



# **ASSESSMENT OF POTENTIAL HEALTH BENEFITS OF NOISE ABATEMENT MEASURES IN THE EU**

**Phenomena project**

Contract number  
07.0203/2019/ETU/815591/ENV.A.3



**EUROPEAN COMMISSION**

Directorate-General for Environment  
Directorate A – Policy, Coordination, LIFE Governance & Resources  
Unit ENV.A.3 – Environmental Knowledge, Eco-Innovation & SMEs  
*Contact:* Marco Paviotti

*E-mail:* ENV-NOISE@ec.europa.eu

*European Commission  
B-1049 Brussels*

# **Assessment of Potential Health Benefits of Noise Abatement Measures in the EU Phenomena project**

The information and views set out in this report are those of the author(s) and do not necessarily reflect the official opinion of the Commission. The commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for the use which may be made of the information contained therein.

The European Commission is not liable for any consequence stemming from the reuse of this publication. Luxembourg: Publications Office of the European Union, 2021.



© European Union, 2021

The reuse policy of European Commission documents is implemented based on Commission Decision 2011/833/ EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39).

Except otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC-BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated.

For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective right holders.

---

PDF ISBN 978-92-76-37097-0

DOI: 10.2779/734688

KH-02-21-568-EN-N

---

## **GETTING IN TOUCH WITH THE EU**

### **In person**

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

### **On the phone or by email**

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696 or
- by email via: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

## **FINDING INFORMATION ABOUT THE EU**

### **Online**

Information about the European Union in all the official languages of the EU is available on the Europa website at: [https://europa.eu/european-union/index\\_en](https://europa.eu/european-union/index_en)

### **EU publications**

You can download or order free and priced EU publications at: <https://op.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)).

### **EU law and related documents**

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: <http://eur-lex.europa.eu>

### **Open data from the EU**

The EU Open Data Portal (<http://data.europa.eu/euodp/en>) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

**The information and views set out in this study are those of the authors and do not necessarily reflect the official opinion of the European Commission.**

# Executive Summary

## Overview

The objective of the Phenomena study was to support the European Commission in defining the potential of measures capable of delivering significant reductions (20%-50%) of the health burden due to environmental noise from roads, railways and aircraft, and to assess how relevant noise related legislation could enhance the implementation of measures, while considering the constraints and specificities of each transport mode. The project collected and analysed data from geographic areas with the following constraints:

- roads and railways inside agglomerations of more than 100,000 inhabitants;
- major roads of more than 3 million vehicles a year;
- around major railway lines of more than 30,000 trains a year; and
- around major airports of more than 50,000 movements a year.

The focus was on areas in agglomerations and along major roads with noise levels above 53 dB Lden, railways with noise levels above 54 dB Lden and airports with noise levels above 45 dB Lden. Peak noise from occasional sources which do not affect the Lden levels are not in the scope of this study, although they can be relevant for perceived noise. Health impacts are primarily associated with the year-averaged Lden and Lnight levels.

The study ensured that results are representative at EU level by analysing a wide range of literature sources and assessing a balanced selection of member state noise solution practices. The following was undertaken to achieve the above objectives:

- review of international and EU literature as well as EU and member state legislation;
- assessment of noise action plans, their implementation and enforcement;
- broad stakeholder consultation and two stakeholder workshops;
- identification and assessment of legislative drivers of noise abatement solutions;
- revision of the intervention logic;
- listing of good practices;
- health impact assessment and cost-benefit analysis;
- assessment of available noise abatement solutions;
- scenario analysis of noise abatement solutions; and
- proposals for EU and Member State policies to reduce the health burden.

## Findings

This 15-month long study, which started in December 2019, combined various qualitative and quantitative methodologies examining individual and combined noise abatement measures implemented across EU member states and included extensive stakeholder consultations. Overall, the study found that within the given timeframe the required, at least 20%, reduction in health burden would only be feasible by using **combined noise abatement solutions**, which are driven and supported by **revised and strengthened EU environmental policies**, including the END, source directives, the Green Deal as well as other legislative measures with a strong environmental impact. There is also a recognition that a revised EU policy framework is only as good as the **national**

**implementation and enforcement** measures are in the member states. Consequently, in order to harmonize the fragmented approaches currently seen in member states and drive the dissemination of good practices, increased emphasis should be put on the **consultative participation** of those **national and local authorities** that identify, select and implement noise abatement measures.

### *EU and national legislation*

The study began with an extensive literature review examining all relevant international, EU and member state level legislation and research that could, directly or indirectly, impact on the reduction of noise sources and consequently on the reduction of the associated health burden. The review found that noise mitigation requires **more efficient horizontal coordination** between different policy areas and alignment with the **Green Deal ambitions** in pursuing sustainable development goals (SDGs). In doing so, EU would put more emphasis on the focal point of its environmental policy: the principle of integration of environmental policy in other sectors. Horizontal coordination can also bring cost savings as pointed out by the EEA 2020 report, which states that air and noise mitigation measures jointly would give **better cost-benefit results** than each of these areas treated separately.

