate. It is nevertheless assumed that - at least - the major lines from the city noise policy will be brought forward by the person who declared to be a relevant interviewee on this topic.

### 4. RESULTS

#### 4.1 Noise problem assessment

For the interviewed city departments, noise is typically considered as the second biggest urban environmental issue (see Table 2). Air pollution is generally seen as the main problem. Somewhat contrasting, the officer of Madrid referred to a population-based survey where noise did not even end up in the top ten. In Hamburg, the lack of legal noise limits was declared to diverge political interest away from the topic. When talking about urban noise, it is clearly all about (road) traffic noise, unless an airport at close distance from the city centre was present. In the EU countries, noise mapping is

indicated as the main objective assessment method, while monitoring is only mentioned by two cities as a policy instrument for noise problem definition. Public participation in the latter is typically centered around the obliged population consulting in the framework of the END (5) action planning. Antwerpen mentioned a strong push from action groups that actually put noise on the local (political) agenda. Ad-hoc complaints and general environmental surveys are mentioned as well. In Eindhoven, public participation is deemed unnecessary to identify noise problems given their “well-organized and elaborate noise planning policy”.

Table 2 – Aspects of the environmental noise problem assessment.

	<b>Antwerpen (BE)</b>	<b>Eindhoven (NL)</b>	<b>Genève (CH)</b>	<b>Hamburg (DE)</b>
<b>Positioning of noise among other environmental issues</b>	1. Air pollution 2. Noise 3. Lack of green space	1. Noise 2. Air pollution 3. Safety	1. Air pollution 2. Water quality 3. Noise	Air pollution ("noise exposure has no legal limits so less policy interest")
<b>Noise sources of main concern</b>	Traffic noise	Road traffic noise, railway noise, leisure noise	1. Road traffic noise 2. Airport noise 3. Leisure noise	Traffic noise
<b>Objective assessment of noise issues</b>	Noise mapping	Noise mapping	Monitoring	Noise mapping
<b>Public participation in noise problem definition</b>	Strong push from action groups putting noise on the political agenda	No public participation for transport noise	Might emerge during 2-yearly (general) environmental surveys	Public hearings/online platforms during END action plans, might appear in the obliged public consultation in any urban planning project

Table 2 – (continued)

	Madrid (ES)	München (DE)	Warschau (PL)	Wien (AT)
<b>Positioning of noise among other environmental issues</b>	Noise not in top ten (following public survey)	Not assessed (but noise is an important issue)	1. Air pollution 2. Noise	All environmental disturbances due to traffic (air quality, noise, ...)
<b>Noise sources of main concern</b>	1. Traffic noise 2. Leisure noise	1. Traffic noise 2. Industrial noise	Traffic noise	1. Traffic noise 2. Neighbor noise 3. Construction noise
<b>Objective assessment of noise issues</b>	Monitoring and noise mapping	Noise mapping	Noise mapping	Noise mapping
<b>Public participation in noise problem definition</b>	Complaint driven by individuals or neighborhood associations	Public hearings/online platforms during END action plans, might appear in the obliged public consultation in any urban planning project	Complaint driven or part of END action plan public consultation	Inclusion in well organised Vienna district cooperative procedures

#### 4.2 Noise mitigation toolbox

Overall, there is a strong emphasis on source interventions (type A, see Table 3), except for the city of Antwerpen. Their urban ring road was identified as the main cause for the city's noise exposure. Silent road pavements are considered inapplicable given the high share of heavy traffic, and since regular replacement of the top layer would lead to a "traffic infarction for a large part of Flanders' region" (i.e. the Northern half of Belgium). In contrast, Genève applies silent road pavements city-wide as the main noise management measure. Satisfying results upon large-scale noise monitoring were declared. Sound pressure level decreases by speed reduction attract interest in various cities (like Madrid and München) and have been applied in Hamburg (50 to 30 km/h near densely inhabited zones), although still controversial.

Path interventions (type B) are slightly less applied/preferred compared to source interventions. Dwelling facade insulation is often cited as an important measure and takes a major part in the toolbox of Eindhoven, Hamburg and München. However, the exposure levels near the dwelling (e.g. in gardens) are then mentioned as a remaining problem. Extensive undergrounding or road coverings have been applied in Madrid and are currently studied/debated in Antwerpen.

City growth and consequently increasing housing demands forces the cities to use zones that are

characterized by sound pressure levels that are actually too high to safeguard human health. This is a recurring remark by the interviewees. Intervention type C, containing buffer zones, can therefore often be considered as inapplicable/unrealistic in many cities. Nevertheless, Eindhoven tries to apply this measure in the first place aiming at preventing future noise issues (using estimated traffic loads at nearby roads within a time frame of 10 years for new dwelling projects).