The role of **national and local** legislation and **enforcement** is of primary importance as urbanisation levels, geographic aspects, local governance mechanisms all have an essential role in determining the selection and implementation of the most adequate noise abatement solutions. Noise abatement practices applicable for various transport modes differ between member states and relatively little attention is being paid to the sharing of good practices. **Increasing communication and encouraging consultation** between the local authorities of EU member states in charge of selecting and implementing the noise abatement measures could facilitate an increase in the implementation of effective noise solution measures.

### *Noise action plans*

The study included the review of **300 noise action plans** (NAPs) with the aim of identifying what noise abatement measures have been planned and implemented in member states. The review included the overarching analysis of 200 and the in-depth analysis of an additional 100 noise action plans. While the overarching analysis identified the types of measures implemented and planned, the in-depth analysis was seeking to gather more detailed information on the implemented interventions and to ascertain the extent to which national and EU legislations **drive** the implementation of noise abatement measures.

**Road:** Overall, the examples reviewed indicated that Member States may prefer noise barriers, quiet road surfaces, and road maintenance as main solutions. These measures are usually combined with various other source interventions, infrastructure interventions, and mobility plans depending on the availability resources, including finances and technological solutions. A less frequent combination is the use of education and communication campaigns.

**Rail:** Overall, common measures that were implemented or planned are rail grinding, noise barriers, rail dampers and embankments solutions. Additionally, innovative or unique solutions such as quieter railpads or low barriers, not yet widespread, were identified during the in-depth analysis.

**Aviation:** The reviewed action plans indicate that a wide variety of measures are focused on noise mitigation both from the receiver as well as the noise source perspective. These often combine operating restrictions such as a curfews with a penalty regime, noise monitoring and infrastructure development including lengthening the runway to avoid low flights over residential areas.

### *Stakeholder consultation and workshops*

Stakeholders were widely consulted throughout the project. Bilateral interviews with member state officials, private enterprises, NGOs, associations, researchers and EU officials were conducted over

the course of 10 months and were concluded in January 2021. The purpose of the interviews was to gather information relating to national or EU level implementation of noise abatement solutions and to clarify stakeholders' positions on the effectiveness of noise abatement measures as well as their suggestions on potential improvements. **Altogether 64 stakeholder interviews** were carried out, bringing together a balanced set of opinions from the three transport modes and agglomeration representatives of various member states.

In addition to the interviews, **two online workshops** took place in June and November 2020. Combined, the two workshops attracted over 200 participants from across Europe.

### *Intervention logic*

The intervention logic represents the causal relationship between the needs, objectives and inputs that drives the action of intervention and results in a form of desired outputs, results and impacts. Based on the first interim results of the project, the initial intervention scheme prepared at the proposal stage has been readjusted.

The **revised intervention logic** presents more defined needs and objectives for reducing noise pollution and relates it to the health burden. These needs and objectives can be met by a more effective implementation of a **common approach to noise reduction**, which also takes socio-economic characteristics into account (e.g. population growth and increased urbanisation, share of low-income households, increasing connectivity in densely populated urban areas and transport innovation). The revised intervention logic emphasises those supporting measures which can further enhance the application of the relevant regulatory frameworks, such as financial assistance or stakeholder involvement.

The revised intervention logic emphasises an effective implementation that relies on a **combination of measures** including compliance with relevant EU and national policies as well as innovation and collaboration. Coherence between EU and member state policies including those on thresholds and noise emission limits are essential for achieving cohesion between noise abatement measures in the member states. Moreover, **increased coherence between noise policy and other various policy areas to enhance co-benefits** (e.g. urban and mobility plans) should be explored to facilitate a more effective implementation of noise abatement measures.

### *Methodology for analysis of health burden and CBA at EU level*

A specific methodology was set up to quantify the health burden and its reduction at EU level over time. The DPSEEA framework was applied, quantifying each step in the chain from source to receiver and health impact. The health burden is quantified by two monetisation methods to account for potential spread, but also in terms of percentage reduction of highly annoyed, highly sleep disturbed people and DALYs (related to heart disease). The existing average noise distribution in the EU, from EEA data, is used for the baseline, including forecast traffic growth and foreseen noise legislation.

The health burden reduction is calculated from the change in this noise distribution resulting from changes to the baseline, for example due to further reduction of noise at source, in the path or at receiver.

The cost-benefit analysis is based on the costs for increased implementation of noise abatement measures and the monetised health benefits using the two methods. It results in a benefit-to cost ratio over the period 2020-2035, net present value and a break-even year.

### *Test site analysis*

The methodology for calculating noise exposure in the EU was based on the exposure distributions calculated in the framework of the END. So as to indicate the uncertainty of the distributions, the END results have been compared with the results of local noise mapping calculations for test sites. The following types of test sites were considered:

- sub-areas of urban agglomerations with road and rail traffic noise,
- areas near major roads and major railways,
- airports and surrounding area.

The test site calculations focused on the effects of noise abatement solutions on the noise exposure distributions. This provided input for the effects of noise abatement solutions in the global health impact assessment methodology. Two examples are the following.

- *Noise barrier*. The effect of inserting a noise barrier in a specific situation has been investigated for various road and rail test sites.
- *Rerouting traffic*. A complex noise abatement solution is rerouting of urban traffic. This has been investigated by a test site calculation for the city of Karlsruhe (DE).

A point that has become clear from the test site calculations is that the effect of (local) traffic measures such as rerouting on the exposure distribution of the entire city is usually quite small. This conclusion also applies to local urban planning solutions such as tunnelling. Further, it was found that low-speed urban streets (50 km/h, 30 km/h) have a major effect on the exposure distributions.

### **Noise abatement solutions**

For each transport mode, available noise abatement solutions were selected for this analysis in terms of their potential noise reduction and known effectiveness. Solutions still under development were not included due to the timescale of 2030.

For road transport these include (A) quieter road surfaces, (B) quieter tyres, (C) quieter vehicles (D) more electric vehicles, (E) noise barriers, (F) speed restriction, (G) car-free zones, (H) quiet facades, (I) dwelling insulation, (J) reception limits.

The railway noise abatement solutions include (A) smooth tracks, (B) smooth wheels, (C) quiet vehicles, (D) quiet tracks, (E) barriers, (F) traffic management, (G) urban planning, (H) dwelling insulation, (I) reception limits.

For aircraft, the main noise abatement solutions include (A) improved flight profiles, (B) precision area navigation, (C,D) night curfews, (E) phase-out of noisier aircraft, (F) accelerated fleet renewal, (G) sound insulation, (H) buffer zones, (I) stakeholder engagement, and (J) reception limits.

### **Scenario analysis**

Single and combined scenarios were analysed in terms of their reduction in health burden and benefit to cost ratio (BCR). Combined scenarios are mostly required to achieve a significant effect. The selection was based on the health burden reduction, feasibility and timescale. In some cases the health burden reduction is high but the BCR rather low, due to relatively high cost, for example in the case of urban planning. This should not necessarily disqualify these solutions, as the benefits may actually be much larger if more parameters than noise are factored in, for example reduced pollution, improved access and property value, quality of life and others.

Based on the scenarios identified and analysed, the following were found to be the most effective:

#### **Roads**

- ABCD: more quiet roads, quieter tyres and specific lower vehicle noise limits  
Health burden reduction in 2030: 18-24%  
Benefit to cost ratio over 2020-2035: 0.9-5.1
- FGHI: speed restriction, car-free zones, quiet façades, and dwelling insulation.  
Health burden reduction in 2030: 16-20%  
Benefit to cost ratio over 2020-2035: 0.04-0.2

## Railways

- ABCD, smoother and quieter vehicles and tracks  
Health burden reduction in 2030: 37-52%  
Benefit to cost ratio over 2020-2035: 0.9-3.1
- EF, more barriers and traffic management  
Health burden reduction in 2030: 5-10%  
Benefit to cost ratio over 2020-2035: 0.9-4.5
- GH, urban planning and reconstruction, and more façade insulation.  
Health burden reduction in 2030: 7.8%  
Benefit to cost ratio over 2020-2035: 0.2-0.4

## Aircraft

- Best possible on "aircraft side" (ABEF): Improved take-off procedures, dispersion or concentration of flights, phase out of noisiest aircraft and accelerated fleet replacement with quiet aircraft  
Health burden reduction in 2030: 44-46%  
Benefit to cost ratio over 2020-2035: -0.2 to -0.1 (cost saving)

## Policy options

Policy options were developed based on the results of the NAPS analysis, stakeholder consultations as well as the cost-benefit analysis and noise abatement scenarios. The analysis found that an effective and EU-wide reduction of noise emission, that would result in an at least 20% decrease of associated health burden within the next ten years, cannot be reached by individual scenarios but rather by a set of **combined and complementary measures**. As the highest benefits from noise reduction are to be expected from the implementation of the best combined scenarios discussed in the previous chapter.

The proposed measures that could be implemented within the next 10 years and include both mandatory (hard) and optional (soft) policies. In addition to noise and transport specific instruments such as the END, TSI Noise and the BAR, other non-noise policy related instruments (legislative and non-legislative across various policy areas) have also been analysed. Altogether **23 individual policy changes are proposed**. This includes six legislative changes for generic policy measures that would affect all transport modes. The remaining policy proposals are split between road, rail and aviation specific legislations. Recognizing the fact that EU legislation was a key stepping stone in the harmonisation and further implementation of noise solutions across member states, a significant share of the proposed policy measures relate to the review and amendment of these policy instruments.

This approach follows the principle of **horizontally integrating environmental issues into different policy areas**. Therefore, it is suggested that the proposed policy options are developed within the context of an overarching strategy. This will require setting an overall target of the noise reduction across different policy fields. This strategy could be ideally composed of a set of a horizontal (general) and vertical (sector-specific) measures. The establishment of such an umbrella approach would streamline the efforts undertaken and ensure their timely application.



■ Publications Office  
of the European Union