Sound perception/soundscape measures (belonging to type D) are only mentioned by the city of Antwerpen. Exploiting wind-induced vegetation noise (e.g. introduction of *Populus tremula*) or water sounds (introduction of fountains) in parks bordering busy roads are currently being considered. The city of München reported specific measures to achieve quiet sides/facades (type D) at buildings (e.g. building orientation optimization and creating so-called “in-fills”).

A few cities mention measures that belong to intervention type E, generally aiming at noise awareness raising. This should not only be seen as people trying to minimize their own exposure (level or duration), but also deals with the fact that citizens are noise producers themselves. Stimulating modal shift (towards bicycle or public transport use) is part of the policy in Madrid, München and Hamburg.

Table 3 – Road traffic noise management focus following the intervention classification system. The scale from “+++” to “0” stands for “a strong emphasize on” to “not considering at all”.

	Antwer pen (BE)	Eindhov en (NL)	Genève (CH)	Hambur g (DE)	Madrid (ES)	Münche n (DE)	Warsch au (PL)	Wien (AT)
<b>A Source interventions</b>	0	+ / ++	+++	+	++	++	+	++
<b>B Path interventions</b>	++	++	+	++	+	++	+	+
<b>C New/closed infrastructure</b>	0	+	+	0	0/+	0	+	0/+
<b>D Other physical interventions</b>	+	0	0	0	0	+	0	0
<b>E Education/communication</b>	0	0	0	+	+ / ++	+	0	0

### 4.3 Evaluating noise policy

Antwerp, Eindhoven, Genève, Hamburg and Madrid mention that project based (ad-hoc) noise measurements after interventions are common practice for manifold reasons (to learn about the effectiveness of a measure, to check a priori modelling during the planning phase, for communication to the population, etc.). Genève and Madrid, in addition, use their (available) noise monitoring network to check long-term effects. München, Warschau and Wien will typically await the next round of strategic noise mapping to evaluate the measures taken.

### 4.4 Public participation

There is a high diversity in public participation in the noise planning processes in the cities considered (see Table 4). At the lowest level, there are ad-hoc complaints (so-called “push” from citizens), facilitated by making telephone numbers easily available or by automated web-forms. In a second step, the obliged interaction with the population in relation to the END noise action plans can be mentioned where the city administration needs to “pull” reactions (e.g. by means of roadshows). A higher degree of participation is the involvement of citizen groups at various or at every stage of

important city planning projects. This becomes even stronger when such a requirement is hardcoded in (local) law. An outlier among the cities considered is Eindhoven, where the strict noise planning regulations for any (new) development are considered as adequate so that participation from the public at large is actually deemed unnecessary for road traffic noise problems.

Table 4 – Qualitative estimate of the degree of public participation in the environmental noise policy. The scale from “+++” to “0” stands for “extensive participation” to “no participation at all”.

Antwerpen (BE)	Eindhoven (NL)	Genève (CH)	Hamburg (DE)	Madrid (ES)	München (DE)	Warschau (PL)	Wien (AT)
++	0	+	++	+ / ++	++	0 / +	++ / +++

#### 4.5 Integration of noise in the urban planning process

The degree at which environmental noise is integrated in the urban planning process is quite different (see Table 5). In Antwerpen, noise is starting to be considered as an important aspect in urban planning; the city department is building up experience with such an early integration. However, they see a problematic lack of knowledge with external planning contractors on the topic of noise. Eindhoven has a high degree of legally-enforced integration of noise in their urban planning process. Silent roads are included standard in new urban developments in Genève, and there is an extensive project-based interaction with the noise specialists from their environmental department. The latter is indicated by the city of Madrid as well, but probably to a somewhat lesser degree than in Genève. In Hamburg, noise is considered in the planning process mainly when raised as an issue during the public consultation. Warschau sees many problems when noise would need to be considered, as this would further complicate the urban planning process. Although Wien has an extensive public participation procedure, noise is considered only as a small aspect of urban planning and there is no full integration.

Table 5 – Qualitative estimate to what degree noise is integrated in urban planning

Antwerpen (BE)	Eindhoven (NL)	Genève (CH)	Hamburg (DE)	Madrid (ES)	München (DE)	Warschau (PL)	Wien (AT)
+ / ++	+++	+ / ++	0 / +	+	?	0	0 / +

## 5. CONCLUSIONS

Noise is a well-recognized environmental issue in most European cities consulted. The proposed classification procedure for noise measures can be used to frame the noise policies of cities, allowing an inter-comparison. Overall, most common are source type interventions, closely followed by path interventions. Other types of interventions are clearly much less exploited. Although all cities considered are European, there are remarkable differences regarding public participation (“at every stage of the planning process” to “none at all for road traffic noise exposure”), the type of noise measures taken (“a main role for silent road surfaces” to declaring that the latter is an “inapplicable measure”), and evaluation procedures for interventions (“awaiting the next round of strategic noise mapping” to “using extensive city-wide noise monitoring networks”).

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